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Joseph W. McMahon, P.E.

November 8, 2019

Jeff Ritter
Town Administrator
Town of Holliston
703 Washington Street
Holliston, MA 01746

RE: **Post Construction Adjustment
Washington Street Signals Project
Holliston, MA**

Dear Mr. Ritter,

At the request of the Town of Holliston, McMahon Associates has completed an analysis of traffic conditions following the signalization of three intersections along the Washington Street corridor approximately one year ago. Based on this analysis and observations conducted in the field, McMahon has also developed recommendations for adjustments at the traffic signals to improve traffic operations during both peak and off-peak periods.

Study Area and Traffic Volumes

The study area for the post-construction analysis includes the intersections of Washington Street at Green Street/Exchange Street, Washington Street at Central Street, and Washington Street at Hollis Street. Updated manual turning movement counts (TMCs), including bicycle and pedestrian volumes, were collected at these three intersections on Tuesday, September 10, 2019 from 7:00 to 9:00 a.m. and 3:00 to 6:00 p.m. The updated traffic volumes were used to identify changes in traffic patterns compared with counts collected in 2016, prior to the installation of traffic signals. The morning and afternoon peak hours were found to occur from 7:00 to 8:00 a.m. and 4:30 to 5:30 p.m., respectively.

Traffic volumes along each intersection approach before and after construction are summarized in Table 1 below. As shown in the table, traffic volumes have generally decreased over the three-year period. The decrease may be attributed to changes in travel patterns due to the signalization of the intersection and other factors.

Table 1: Traffic Volume Comparison

	September 2016 Pre-Construction		September 2019 Post-Construction	
	AM Peak (7:00AM to 8:00AM)	PM Peak (4:30 PM to 5:30 PM)	AM Peak (7:00AM to 8:00AM)	PM Peak (4:30 PM to 5:30 PM)
<u>Washington St at Hollis St/Charles St</u>				
Northbound	1,065	756	965	731
Southbound	627	910	632	811
Eastbound	<u>366</u>	<u>335</u>	<u>369</u>	<u>300</u>
TOTAL	2,058	2,001	1,966	1,842
<u>Washington St at Central St</u>				
Northbound	1,045	760	949	718
Southbound	611	1,042	564	770
Westbound	<u>212</u>	<u>317</u>	<u>260</u>	<u>267</u>
TOTAL	1,868	2,119	1,773	1,755
<u>Washington St at Green St/Exchange St</u>				
Northbound	1,084	713	924	665
Southbound	510	944	506	781
Eastbound	15	<u>13</u>	10	39
Westbound	<u>55</u>	<u>82</u>	<u>65</u>	<u>168</u>
TOTAL	1,664	1,752	1,505	1,653

June 2019 Signal Timing and Coordination Adjustments

Based on field observations, McMahon made minor traffic signal timing and coordination adjustments along the Washington Street corridor on June 12, 2019 to provide an incremental improvement in vehicle operations without additional cost for equipment or rewiring. The WALK intervals at both signals were reduced from 7 seconds to 5 seconds, with the remaining 2 seconds added to the Hollis Street and Central Street phases to reduce side street delays and queuing. In addition, three seconds were shifted from the flashing DON'T WALK/countdown time to the solid DON'T WALK/all red buffer interval to increase the buffer interval from one second to the current MassDOT standard of four seconds.

Additional Post-Construction Adjustments

Based on the September 2019 traffic counts and field observations, McMahon prepared updated traffic analysis using Synchro software to identify additional changes to traffic signal timing, phasing, and/or lane assignments that may improve operations through the Washington Street signals. The following potential improvements and associated implementation costs were identified. Estimated costs are based on available unit cost data and include 3 percent mobilization and a 20 percent contingency. McMahon has also solicited feedback from local traffic signal vendors to further refine the cost estimate.

- **Provide a protected left turn phase from northbound Washington Street to westbound Hollis Street.** A phase would be added to the Washington Street at Hollis Street/Charles Street intersection to stop southbound traffic and provide a green left arrow for northbound left turns. A flashing yellow left arrow would be provided for northbound left turns when southbound Washington Street has a green signal. (\$7,000)
- **Provide a right turn lane from southbound Washington Street to westbound Hollis Street.** Vehicles traveling southbound on Washington Street currently travel in the 8-foot wide parking lane to bypass stopped vehicles and turn right onto Hollis Street. This behavior increases the risk of crashes due to drivers and pedestrians not expecting vehicles traveling in the parking lane. This proposed adjustment would eliminate three on-street parking spaces on the west side of Washington Street north of Hollis Street and provide an 11-foot wide right turn lane with 75 feet of storage (approximately three vehicles). A curb extension would be constructed in the parking lane north of the right turn lane to prevent vehicles from traveling in the parking lane prior to the start of the turn lane. (\$4,500)
- **Provide “Do Not Block Intersection” signs and pavement markings at the Washington Street at Hollis Street intersection.** Currently, southbound vehicle queues from the Washington Street at Central Street signal may extend through and block the Hollis Street intersection. This improvement would add “DO NOT BLOCK INTERSECTION” signs (Sign Code R10-7, per the Manual on Uniform Traffic Control Devices [MUTCD]) to the southbound Washington Street approach at Hollis Street, as well as pavement markings within the southbound portion of the intersection to discourage blocking. (\$1,000)
- **Repair wire loop vehicle detection on northbound Washington Street at Hollis Street.** The existing wire loop detector in the northbound left turn lane at the Washington Street at Hollis Street intersection is failing, causing the traffic signal controller to receive a constant call that a vehicle is present on the approach and extending the green time on Washington Street to its maximum time each cycle. While this has no impact on operations during peak traffic times when Washington Street always reaches its maximum green time, it results in unnecessary delays for vehicles on Hollis Street and for pedestrians at off-peak times. With the loop detector repaired, the traffic signal controller will recognize the lack of traffic on northbound Washington Street and will allow the signal to operate more efficiently during off-peak periods. (\$2,500)

- **Remove variable lane assignment sign on northbound Washington Street at Central Street; provide blankout “NO TURN ON RED” sign facing Central Street during pedestrian phase.** Under existing conditions, northbound Washington Street operates as two lanes from 6:00 to 9:00 a.m. through the Exchange Street and Central Street intersections to accommodate heavy morning peak hour traffic volumes. At other times, parking is allowed in the right lane south of Exchange Street and north of Central Street, and the right lane between Exchange Street and Central Street is only for right turns onto Central Street. A variable message sign mounted over the lane displays the permitted movements based on the time of day. Based on field observations, northbound through traffic typically does not use this lane during the morning peak period. To avoid potential confusion, this sign would be removed and the right lane would be only for vehicles turning right onto Central Street at all times.

In addition, there have been complaints about vehicles turning right on red from Central Street during the exclusive pedestrian phase, creating vehicle-pedestrian conflicts in the crosswalk across Washington Street. With this improvement, a blankout “NO TURN ON RED” sign would be provided facing the westbound Central Street approach at Washington Street, which would only illuminate during the exclusive pedestrian phase. As a cost saving measure, the housing for the existing variable lane use sign would be reused. (\$6,250)

In the long term, the existing northbound through lane through the Exchange Street and Central Street intersections could be converted to green space and/or additional sidewalk space, potentially reducing the curb to curb width of Washington Street and further shortening the time required for the exclusive pedestrian phase.

- **Shorten pedestrian phase for calls to cross Central Street, Exchange Street, and Green Street.** The length of the exclusive pedestrian phase is dictated by the MUTCD, which requires sufficient time for a pedestrian to cross at an average walking speed of 3.5 feet per second (fps). The crosswalks across Washington Street at Exchange and Central Streets are each 62 feet long, requiring 18 seconds, while the longest side street crossing, 31 feet across Central Street, requires only 9 seconds. This improvement would retain the exclusive pedestrian phase, stopping all side street traffic when pedestrians are crossing, but the pedestrian signal heads to cross Washington Street would display DON'T WALK and the time would be shortened when a pedestrian is crossing Central Street, Exchange Street, or Green Street. All WALK intervals along the corridor will be increased from 5 seconds back to 7 seconds in response to public feedback that the current crossing time is not sufficient. (\$3,750)
- **Shorten pedestrian crossing time and provide additional time via extended button push.** The MUTCD allows the pedestrian phase to be reduced to provide sufficient crossing time for an average walking speed of 4 fps, provided the time can be extended for slower pedestrians by holding in the pedestrian push button. Additional signage and public education would be required to inform pedestrians of the feature. Based on public feedback that the current crossing time is not sufficient, implementing this feature is not recommended at this time.

- **Replace wire loop vehicle detection with video vehicle detection.** Video vehicle detection identifies contrast in images obtained via a camera mounted on the traffic signal mast arm to detect the presence of vehicles. The detection cameras do not record or transmit images. Unlike wire loop detection, video detection is not susceptible to failure due to pavement condition or trenching activities within the roadway such as utility repairs. There would be no significant difference in traffic operations with video detection compared with wire loop detection during most times. During peak times, video detection may be programmed to detect queueing from adjacent intersections and place a priority call to the traffic signal controller to extend the green time and clear the queue. However, giving priority to one roadway approach would also result in increasing delays for vehicles on other approaches and for pedestrians. (\$20,000)

In addition, traffic signal timing and coordination would be adjusted to provide optimal operations. The total cycle length would be reduced from 100 seconds to 95 seconds, reducing vehicle queues and the amount of red time per cycle for each approach. The reduction in cycle length and increase in the WALK time from 5 seconds to 7 seconds would reduce the maximum wait time for a pedestrian to receive a WALK signal by 7 seconds at each intersection.

The total estimated cost of the above recommended improvements, excluding conversion to video vehicle detection, is \$25,000. As noted above, converting from wire loop detection to video detection would cost an additional \$20,000. The cost of additional curb extensions, green space, or sidewalk widening as a result of eliminating the second northbound travel lane north of Central Street is dependent on the exact scope of the improvements.

Traffic Operations Analysis

To evaluate the effectiveness of the proposed post-construction adjustments, existing conditions and conditions with the proposed adjustments were modeled using SimTraffic traffic simulation software using the morning and afternoon peak hour traffic volumes collected in September 2019. To reflect actual operations observed in the field during the morning peak hour, the simulation assumes that the northbound right lane at the Central Street intersection is used only by vehicles turning right onto Central Street, and all northbound through vehicles use a single lane.

Table 2 below presents the following SimTraffic analysis results under existing conditions, compared with operations with the additional post-construction adjustments outlined above:

- Average delay per vehicle in seconds by intersection approach.
- Level of service (LOS) for each intersection approach. LOS is defined by the *Highway Capacity Manual* as “a qualitative measure describing operational conditions within a traffic stream, and their perceptions by motorists and/or passengers,” and is related to the average delay per vehicle. LOS D is generally considered acceptable on arterial roadways in urban and suburban areas; however, vehicle level of service must be balanced with the needs of pedestrians, cyclists, residents, and businesses along the corridor.
- 95th percentile vehicle queues in feet along each intersection approach. There is a 5 percent probability of longer queues during the peak period.

Table 2: Traffic Operational Analysis - September 2019 Traffic Volumes

	Weekday Morning Peak Hour						Weekday Afternoon Peak Hour					
	Existing Conditions			With Proposed Post-Construction Adjustments			Existing Conditions			With Proposed Post-Construction Adjustments		
	<u>Delay</u> ¹	<u>LOS</u> ²	<u>Queue</u> ³	<u>Delay</u>	<u>LOS</u>	<u>Queue</u>	<u>Delay</u>	<u>LOS</u>	<u>Queue</u>	<u>Delay</u>	<u>LOS</u>	<u>Queue</u>
Washington Street at Hollis/Charles Streets												
Washington St Northbound	16.6	B	369	19.3	B	421	25.5	C	369	16.8	B	296
Washington St Southbound	13.2	B	314	16.9	B	397	68.4	E	1,104	50.2	D	929
Hollis St Eastbound	137.6	F	805	45.5	D	424	171.0	F	742	30.5	C	237
Overall	40.2	D		23.5	C		69.0	E		34.1	C	
Washington Street at Central Street												
Washington St Northbound	3.5	A	90	3.8	A	105	4.6	A	82	4.4	A	78
Washington St Southbound	14.3	B	194	12.1	B	221	32.3	C	421	18.4	B	374
Central St Westbound	111.0	F	617	90.9	F	482	316.7	F	1,251	52.3	E	295
Overall	23.5	C		19.7	B		67.6	E		18.7	B	
Washington Street at Green/Exchange Streets												
Washington St Northbound	187.5	F	3,488	62.3	E	1,204	39.6	D	514	48.2	D	331
Washington St Southbound	1.9	A	63	1.8	A	69	3.4	A	83	2.7	A	44
Green St Eastbound	39.8	D	36	51.7	D	35	51.5	D	64	45.1	D	73
Exchange St Westbound	39.6	D	104	38.6	C	93	58.8	E	210	119.5	F	308
Overall	119.1	F		41.2	D		25.0	C		34.1	C	
Network Performance Average Delay/Vehicle	131.4	F		67.1	E		142.3	F		74.1	E	

¹ Average Delay per Vehicle in seconds

² Level of Service (A = 0-10 sec.; B = 10-20 sec.; C = 20-35 sec.; D = 35-55 sec.; E = 55-80 sec.; F = >80 sec.)

³ 95th Percentile Vehicle Queue in feet (1 vehicle = approx. 25 feet)

As shown in Table 2, overall traffic operations will improve with the proposed adjustments, although some individual approaches will still experience congestion during peak commute times. Due to limitations in the modeling software, approaches that operate at LOS F may exhibit shorter delays and queues than the reported results due to drivers behaving more aggressively as delays increase. Similarly, approaches with short delays and queues may be longer in the field due to driver inattention, jaywalking, parking maneuvers, and other real-world factors not incorporated into the simulated traffic model. The following is a detailed discussion of modelled peak hour traffic operations at each intersection.

Washington Street at Hollis Street and Charles Street

During the morning peak hour, the northbound and southbound Washington Street approaches operate at LOS B, with queues extending 369 feet along the northbound approach and 314 feet on the southbound approach. The eastbound Hollis Street approach operates at LOS F, with over two minutes of delay per vehicle and queues extending 805 feet. During the afternoon peak hour, northbound Washington Street operates at LOS C with 95th percentile queues of 369 feet. Southbound Washington Street operates at LOS E, with queues extending nearly a quarter mile. The eastbound Hollis Street approach operates at LOS F, with an average delay of nearly three minutes per vehicle and queues extending 742 feet. Overall, the intersection operates at LOS D during the morning peak hour and LOS E during the afternoon peak hour.

With the proposed post-construction adjustments in place, the LOS on northbound and southbound Washington Street would remain unchanged at LOS B during the morning peak hour. 95th percentile queues on northbound Washington Street would be marginally longer than under existing conditions, extending 421 feet and intermittently extending into the Central Street intersection during the peak 15-minute period of the morning. The eastbound Hollis Street approach would improve from LOS F to LOS D, with queues extending 424 feet. During the afternoon peak hour, northbound Washington Street would improve from LOS C to LOS B, with 95th percentile queues reduced from 369 feet to 296 feet. Southbound Washington Street would improve from LOS E to LOS D. 95th percentile queues along the southbound approach would be reduced from 1,140 feet to 929 feet. The eastbound Hollis Street approach would improve from LOS F to LOS C, as the “DO NOT BLOCK” markings and improved efficiency at the Exchange Street and Central Street intersections would reduce intersection blocking and allow more vehicles out of the Hollis Street approach. Queues along the eastbound Hollis Street approach would be reduced from 742 feet to 237 feet. Overall, the intersection would operate at LOS C during both peak periods with the proposed adjustments.

Washington Street at Central Street

During the morning peak hour, the northbound and southbound Washington Street approaches operate at LOS A and B, respectively. Vehicle queues extend 90 feet along the northbound approach and 194 feet along the southbound approach. However, vehicles on these approaches are held back at the adjacent intersections, resulting in low reported delays and queues at this location. The westbound Central Street approach operates at LOS F, with average delays of 111 seconds per vehicle and a 95th percentile queue of 617 feet. During the afternoon peak hour, northbound Washington Street operates at LOS A with queues of only 82 feet due to vehicles being held back at the Exchange Street signal, while southbound Washington Street operates at LOS C with queues of 421 feet, extending to and

occasionally blocking the Hollis Street intersection to the north. The westbound Central Street approach operates at LOS F, with average delay potentially exceeding 5 minutes and queues extending nearly a quarter mile.

With the proposed post-construction adjustments in place, northbound and southbound Washington Street would operate at LOS A and LOS B, respectively, during both peak hours. Queues along northbound Washington Street would extend 105 feet during the morning peak hour and 81 feet during the afternoon peak hour. Along southbound Washington Street, queues would extend 221 feet in the morning peak hour. During the afternoon peak hour, southbound 95th percentile queues would be reduced from 421 feet to 374 feet, reducing the probability of vehicles blocking the Hollis Street intersection. The proposed “DO NOT BLOCK” markings and signage would serve to keep the intersection clear to lessen impacts at the Hollis Street intersection in the event of vehicle queuing. The westbound Central Street approach would remain over capacity during the weekday morning peak hour, but with average delay per vehicle reduced from 111 seconds to 90.9 seconds and 95th percentile queues reduced from 617 feet to 482 feet. During the afternoon peak hour, operations on the westbound Central Street approach would improve from LOS F to LOS E, with a reduction in delay per vehicle from over 5 minutes to 52.3 seconds, and a reduction in queues from 1,251 feet to 295 feet. Overall intersection operations would improve from LOS C to LOS B during the morning peak hour, and from LOS E to LOS B during the afternoon peak hour.

Washington Street at Green Street and Exchange Street

During the morning peak hour, the northbound Washington Street approach operates at LOS F, with average delays per vehicle of over three minutes and 95th percentile queues extending approximately two thirds of a mile to the Highland Street intersection. The southbound approach operates at LOS A with queues of only 63 feet due to southbound traffic being held back at adjacent intersections. The eastbound Green Street and westbound Exchange Street approaches each operate at LOS D with queues of 36 feet and 104 feet, respectively. During the afternoon peak hour, the northbound Washington Street approach operates at LOS D, with 95th percentile queues extending 514 feet. Similar to the morning peak hour, the southbound approach operates at LOS A with queues of 83 feet. The eastbound Green Street approach operates at LOS D with a queue of 64 feet, while the westbound Exchange Street approach operates at LOS E with a queue of 210 feet.

With the proposed post-construction adjustments in place, operations on northbound Washington Street would improve from LOS F to LOS E during the morning peak hour, with average delays reduced from over three minutes per vehicle to approximately one minute. 95th percentile queues would be reduced to approximately one quarter mile, extending approximately to the Prospect Street/Pleasant Street intersection. The southbound Washington Street approach would continue to operate at LOS A. The eastbound Green Street approach would operate at LOS D, with marginally longer delays compared with existing conditions, while the westbound Exchange Street approach would improve from LOS D to LOS C. Queues on the Green Street and Exchange Street approaches would remain approximately equal to existing conditions. During the afternoon peak hour, the northbound Washington Street approach would continue operating at LOS D, with average delay increasing from 39.6 seconds per vehicle to 48.2 seconds; however, the northbound queue length would be reduced from 514 feet to 331 feet due to the shorter cycle length. The southbound Washington Street approach would continue to operate at LOS A. The eastbound Green Street approach would continue

to operate at LOS D, with a nominal decrease in delay of 6.4 seconds per vehicle, while the westbound Exchange Street approach would experience a 60.7 second increase in delay over existing conditions, operating at LOS F, due to changes in signal timing to improve operations along Washington Street and Central Street. 95th percentile queues on the Exchange Street approach would increase by approximately 100 feet, from 210 feet to 308 feet.

Overall Network Performance

As shown in Table 2, average delay per vehicle through the three study intersections was measured to be 131.4 seconds during the morning peak hour and 142.3 seconds during the afternoon peak hour, each equivalent to LOS F. With the post-construction adjustments in place, average network delay would improve to 67.1 seconds in the morning peak hour and 74.1 seconds in the afternoon peak hour, equivalent to LOS E. While there would still be congestion during the peak travel times of the day, overall delays and queues would be improved over current conditions.

Conclusion

The signalization of the intersections of Washington Street at Hollis Street/Charles Street, Central Street, and Green Street/Exchange Street with exclusive pedestrian phasing have vastly improved conditions for pedestrians in Holliston's business district and improved safety for vehicles exiting from the side street approaches. However, traffic which once flowed freely along Washington Street is now interrupted by the signals, resulting in traffic congestion during peak weekday morning and afternoon commute times. Based on McMahon's June 2019 field observations and September 2019 post-construction analysis, minor adjustments to traffic signal equipment and timing are appropriate in response to changes in travel patterns since 2016 to reduce traffic congestion during peak travel periods and to provide optimal operations for all users during all times of day, while retaining the existing exclusive pedestrian signal phasing. Congestion will still be present during peak periods, particularly on the northbound Washington Street approach at Exchange Street during the weekday morning peak hour, along the southbound Washington Street approach at Hollis Street during the weekday afternoon peak hour, and along the westbound Central Street approach during both peak periods. As detailed above, the total cost of these adjustments is approximately \$25,000, excluding the addition of video vehicle detection and additional geometric changes. In the long term, additional geometric changes may be made along Washington Street to provide wider sidewalks and/or additional green space.

Sincerely,



Robert A. Smith, P.E.
Senior Project Manager

Attachments:

Traffic Count Data
SimTraffic Analysis Outputs
Washington Street at Hollis Street Conceptual Plan
Draft Traffic Signal Plans

Client: Michael V. Pompili
 Project #: 446_004_MM
 BTD #: Location 1
 Location: Holliston, MA
 Street 1: Washington Street
 Street 2: Hollis Street/Charles Street
 Count Date: 9/10/2019
 Day of Week: Tuesday
 Weather: Clouds & Sun, 70°F



PASSENGER CARS & HEAVY VEHICLES COMBINED

Washington Street Northbound					Washington Street Southbound				Hollis Street Eastbound				Charles Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	54	206	0	0	0	105	69	0	65	2	25	0	0	0	0
7:15 AM	0	53	179	1	0	4	103	76	0	60	8	37	0	0	0	0
7:30 AM	0	30	200	0	0	2	111	18	0	61	6	38	0	0	0	0
7:45 AM	0	26	212	4	0	0	125	19	0	44	3	20	0	0	0	0
8:00 AM	0	25	201	0	0	2	112	25	0	63	2	29	0	0	0	0
8:15 AM	0	24	239	1	0	2	105	13	0	60	6	15	0	0	0	0
8:30 AM	0	16	194	0	0	2	98	14	0	59	2	33	0	0	0	0
8:45 AM	0	17	166	3	0	1	112	21	0	59	2	35	0	0	0	0

Washington Street Northbound					Washington Street Southbound				Hollis Street Eastbound				Charles Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
3:00 PM	0	38	84	0	0	2	158	44	0	32	5	25	0	0	0	0
3:15 PM	0	34	97	0	0	1	155	47	0	21	2	28	0	0	0	0
3:30 PM	0	35	119	4	0	2	152	46	0	29	4	26	0	0	0	0
3:45 PM	0	35	138	2	0	3	149	39	0	21	9	24	0	0	0	0
4:00 PM	0	33	103	3	0	3	168	36	0	20	7	25	0	0	0	0
4:15 PM	0	20	133	5	0	1	145	39	0	32	6	27	0	0	0	1
4:30 PM	0	45	115	2	0	1	173	36	0	32	6	17	0	1	0	0
4:45 PM	0	43	156	3	0	0	142	54	0	20	12	30	0	0	0	0
5:00 PM	0	40	137	1	0	2	171	45	0	30	11	35	0	0	0	0
5:15 PM	0	37	150	2	0	2	142	43	0	39	9	59	0	0	0	0
5:30 PM	0	37	106	0	0	0	138	36	0	37	10	47	0	0	0	0
5:45 PM	0	35	124	0	0	1	161	51	0	43	7	46	0	0	0	0

AM PEAK HOUR 7:00 AM to 8:00 AM	Washington Street Northbound				Washington Street Southbound				Hollis Street Eastbound				Charles Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	163	797	5	0	6	444	182	0	230	19	120	0	0	0	0
PHF	0.93				0.86				0.88				0.00			
HV %	0.0%	4.3%	6.9%	0.0%	0.0%	16.7%	11.0%	5.5%	0.0%	7.8%	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%

PM PEAK HOUR 4:30 PM to 5:30 PM	Washington Street Northbound				Washington Street Southbound				Hollis Street Eastbound				Charles Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	165	558	8	0	5	628	178	0	121	38	141	0	1	0	0
PHF	0.90				0.93				0.70				0.25			
HV %	0.0%	0.6%	2.5%	0.0%	0.0%	0.0%	3.3%	2.2%	0.0%	2.5%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%

Client: Michael V. Pompili
 Project #: 446_004_MM
 BTM #: Location 1
 Location: Holliston, MA
 Street 1: Washington Street
 Street 2: Hollis Street/Charles Street
 Count Date: 9/10/2019
 Day of Week: Tuesday
 Weather: Clouds & Sun, 70°F

HEAVY VEHICLES

Washington Street Northbound					Washington Street Southbound				Hollis Street Eastbound				Charles Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	6	11	0	0	0	5	5	0	9	0	1	0	0	0	0
7:15 AM	0	1	12	0	0	1	13	3	0	1	0	1	0	0	0	0
7:30 AM	0	0	17	0	0	0	15	1	0	1	0	1	0	0	0	0
7:45 AM	0	0	15	0	0	0	16	1	0	7	0	1	0	0	0	0
8:00 AM	0	1	13	0	0	0	15	4	0	1	0	2	0	0	0	0
8:15 AM	0	2	12	0	0	0	12	2	0	0	0	2	0	0	0	0
8:30 AM	0	1	11	0	0	0	9	0	0	3	0	2	0	0	0	0
8:45 AM	0	0	12	0	0	0	11	1	0	2	0	1	0	0	0	0

Washington Street Northbound					Washington Street Southbound				Hollis Street Eastbound				Charles Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
3:00 PM	0	1	1	0	0	0	12	1	0	4	0	1	0	0	0	0
3:15 PM	0	1	3	0	0	0	10	6	0	2	0	2	0	0	0	0
3:30 PM	0	0	11	0	0	0	6	1	0	2	0	0	0	0	0	0
3:45 PM	0	0	10	0	0	0	8	0	0	1	0	1	0	0	0	0
4:00 PM	0	0	3	0	0	0	3	1	0	2	0	1	0	0	0	0
4:15 PM	0	0	5	0	0	0	3	0	0	1	0	0	0	0	0	0
4:30 PM	0	1	5	0	0	0	9	1	0	1	0	0	0	0	0	0
4:45 PM	0	0	2	0	0	0	5	1	0	0	0	0	0	0	0	0
5:00 PM	0	0	4	0	0	0	4	1	0	0	0	0	0	0	0	0
5:15 PM	0	0	3	0	0	0	3	1	0	2	0	1	0	0	0	0
5:30 PM	0	0	1	0	0	0	3	1	0	0	0	1	0	0	0	0
5:45 PM	0	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:00 AM to 8:00 AM	Washington Street Northbound				Washington Street Southbound				Hollis Street Eastbound				Charles Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	7	55	0	0	1	49	10	0	18	0	4	0	0	0	0
PHF	0.91				0.88				0.55				0.00			

PM PEAK HOUR 3:00 PM to 4:00 PM	Washington Street Northbound				Washington Street Southbound				Hollis Street Eastbound				Charles Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	2	25	0	0	0	36	8	0	9	0	4	0	0	0	0
PHF	0.61				0.69				0.65				0.00			

Client: Michael V. Pompili
 Project #: 446_004_MM
 BTID #: Location 1
 Location: Holliston, MA
 Street 1: Washington Street
 Street 2: Hollis Street/Charles Street
 Count Date: 9/10/2019
 Day of Week: Tuesday
 Weather: Clouds & Sun, 70°F

PEDESTRIANS & BICYCLES

Washington Street Northbound					Washington Street Southbound					Hollis Street Eastbound					Charles Street Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED
7:00 AM	0	1	0	0		0	0	0	0		0	0	0	0		0	0	0	0
7:15 AM	0	0	0	0		1	0	0	0		0	0	0	0		0	0	0	1
7:30 AM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	1
7:45 AM	0	0	0	1		0	0	0	0		0	0	0	1		0	0	0	0
8:00 AM	0	0	0	0		0	0	0	0		0	0	0	2		0	0	0	0
8:15 AM	0	0	0	0		0	0	0	0		0	0	0	2		0	0	0	0
8:30 AM	0	0	0	1		0	0	0	0		0	0	0	2		0	0	0	1
8:45 AM	0	0	0	0		0	0	0	0		0	0	0	2		0	0	0	1

Washington Street Northbound					Washington Street Southbound					Hollis Street Eastbound					Charles Street Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED
3:00 PM	0	0	0	1		0	0	0	0		0	0	0	0		0	0	0	1
3:15 PM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
3:30 PM	0	0	0	2		0	0	0	0		0	0	0	0		0	0	0	1
3:45 PM	0	1	0	0		0	1	0	0		0	0	0	0		0	0	0	0
4:00 PM	0	0	1	1		0	0	0	0		0	0	0	0		0	0	0	3
4:15 PM	0	0	0	3		0	0	0	0		0	0	0	2		0	0	0	2
4:30 PM	0	0	0	3		0	1	0	0		0	0	0	2		0	0	0	3
4:45 PM	0	0	0	1		0	0	0	0		0	0	0	4		0	0	0	1
5:00 PM	0	0	0	2		0	0	0	0		0	0	0	2		0	0	0	2
5:15 PM	0	0	0	2		0	0	0	0		0	0	0	2		0	0	0	0
5:30 PM	0	0	0	0		0	0	0	0		0	0	0	1		0	0	0	3
5:45 PM	1	0	0	0		0	1	0	0		0	0	0	0		0	0	0	1

AM PEAK HOUR ¹ 7:00 AM to 8:00 AM	Washington Street Northbound					Washington Street Southbound					Hollis Street Eastbound					Charles Street Westbound				
	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	0	1	0	1		1	0	0	0		0	0	0	1		0	0	0	2	

PM PEAK HOUR ¹ 4:30 PM to 5:30 PM	Washington Street Northbound					Washington Street Southbound					Hollis Street Eastbound					Charles Street Westbound				
	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	0	0	0	8		0	1	0	0		0	0	0	10		0	0	0	6	

¹ Peak hours corresponds to vehicular peak hours.

Client: Michael V. Pompili
 Project #: 446_004_MM
 BTD #: Location 2
 Location: Holliston, MA
 Street 1: Washington Street
 Street 2: Central Street
 Count Date: 9/10/2019
 Day of Week: Tuesday
 Weather: Clouds & Sun, 70°F

PASSENGER CARS & HEAVY VEHICLES COMBINED

Washington Street Northbound					Washington Street Southbound					Eastbound				Central Street Westbound		
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	202	58	0	35	95	0	0	0	0	0	0	19	0	58
7:15 AM	0	0	184	38	0	41	99	0	0	0	0	0	0	21	0	49
7:30 AM	0	0	191	34	0	36	113	0	0	0	0	0	0	18	0	39
7:45 AM	0	0	201	41	0	19	126	0	0	0	0	0	0	15	0	41
8:00 AM	0	0	197	32	0	31	110	0	0	0	0	0	0	25	0	29
8:15 AM	0	0	232	25	0	19	101	0	0	0	0	0	0	14	0	32
8:30 AM	0	0	180	49	0	39	92	0	0	0	0	0	0	24	0	30
8:45 AM	0	0	155	24	0	38	109	0	0	0	0	0	0	27	0	31

Washington Street Northbound					Washington Street Southbound					Eastbound				Central Street Westbound		
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
3:00 PM	0	0	83	47	0	32	151	0	0	0	0	0	0	28	0	39
3:15 PM	0	0	94	21	0	29	154	0	0	0	0	0	0	29	0	37
3:30 PM	0	0	121	18	0	35	143	0	0	0	0	0	0	30	0	37
3:45 PM	0	0	141	35	0	20	153	0	0	0	0	0	0	27	0	34
4:00 PM	0	0	111	23	0	28	165	0	0	0	0	0	0	28	0	28
4:15 PM	0	0	134	27	0	26	146	0	0	0	0	0	0	30	0	24
4:30 PM	0	0	124	28	0	21	170	0	0	0	0	0	0	30	0	38
4:45 PM	0	0	161	41	0	23	149	0	0	0	0	0	0	31	0	41
5:00 PM	0	0	139	30	0	28	178	0	0	0	0	0	0	25	0	39
5:15 PM	0	0	160	35	0	37	164	0	0	0	0	0	0	34	0	29
5:30 PM	0	0	118	25	0	33	152	0	0	0	0	0	0	33	0	25
5:45 PM	0	0	126	20	0	37	170	0	0	0	0	0	0	31	0	33

AM PEAK HOUR 7:00 AM to 8:00 AM	Washington Street Northbound				Washington Street Southbound				Eastbound				Central Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	0	778	171	0	131	433	0	0	0	0	0	0	73	0	187
PHF	0.91				0.95				0.00				0.84			
HV %	0.0%	0.0%	6.8%	2.9%	0.0%	3.1%	11.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	4.8%

PM PEAK HOUR 4:30 PM to 5:30 PM	Washington Street Northbound				Washington Street Southbound				Eastbound				Central Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	0	584	134	0	109	661	0	0	0	0	0	0	120	0	147
PHF	0.89				0.93				0.00				0.93			
HV %	0.0%	0.0%	2.4%	0.0%	0.0%	0.9%	3.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.2%	0.0%	0.7%

Client: Michael V. Pompili
 Project #: 446_004_MM
 BTM #: Location 2
 Location: Holliston, MA
 Street 1: Washington Street
 Street 2: Central Street
 Count Date: 9/10/2019
 Day of Week: Tuesday
 Weather: Clouds & Sun, 70°F

HEAVY VEHICLES

Washington Street Northbound					Washington Street Southbound				Eastbound				Central Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	13	2	0	0	6	0	0	0	0	0	0	0	0	4
7:15 AM	0	0	11	0	0	1	13	0	0	0	0	0	0	0	0	2
7:30 AM	0	0	16	1	0	2	14	0	0	0	0	0	0	1	0	1
7:45 AM	0	0	13	2	0	1	16	0	0	0	0	0	0	0	0	2
8:00 AM	0	0	12	2	0	3	14	0	0	0	0	0	0	0	0	2
8:15 AM	0	0	10	2	0	1	13	0	0	0	0	0	0	1	0	4
8:30 AM	0	0	11	4	0	3	8	0	0	0	0	0	0	2	0	1
8:45 AM	0	0	11	0	0	2	10	0	0	0	0	0	0	0	0	1

Washington Street Northbound					Washington Street Southbound				Eastbound				Central Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
3:00 PM	0	0	1	4	0	5	8	0	0	0	0	0	0	0	0	1
3:15 PM	0	0	2	2	0	1	11	0	0	0	0	0	0	0	0	2
3:30 PM	0	0	10	0	0	1	5	0	0	0	0	0	0	2	0	1
3:45 PM	0	0	10	2	0	1	8	0	0	0	0	0	0	1	0	0
4:00 PM	0	0	3	2	0	1	3	0	0	0	0	0	0	1	0	0
4:15 PM	0	0	5	3	0	0	3	0	0	0	0	0	0	4	0	0
4:30 PM	0	0	5	0	0	0	9	0	0	0	0	0	0	2	0	1
4:45 PM	0	0	2	0	0	1	4	0	0	0	0	0	0	2	0	0
5:00 PM	0	0	4	0	0	0	4	0	0	0	0	0	0	1	0	0
5:15 PM	0	0	3	0	0	0	4	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	1	0	0	1	3	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:30 AM to 8:30 AM	Washington Street Northbound				Washington Street Southbound				Eastbound				Central Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	0	51	7	0	7	57	0	0	0	0	0	0	2	0	9
PHF	0.85				0.94				0.00				0.55			

PM PEAK HOUR 3:00 PM to 4:00 PM	Washington Street Northbound				Washington Street Southbound				Eastbound				Central Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	0	23	8	0	8	32	0	0	0	0	0	0	3	0	4
PHF	0.65				0.77				0.00				0.58			

Client: Michael V. Pompili
 Project #: 446_004_MM
 BTID #: Location 2
 Location: Holliston, MA
 Street 1: Washington Street
 Street 2: Central Street
 Count Date: 9/10/2019
 Day of Week: Tuesday
 Weather: Clouds & Sun, 70°F

PEDESTRIANS & BICYCLES

Washington Street Northbound					Washington Street Southbound					Eastbound					Central Street Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED
7:00 AM	0	1	0	0		0	0	0	0		0	0	0	0		0	0	0	0
7:15 AM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
7:30 AM	0	0	0	0		0	0	0	1		0	0	0	0		0	0	0	0
7:45 AM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
8:00 AM	0	0	0	0		0	0	0	1		0	0	0	0		0	0	0	0
8:15 AM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
8:30 AM	0	0	0	0		0	0	0	2		0	0	0	0		0	0	0	0
8:45 AM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0

Washington Street Northbound					Washington Street Southbound					Eastbound					Central Street Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED
3:00 PM	0	0	0	0		0	0	0	2		0	0	0	0		0	0	0	0
3:15 PM	0	0	0	0		0	0	0	2		0	0	0	0		0	0	0	1
3:30 PM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
3:45 PM	0	0	0	0		0	1	0	4		0	0	0	0		0	0	0	2
4:00 PM	0	0	0	0		0	0	0	3		0	0	0	0		0	0	0	5
4:15 PM	0	0	0	0		0	0	0	4		0	0	0	0		0	0	0	0
4:30 PM	0	0	0	0		0	1	0	3		0	0	0	0		0	0	0	0
4:45 PM	0	0	0	0		0	0	0	3		0	0	0	0		0	0	0	0
5:00 PM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	1
5:15 PM	0	0	0	0		0	0	0	2		0	0	0	0		0	0	0	0
5:30 PM	0	0	0	0		0	0	0	2		0	0	0	0		0	0	0	0
5:45 PM	0	0	0	0		0	1	0	3		0	0	0	0		0	0	0	0

AM PEAK HOUR ¹ 7:00 AM to 8:00 AM	Washington Street Northbound					Washington Street Southbound					Eastbound					Central Street Westbound				
	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	0	1	0	0		0	0	0	1		0	0	0	0		0	0	0	0	

PM PEAK HOUR ¹ 4:30 PM to 5:30 PM	Washington Street Northbound					Washington Street Southbound					Eastbound					Central Street Westbound				
	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	0	0	0	0		0	1	0	8		0	0	0	0		0	0	0	1	

¹ Peak hours corresponds to vehicular peak hours.

Client: Michael V. Pompili
 Project #: 446_004_MM
 BTD #: Location 3
 Location: Holliston, MA
 Street 1: Washington Street
 Street 2: Green Street/Exchange Street
 Count Date: 9/10/2019
 Day of Week: Tuesday
 Weather: Clouds & Sun, 70°F

PASSENGER CARS & HEAVY VEHICLES COMBINED

Washington Street Northbound					Washington Street Southbound				Green Street Eastbound				Exchange Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	243	2	0	3	109	2	0	2	0	0	0	6	1	15
7:15 AM	0	0	215	3	0	4	115	1	0	1	0	0	0	15	1	6
7:30 AM	0	1	217	4	0	4	125	2	0	4	1	0	0	6	0	4
7:45 AM	0	0	236	3	0	3	138	0	0	2	0	0	0	6	1	4
8:00 AM	0	0	221	2	0	3	129	3	0	2	0	0	0	11	1	6
8:15 AM	0	0	249	2	0	6	109	0	0	4	2	0	0	6	0	4
8:30 AM	0	0	220	2	0	2	113	1	0	5	0	0	0	18	1	4
8:45 AM	0	0	175	4	0	3	132	1	0	2	0	0	0	9	1	2

Washington Street Northbound					Washington Street Southbound				Green Street Eastbound				Exchange Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
3:00 PM	0	0	123	2	0	0	173	6	0	0	1	1	0	22	1	7
3:15 PM	0	0	101	3	0	3	177	3	0	4	0	1	0	28	0	10
3:30 PM	0	1	125	6	0	1	170	2	0	4	1	0	0	22	0	10
3:45 PM	0	2	161	6	0	3	168	9	0	4	0	1	0	23	2	11
4:00 PM	0	0	123	3	0	5	185	3	0	7	1	1	0	20	2	4
4:15 PM	0	0	147	5	0	2	165	9	0	8	1	3	0	20	3	6
4:30 PM	0	1	136	4	0	2	194	4	0	6	0	1	0	32	2	10
4:45 PM	0	2	182	5	0	2	171	7	0	8	0	2	0	26	2	12
5:00 PM	0	1	148	6	0	3	195	5	0	8	3	2	0	27	2	13
5:15 PM	0	0	177	3	0	5	183	10	0	6	2	1	0	26	4	12
5:30 PM	0	1	127	5	0	3	175	7	0	11	0	4	0	15	3	5
5:45 PM	0	1	136	0	0	3	196	2	0	3	0	0	0	10	2	7

AM PEAK HOUR 7:30 AM to 8:30 AM	Washington Street Northbound				Washington Street Southbound				Green Street Eastbound				Exchange Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	1	923	11	0	16	501	5	0	12	3	0	0	29	2	18
PHF	0.93				0.93				0.63				0.68			
HV %	0.0%	0.0%	6.1%	0.0%	0.0%	6.3%	11.6%	0.0%	0.0%	16.7%	0.0%	0.0%	0.0%	3.4%	50.0%	0.0%

PM PEAK HOUR 4:30 PM to 5:30 PM	Washington Street Northbound				Washington Street Southbound				Green Street Eastbound				Exchange Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	4	643	18	0	12	743	26	0	28	5	6	0	111	10	47
PHF	0.88				0.96				0.75				0.95			
HV %	0.0%	0.0%	2.2%	0.0%	0.0%	0.0%	3.5%	0.0%	0.0%	0.0%	20.0%	0.0%	0.0%	0.9%	0.0%	0.0%

Client: Michael V. Pompili
 Project #: 446_004_MM
 BTM #: Location 3
 Location: Holliston, MA
 Street 1: Washington Street
 Street 2: Green Street/Exchange Street
 Count Date: 9/10/2019
 Day of Week: Tuesday
 Weather: Clouds & Sun, 70°F

HEAVY VEHICLES

Washington Street Northbound					Washington Street Southbound				Green Street Eastbound				Exchange Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	13	0	0	0	5	1	0	1	0	0	0	0	0	1
7:15 AM	0	0	11	0	0	0	13	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	17	0	0	0	15	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	15	0	0	0	16	0	0	0	0	0	0	0	1	0
8:00 AM	0	0	14	0	0	0	14	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	10	0	0	1	13	0	0	2	0	0	0	1	0	0
8:30 AM	0	0	15	0	0	0	10	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	11	0	0	0	10	0	0	0	0	0	0	0	0	0

Washington Street Northbound					Washington Street Southbound				Green Street Eastbound				Exchange Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
3:00 PM	0	0	5	0	0	0	8	0	0	0	0	0	0	0	0	0
3:15 PM	0	0	4	1	0	0	11	0	0	0	0	0	0	0	0	0
3:30 PM	0	0	10	0	0	0	7	0	0	0	0	0	0	0	0	0
3:45 PM	0	0	12	0	0	0	9	0	0	0	0	0	0	2	0	0
4:00 PM	0	0	5	0	0	0	4	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	7	0	0	0	7	0	0	1	0	0	0	0	0	0
4:30 PM	0	0	5	0	0	0	11	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	2	0	0	0	6	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	4	0	0	0	5	0	0	0	1	0	0	1	0	0
5:15 PM	0	0	3	0	0	0	4	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:30 AM to 8:30 AM	Washington Street Northbound				Washington Street Southbound				Green Street Eastbound				Exchange Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	0	56	0	0	1	58	0	0	2	0	0	0	1	1	0
PHF	0.82				0.92				0.25				0.50			

PM PEAK HOUR 3:00 PM to 4:00 PM	Washington Street Northbound				Washington Street Southbound				Green Street Eastbound				Exchange Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	0	31	1	0	0	35	0	0	0	0	0	0	2	0	0
PHF	0.67				0.80				0.00				0.25			

Client: Michael V. Pompili
 Project #: 446_004_MM
 BTID #: Location 3
 Location: Holliston, MA
 Street 1: Washington Street
 Street 2: Green Street/Exchange Street
 Count Date: 9/10/2019
 Day of Week: Tuesday
 Weather: Clouds & Sun, 70°F

PEDESTRIANS & BICYCLES

Washington Street Northbound					Washington Street Southbound					Green Street Eastbound					Exchange Street Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED
7:00 AM	0	1	0	0		0	0	0	0		0	0	0	0		0	0	0	0
7:15 AM	0	0	0	1		0	0	0	0		0	0	0	0		0	0	0	0
7:30 AM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
7:45 AM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
8:00 AM	0	0	0	1		0	0	0	0		0	0	0	1		0	0	0	0
8:15 AM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
8:30 AM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
8:45 AM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0

Washington Street Northbound					Washington Street Southbound					Green Street Eastbound					Exchange Street Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED
3:00 PM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
3:15 PM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
3:30 PM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
3:45 PM	0	0	0	0		1	0	0	0		0	0	0	0		0	0	0	0
4:00 PM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
4:15 PM	0	0	0	1		0	0	0	0		0	0	0	0		0	0	0	0
4:30 PM	0	0	0	1		0	1	0	0		0	0	0	1		0	0	0	0
4:45 PM	0	0	0	1		0	0	0	0		0	0	0	1		0	0	0	2
5:00 PM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	2
5:15 PM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
5:30 PM	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
5:45 PM	0	0	0	0		0	1	0	0		0	0	0	0		0	0	0	0

AM PEAK HOUR¹	Washington Street Northbound					Washington Street Southbound					Green Street Eastbound					Exchange Street Westbound				
	7:30 AM	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED
	to 8:30 AM	0	0	0	1		0	0	0	0		0	0	0	1		0	0	0	0

PM PEAK HOUR¹	Washington Street Northbound					Washington Street Southbound					Green Street Eastbound					Exchange Street Westbound				
	4:30 PM	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED
	to 5:30 PM	0	0	0	2		0	1	0	0		0	0	0	2		0	0	0	4

¹ Peak hours corresponds to vehicular peak hours.

3: Washington Street & Hollis Street/Charles Street Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	3.0	0.2	0.0	0.7
Total Del/Veh (s)	137.6	16.6	13.2	40.2

6: Washington Street & Central Street Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.1	0.0	0.1
Total Del/Veh (s)	111.0	3.5	14.3	23.5

8: Washington Street & Green Street/Exchange Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.2	0.0	0.0	0.0
Total Del/Veh (s)	39.8	39.6	187.5	1.9	119.2

Total Network Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	131.4

Arterial Level of Service: NB Washington Street

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Exchange Street	8	187.6	265.9	0.7	9
Central Street	6	3.6	6.6	0.0	13
Charles Street	3	9.2	18.5	0.1	15
	11	2.0	20.9	0.2	27
Total		202.4	311.8	0.9	11

Arterial Level of Service: SB Washington Street

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Hollis Street	3	14.2	32.4	0.2	17
Central Street	6	12.3	21.4	0.1	13
Green Street	8	1.3	4.1	0.0	21
	13	6.8	87.1	0.7	28
Total		34.6	145.0	0.9	23

Intersection: 3: Washington Street & Hollis Street/Charles Street

Movement	EB	EB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	L	TR
Maximum Queue (ft)	713	100	140	350	64	400
Average Queue (ft)	496	83	92	171	6	158
95th Queue (ft)	805	135	159	369	28	314
Link Distance (ft)	679			339		753
Upstream Blk Time (%)	6			3		
Queuing Penalty (veh)	0			24		
Storage Bay Dist (ft)		60	100		60	
Storage Blk Time (%)	76	6	12	11	0	21
Queuing Penalty (veh)	92	16	93	18	0	1

Intersection: 6: Washington Street & Central Street

Movement	WB	NB	NB	SB	SB
Directions Served	LR	T	R	L	T
Maximum Queue (ft)	738	80	75	174	278
Average Queue (ft)	282	37	9	72	96
95th Queue (ft)	617	90	40	124	194
Link Distance (ft)	1745	67	67		339
Upstream Blk Time (%)		8	0		
Queuing Penalty (veh)		38	1		
Storage Bay Dist (ft)				150	
Storage Blk Time (%)				1	3
Queuing Penalty (veh)				3	4

Intersection: 8: Washington Street & Green Street/Exchange Street

Movement	EB	WB	NB	NB	SB	SB
Directions Served	LTR	LTR	LT	TR	L	TR
Maximum Queue (ft)	46	137	3328	75	29	96
Average Queue (ft)	10	54	1731	37	4	23
95th Queue (ft)	36	104	3488	93	21	63
Link Distance (ft)	540	620	3566		67	67
Upstream Blk Time (%)						1
Queuing Penalty (veh)						2
Storage Bay Dist (ft)				50		
Storage Blk Time (%)			49	2		
Queuing Penalty (veh)			232	11		

Network Summary

Network wide Queuing Penalty: 534

3: Washington Street & Hollis Street/Charles Street Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	3.2	0.5	0.0	0.7
Total Del/Veh (s)	171.0	25.5	68.4	69.0

6: Washington Street & Central Street Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.1	0.4	0.3
Total Del/Veh (s)	316.7	4.6	32.3	67.6

8: Washington Street & Green Street/Exchange Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.2	0.0	0.1	0.1
Total Del/Veh (s)	51.5	58.8	39.6	3.4	25.0

Total Network Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	142.3

Arterial Level of Service: NB Washington Street

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Exchange Street	8	39.9	121.8	0.7	20
Central Street	6	3.0	6.1	0.0	14
Charles Street	3	15.7	25.5	0.1	11
	11	2.0	20.9	0.2	27
Total		60.7	174.3	0.9	20

Arterial Level of Service: SB Washington Street

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Hollis Street	3	70.0	88.0	0.2	6
Central Street	6	35.5	45.0	0.1	6
Green Street	8	2.4	5.3	0.0	16
	13	10.4	90.9	0.7	27
Total		118.2	229.2	0.9	15

Intersection: 3: Washington Street & Hollis Street/Charles Street

Movement	EB	EB	NB	NB	SB	SB	B11
Directions Served	LT	R	L	TR	L	TR	T
Maximum Queue (ft)	694	100	140	348	44	861	1365
Average Queue (ft)	407	88	98	181	5	573	401
95th Queue (ft)	742	128	165	369	24	1104	1160
Link Distance (ft)	679			339		753	2383
Upstream Blk Time (%)	4			7		36	
Queuing Penalty (veh)	0			47		0	
Storage Bay Dist (ft)		60	100		60		
Storage Blk Time (%)	72	30	28	7	0	37	
Queuing Penalty (veh)	104	50	158	12	0	2	

Intersection: 6: Washington Street & Central Street

Movement	WB	NB	NB	SB	SB
Directions Served	LR	T	R	L	T
Maximum Queue (ft)	1180	78	31	174	360
Average Queue (ft)	671	40	5	109	312
95th Queue (ft)	1251	82	23	225	421
Link Distance (ft)	1745	67	67		339
Upstream Blk Time (%)		7			15
Queuing Penalty (veh)		24			115
Storage Bay Dist (ft)				150	
Storage Blk Time (%)				0	36
Queuing Penalty (veh)				0	39

Intersection: 8: Washington Street & Green Street/Exchange Street

Movement	EB	WB	NB	NB	SB	SB
Directions Served	LTR	LTR	LT	TR	L	TR
Maximum Queue (ft)	69	247	556	75	50	88
Average Queue (ft)	28	130	310	45	15	42
95th Queue (ft)	64	210	514	99	39	83
Link Distance (ft)	540	620	3566		67	67
Upstream Blk Time (%)					0	5
Queuing Penalty (veh)					0	20
Storage Bay Dist (ft)				50		
Storage Blk Time (%)			51	7		
Queuing Penalty (veh)			174	23		

Network Summary

Network wide Queuing Penalty: 768

3: Washington Street & Hollis Street/Charles Street Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.6	0.3	0.0	0.4
Total Del/Veh (s)	45.5	19.3	16.9	23.5

6: Washington Street & Central Street Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.3	0.1	0.2	0.1
Total Del/Veh (s)	90.9	3.8	12.1	19.7

8: Washington Street & Green Street/Exchange Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0
Total Del/Veh (s)	51.7	38.6	62.3	1.8	41.2

Total Network Performance

Denied Del/Veh (s)	1.0
Total Del/Veh (s)	67.1

Arterial Level of Service: NB Washington Street

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Exchange Street	8	62.5	142.3	0.7	17
Central Street	6	3.6	6.6	0.0	13
Charles Street	3	17.7	27.1	0.1	10
	11	2.3	21.2	0.2	27
Total		86.1	197.2	0.9	17

Arterial Level of Service: SB Washington Street

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Hollis Street	3	19.6	37.9	0.2	15
Central Street	6	7.6	16.9	0.1	17
Green Street	8	0.9	3.8	0.0	23
	13	6.8	87.3	0.7	28
Total		34.9	145.9	0.9	23

Intersection: 3: Washington Street & Hollis Street/Charles Street

Movement	EB	EB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	TR	L	T	R
Maximum Queue (ft)	494	100	140	353	99	589	125
Average Queue (ft)	215	72	84	258	9	184	71
95th Queue (ft)	424	126	157	421	41	397	141
Link Distance (ft)	666			339		749	
Upstream Blk Time (%)				4			
Queuing Penalty (veh)				34			
Storage Bay Dist (ft)		60	100		60		100
Storage Blk Time (%)	50	1	1	29		25	0
Queuing Penalty (veh)	61	3	10	47		46	1

Intersection: 6: Washington Street & Central Street

Movement	WB	NB	NB	SB	SB
Directions Served	LR	T	R	L	T
Maximum Queue (ft)	520	97	56	174	339
Average Queue (ft)	247	51	8	71	88
95th Queue (ft)	482	105	34	128	221
Link Distance (ft)	1745	67	67		339
Upstream Blk Time (%)		9	0		0
Queuing Penalty (veh)		42	0		1
Storage Bay Dist (ft)				150	
Storage Blk Time (%)				1	2
Queuing Penalty (veh)				2	3

Intersection: 8: Washington Street & Green Street/Exchange Street

Movement	EB	WB	NB	NB	SB	SB
Directions Served	LTR	LTR	LT	TR	L	TR
Maximum Queue (ft)	48	110	1410	140	29	110
Average Queue (ft)	10	50	614	93	10	19
95th Queue (ft)	35	93	1204	184	31	69
Link Distance (ft)	540	620	3566		67	67
Upstream Blk Time (%)						0
Queuing Penalty (veh)						0
Storage Bay Dist (ft)				115		
Storage Blk Time (%)			40	1		
Queuing Penalty (veh)			188	6		

Network Summary

Network wide Queuing Penalty: 445

3: Washington Street & Hollis Street/Charles Street Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.9	0.2	0.0	0.4
Total Del/Veh (s)	30.5	16.8	50.2	34.1

6: Washington Street & Central Street Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.1	0.1
Total Del/Veh (s)	52.3	4.4	18.4	18.7

8: Washington Street & Green Street/Exchange Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.2	0.0	0.0	0.1
Total Del/Veh (s)	45.1	119.5	48.2	2.7	34.1

Total Network Performance

Denied Del/Veh (s)	0.8
Total Del/Veh (s)	74.1

Arterial Level of Service: NB Washington Street

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Exchange Street	8	48.1	129.6	0.7	19
Central Street	6	2.2	5.0	0.0	17
Charles Street	3	13.6	22.9	0.1	12
	11	2.1	20.9	0.2	27
Total		66.0	178.4	0.9	19

Arterial Level of Service: SB Washington Street

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Hollis Street	3	53.2	71.7	0.2	8
Central Street	6	15.5	24.9	0.1	11
Green Street	8	2.2	5.1	0.0	17
	13	9.4	90.5	0.7	27
Total		80.2	192.2	0.9	18

Intersection: 3: Washington Street & Hollis Street/Charles Street

Movement	EB	EB	NB	NB	SB	SB	SB	B11
Directions Served	LT	R	L	TR	L	T	R	T
Maximum Queue (ft)	326	100	140	345	14	839	125	386
Average Queue (ft)	111	53	85	160	0	464	88	33
95th Queue (ft)	237	114	154	296	5	929	162	193
Link Distance (ft)	666			339		749		2383
Upstream Blk Time (%)				1		9		
Queuing Penalty (veh)				7		0		
Storage Bay Dist (ft)		60	100		60		100	
Storage Blk Time (%)	23	6	6	15		40	0	
Queuing Penalty (veh)	37	11	32	25		75	1	

Intersection: 6: Washington Street & Central Street

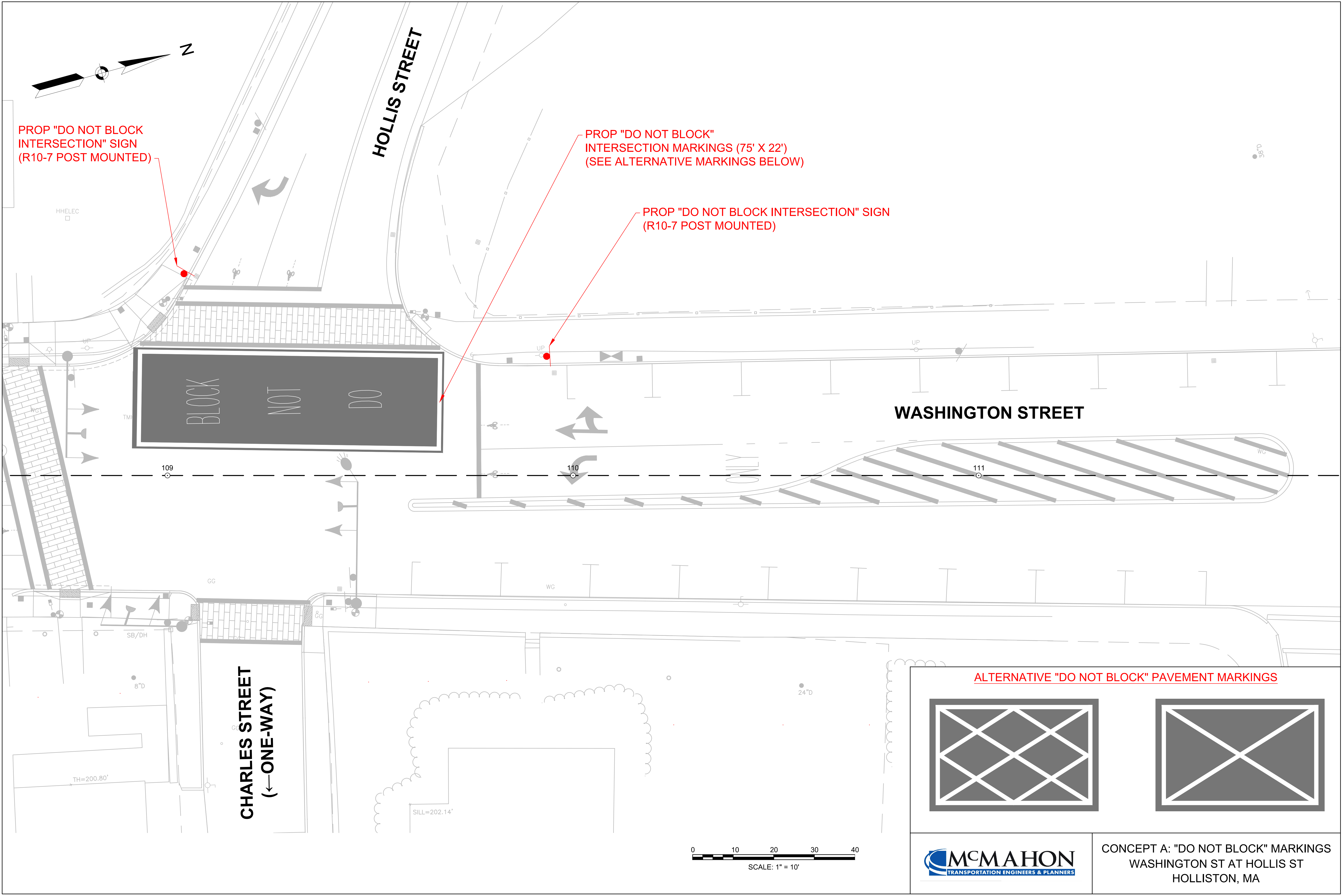
Movement	WB	NB	NB	SB	SB
Directions Served	LR	T	R	L	T
Maximum Queue (ft)	328	80	53	174	353
Average Queue (ft)	190	41	12	69	208
95th Queue (ft)	295	78	39	175	374
Link Distance (ft)	1745	67	67		339
Upstream Blk Time (%)		6	0		2
Queuing Penalty (veh)		21	0		12
Storage Bay Dist (ft)				150	
Storage Blk Time (%)				0	14
Queuing Penalty (veh)				0	15

Intersection: 8: Washington Street & Green Street/Exchange Street

Movement	EB	WB	NB	NB	SB	SB
Directions Served	LTR	LTR	LT	TR	L	TR
Maximum Queue (ft)	91	327	767	140	29	96
Average Queue (ft)	30	199	331	93	9	44
95th Queue (ft)	73	308	651	188	31	85
Link Distance (ft)	540	620	3566		67	67
Upstream Blk Time (%)						3
Queuing Penalty (veh)						13
Storage Bay Dist (ft)				115		
Storage Blk Time (%)			39	1		
Queuing Penalty (veh)			130	3		

Network Summary

Network wide Queuing Penalty: 381



PROP "DO NOT BLOCK
INTERSECTION" SIGN
(R10-7 POST MOUNTED)

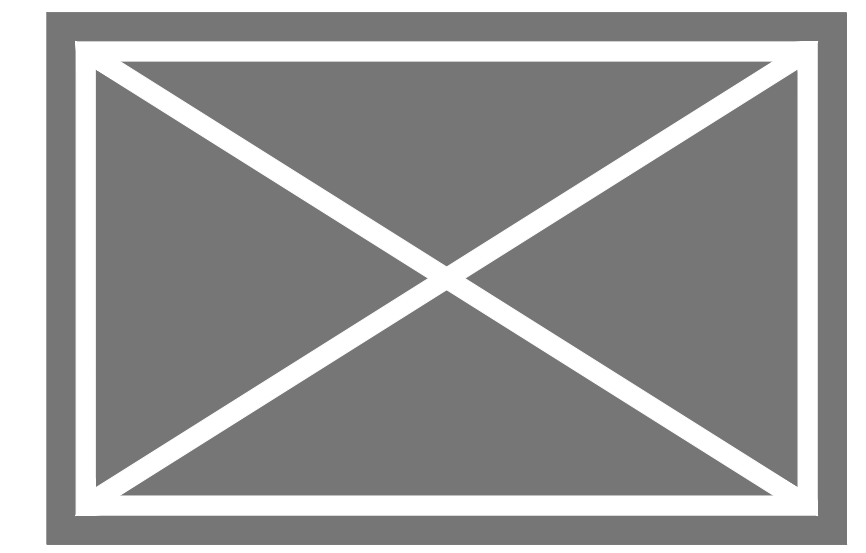
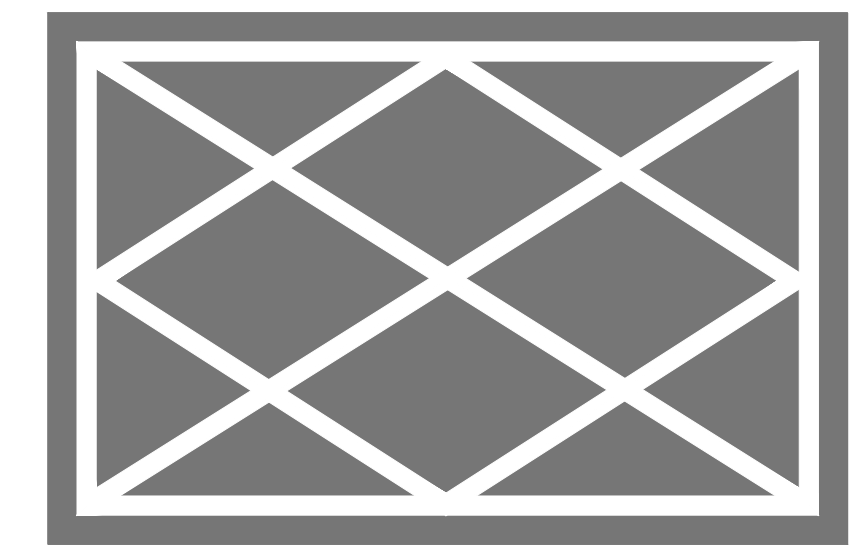
PROP "DO NOT BLOCK"
INTERSECTION MARKINGS (75' X 22')
(SEE ALTERNATIVE MARKINGS BELOW)

PROP "DO NOT BLOCK INTERSECTION" SIGN
(R10-7 POST MOUNTED)

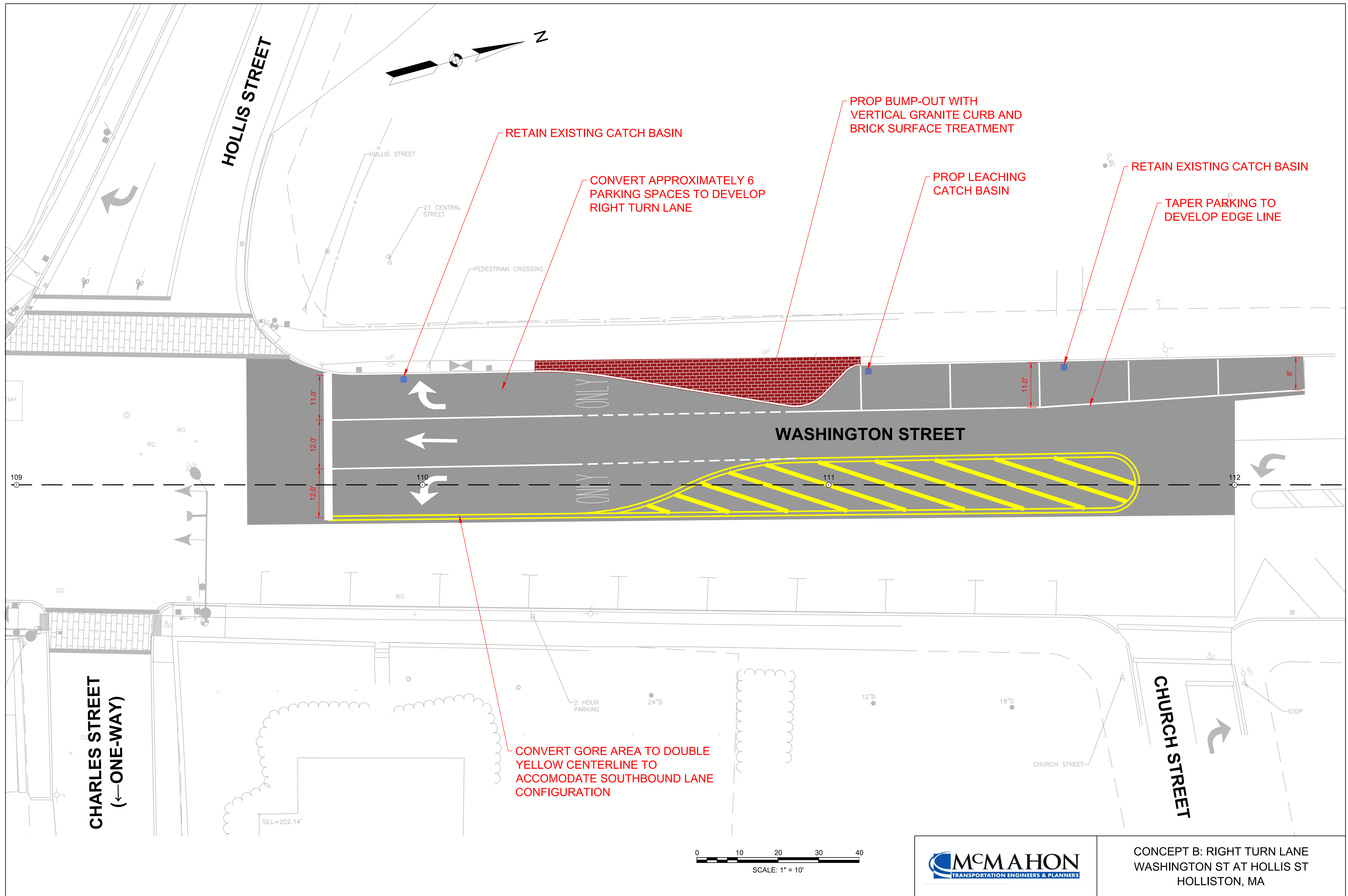
WASHINGTON STREET

CHARLES STREET
(←ONE-WAY)

ALTERNATIVE "DO NOT BLOCK" PAVEMENT MARKINGS



CONCEPT A: "DO NOT BLOCK" MARKINGS
WASHINGTON ST AT HOLLIS ST
HOLLISTON, MA

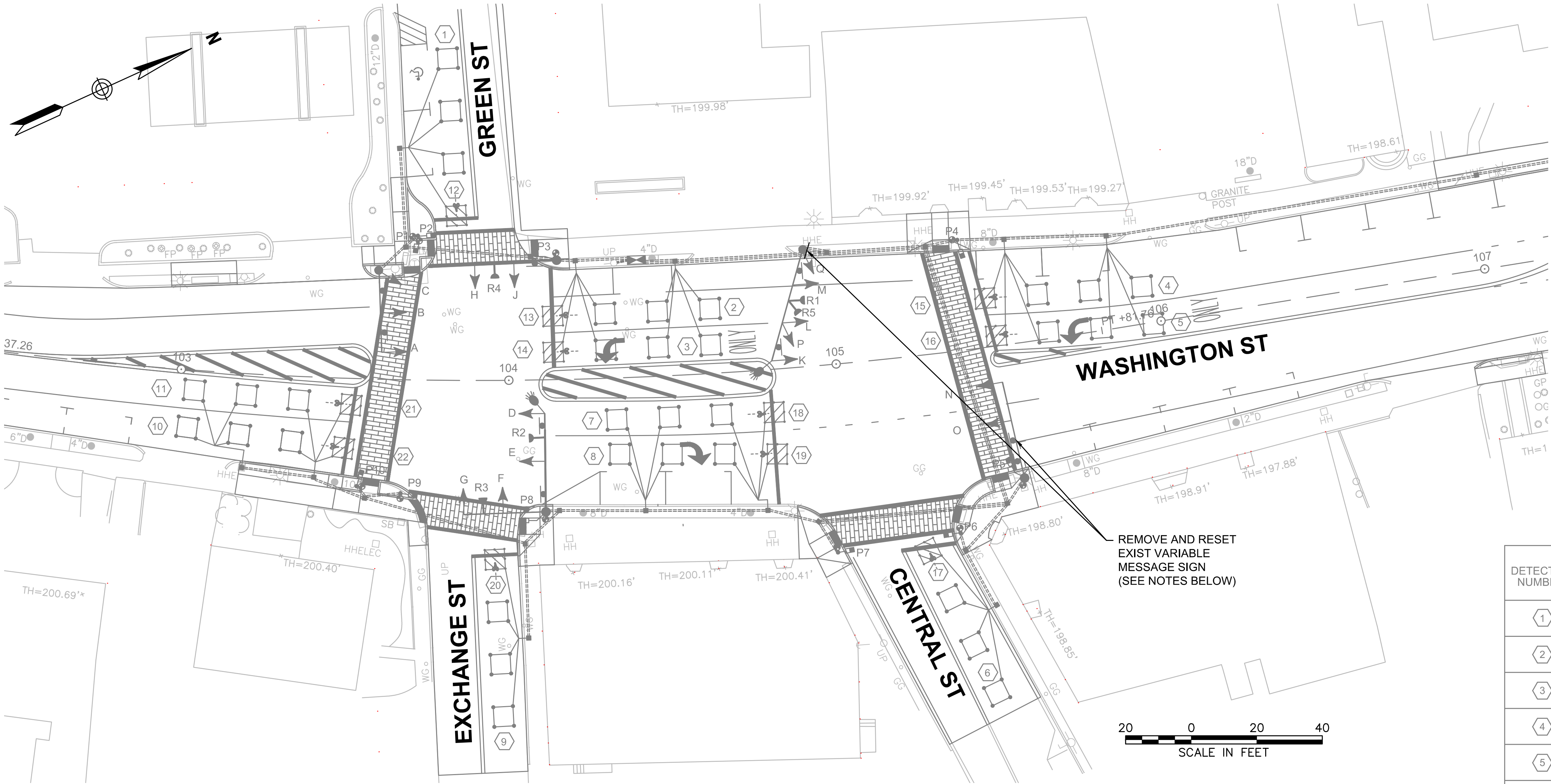


CONCEPT B: RIGHT TURN LANE
WASHINGTON ST AT HOLLIS ST
HOLLISTON, MA

HOLLISTON
WASHINGTON ST CORRIDOR
POST-CONSTRUCTION ADJUSTMENTS

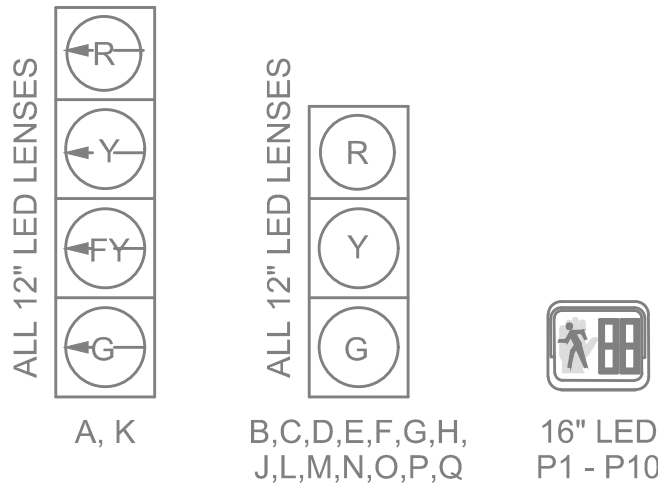
SHEET NO.	TOTAL SHEETS
1	3

TRAFFIC SIGNAL PLAN
EXCHANGE ST/GREEN ST/CENTRAL ST



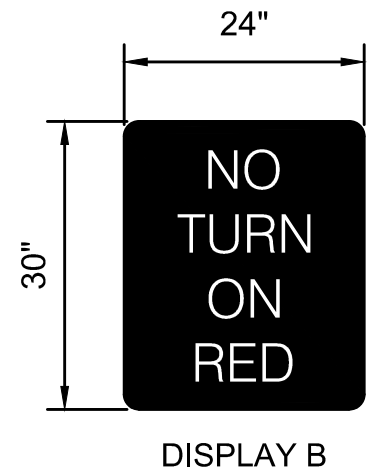
NOTE: ADJUSTMENT OF OVERHEAD UTILITIES TO AVOID CONFLICT WITH SIGNAL MAST ARMS SHALL BE COORDINATED PRIOR TO INSTALLATION OF SIGNAL EQUIPMENT.

SIGNAL IDENTIFICATION



- NOTES:
- ALL SIGNALS SHALL HAVE CUT AWAY VISORS.
 - ALL SIGNALS SHALL HAVE 5" LOUVERED BACK PLATES WITH 3" RETROREFLECTIVE BORDERS.

VARIABLE MESSAGE SIGN



- NOTES:
- EXISTING LANE ASSIGNMENT DISPLAY TO BE REPLACED WITH "NO TURN ON RED" DISPLAY.
 - "NO TURN ON RED" TO BE ILLUMINATED DURING Ø9. DISPLAY TO REMAIN DARK ALL OTHER TIMES.

MAJOR ITEMS REQUIRED		
PAY ITEM	QUANTITY	ITEM
816.01	1	REPROGRAM EXISTING CONTROLLER
	1	REMOVE, MODIFY, AND RESET EXISTING VARIABLE MESSAGE SIGN PLUS ALL NECESSARY DUCT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION.

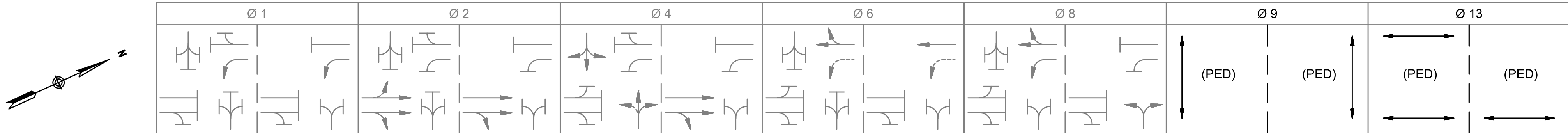
LOOP DETECTOR DATA

DETECTOR NUMBER	AMPLIFIER NUMBER	CHANNEL NUMBER	LOOP SIZE	NUM OF TURNS	Ø CALLED	Ø EXT	MODE A=PULSE B=PRES	DELAY TIME	EXT TIME
1	1	1	3@6'X6"	3	4	4	B	5	0
2	1	2	3@6'X6"	3	6	6	B	0	0
3	2	1	3@6'X6"	3	1	6	B	0	0
4	2	2	3@6'X6"	3	6	6	B	0	0
5	3	1	3@6'X6"	3	1	6	B	0	0
6	3	2	3@6'X6"	3	8	8	B	5	0
7	4	1	3@6'X6"	3	2	4	B	0	0
8	4	2	3@6'X6"	3	2	4	B	0	0
9	5	1	3@6'X6"	3	4	4	B	5	0
10	5	2	3@6'X6"	3	2	2	B	0	0
11	6	1	3@6'X6"	3	2	2	B	0	0
12	6	2	1@6'X6"	D-2	4	4	BICYCLE	5	0
13	7	1	1@6'X6"	D-2	6	6	BICYCLE	0	0
14	7	2	1@6'X6"	D-2	1	1	BICYCLE	0	0
15	8	1	1@6'X6"	D-2	6	6	BICYCLE	0	0
16	8	2	1@6'X6"	D-2	1	1	BICYCLE	0	0
17	9	1	1@6'X6"	D-2	8	8	BICYCLE	5	0
18	9	2	1@6'X6"	D-2	2	2	BICYCLE	0	0
19	10	1	1@6'X6"	D-2	2	2	BICYCLE	0	0
20	10	2	1@6'X6"	D-2	4	4	BICYCLE	5	0
21	11	1	1@6'X6"	D-2	2	2	BICYCLE	0	0
22	11	2	1@6'X6"	D-2	2	2	BICYCLE	0	0

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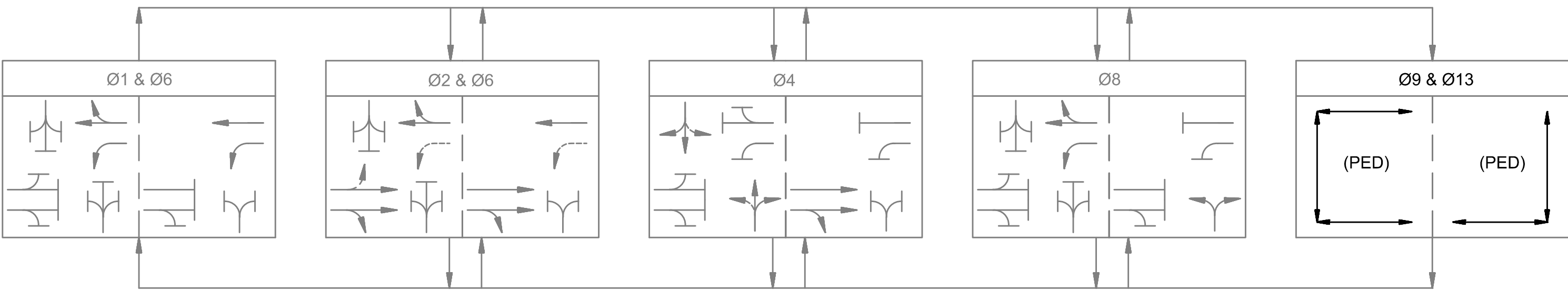
SHEET NO.	TOTAL SHEETS
2	3

TRAFFIC SIGNAL PLAN
EXCHANGE ST/GREEN ST/CENTRAL ST

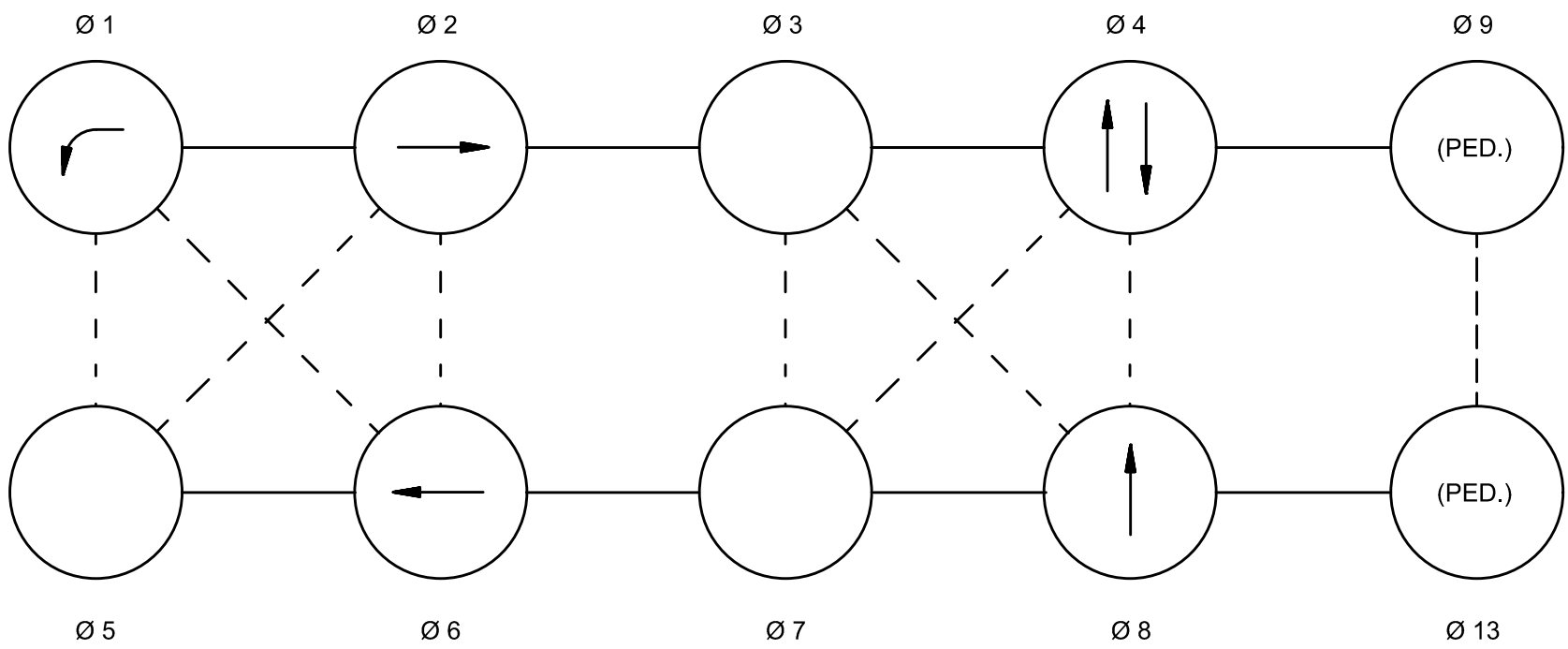


SEQUENCE AND TIMING FOR FULL ACTUATED CONTROL (ISOLATED)																									
STREET	DIRECTION	HEAD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	FLASH OP	
WASHINGTON ST AT EXCHANGE ST	SB LEFT	A	← G —	← Y —	← R —	← R —	← R —	← R —	← R —	← R —	← R —	← FY —	← Y —	← R —	← G —	← Y —	← R —	← R —	← R —	← R —	← R —	← R —	← R —	← FR —	
WASHINGTON ST AT CENTRAL ST	SB LEFT	K	← G —	← Y —	← R —	← R —	← R —	← R —	← R —	← R —	← R —	← FY —	← Y —	← R —	← R —	← R —	← R —	← R —	← R —	← R —	← R —	← R —	← R —	← FR —	
WASHINGTON ST AT EXCHANGE ST	SB	B,C	R	R	R	R	R	R	R	R	R	G	Y	R	G	Y	R	R	R	R	R	R	R	FY	
WASHINGTON ST AT CENTRAL ST	SB	L,M	R	R	R	R	R	R	R	R	R	G	Y	R	R	R	R	R	R	R	R	R	R	FY	
WASHINGTON ST AT EXCHANGE ST	NB	D,E	R	R	R	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	FY	
WASHINGTON ST AT CENTRAL ST	NB	N,O	R	R	R	G	Y	R	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	FY	
GREEN ST	EB	F,G	R	R	R	R	R	R	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	FR	
EXCHANGE ST	WB	H,J	R	R	R	R	R	R	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	FR	
CENTRAL ST	WB	P,Q	R	R	R	R	R	R	R	R	R	R	R	R	G	Y	R	R	R	R	R	R	R	FR	
PEDESTRIAN	EB-WB	P1,P4,P5,P10	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	W	FDW	DW	DW	DW	DW	OUT	
PEDESTRIAN	NB-SB	P2,P3,P6-P9	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	W	FDW	DW	OUT	
			TIMING IN SECONDS																						
MINIMUM GREEN (INITIAL)			4			10			6			10			6										
PASSAGE TIME (VEHICLE)			2			4			4			4			4										
MAXIMUM 1			10			25			10			35			10										
MAXIMUM 2			4			34			6			36			14										
YELLOW CLEARANCE				3			3			3			3			3									
RED CLEARANCE					1			1			1			1			1								
WALK (W)																		7			7				
PEDESTRIAN CLEARANCE																			14	4		5	4		
RECALL			NONE			SOFT			NONE			SOFT			NONE			NONE			NONE				
MEMORY			NON-LOCK			NON-LOCK			NON-LOCK			NON-LOCK			NON-LOCK			LOCK			LOCK				
COORDINATION DATA			COORDINATION PHASE TIMING (SEC)																						
TIMING PLAN	CYCLE LENGTH	REF/OFFSET	Ø 1			Ø 2			Ø 4			Ø 6			Ø 8			Ø 9			Ø 13				
TP1 (M-F 6 AM - 9 AM)	95	0	8			38			10			40			13			26			17				
TP2 (M-F 3 PM - 6 PM)	95	0	8			33			10			33			18			26			17				
TP3 (ALL OTHER TIMES)	FREE	-																							

PREFERENTIAL PHASING SEQUENCE



NEMA DUAL RING PHASING NOTES:



- PHASES ASSOCIATED BY A SOLID LINE SHALL NOT OPERATE CONCURRENTLY.
- PHASES ASSOCIATED BY A DASHED LINE MAY OPERATE CONCURRENTLY.
- THROUGH MOVEMENTS MAY INCLUDE RIGHT TURNS.
- IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT SHALL NOT CHANGE DURING THE CHANGE INTERVAL(S) UNLESS OTHERWISE NOTED.

EMERGENCY PREEMPTION SCHEDULE

APPROACH	PREEMPTION PHASE	NEXT PHASE CALLED
NORTHBOUND	Ø 2	Ø 4
SOUTHBOUND	Ø 1 & Ø 6	Ø 2 & Ø 6
EASTBOUND	Ø 4	Ø 8
WESTBOUND	Ø 8	Ø 1 & Ø 6

EMERGENCY PREEMPTION OPERATION:

- EMERGENCY VEHICLE PREEMPTION SHALL BE ACTUATED BY AN OPTICAL SIGNAL FROM AN OPTICAL EMITTER MOUNTED ON AN EMERGENCY VEHICLE AND RECEIVED BY AN OPTICAL DETECTOR LOCATED AT INTERSECTION. A SEPARATE RECEIVING DETECTOR IS REQUIRED FOR EACH DETECTED APPROACH. PREEMPTION SIGNALS FROM MULTIPLE APPROACHES SHALL BE SERVICED ON A FIRST DETECTED FIRST SERVED BASIS.
- IN RESPONSE TO A PREEMPTION SIGNAL RECEIVED AT AN INTERSECTION BY AN OPTICAL DETECTOR, THE CONTROLLER SHALL TIME THE CLEARANCE INTERVALS OF THE ACTIVE PHASE (IF DIFFERENT THAT TO BE SERVICED) AND ADVANCE TO AND/OR HOLD IN EMERGENCY VEHICLE PREEMPTION PHASE UNTIL PREEMPTION SIGNAL CEASES. THE CONTROLLER SHALL THEN TIME CLEARANCES AND SIMILARLY SERVICE OTHER EMERGENCY VEHICLE PREEMPTION SEQUENCES IN THE ORDER RECEIVED (IF RECEIVED), OTHERWISE, RESUME NORMAL PREFERENTIAL PHASE SEQUENCE.
- PREEMPTION MINIMUM GREENS SHALL BE 6 SECONDS.
- NORMAL CLEARANCES SHALL BE PROVIDED ON PHASES THAT ARE TERMINATED BY PREEMPTION DEMAND.
- ACTUAL TIMING FOR PREEMPTION SHALL BE DETERMINED IN THE FIELD IN COORDINATION WITH THE FIRE DEPARTMENT.

COORDINATION NOTES:

- OFFSET TO BEGINNING OF FIRST COORDINATED PHASE TO THE BEGINNING OF GREEN.
- PHASE 2 TO BE COORDINATED PHASE.
- ALL COORDINATION PHASE TIMES INCLUDE YELLOW AND RED CLEARANCE TIME.
- COORDINATED PHASE DETECTORS SHALL BE DISABLED DURING COORDINATION.
- COORDINATION MODE SHALL BE PERMISSIVE. FLOATING FORCE OFFS SHALL BE IN EFFECT DURING COORDINATION.
- OFFSET SEEKING SHALL BE THE SHORTWAY METHOD.
- MAXIMUM GREEN #1 FOR FREE OPERATION. MAXIMUM GREEN #2 IN EFFECT DURING COORDINATION.

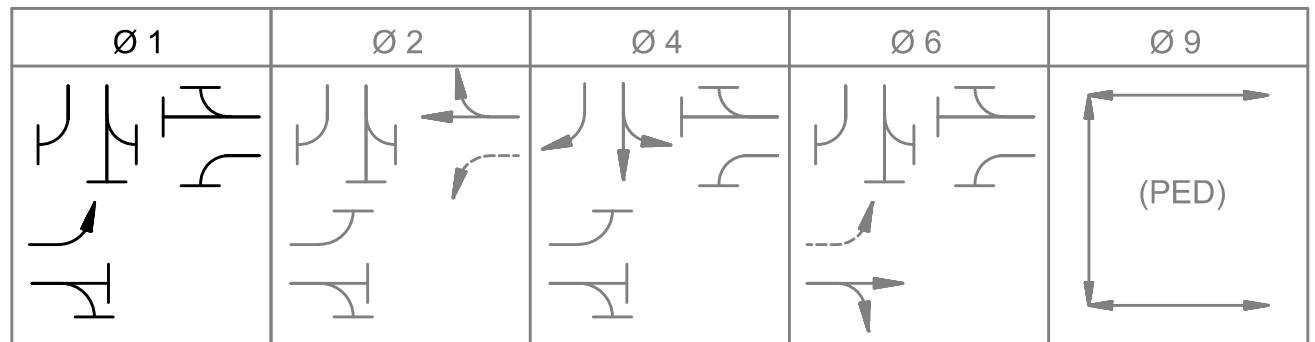
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HOLLISTON
WASHINGTON ST CORRIDOR
POST-CONSTRUCTION ADJUSTMENTS

SHEET NO.	TOTAL SHEETS
3	3

TRAFFIC SIGNAL PLAN
CHARLES ST/HOLLIS ST

MAJOR ITEMS REQUIRED		
PAY ITEM	QUANTITY	ITEM
816.02	1	REPROGRAM EXISTING CONTROLLER
	1	REPAIR WIRE LOOP DETECTOR
	1	REMOVE AND RESET EXISTING 1 WAY, 3 SECTION SIGNAL HOUSING "D"
	1	1 WAY, 4 SECTION, SIGNAL HOUSING (12" LED)
	1	5" LOUVERED SIGNAL BACKPLATES W/ RETROREFLECTIVE BORDERS
PLUS ALL NECESSARY DUCT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION.		



SEQUENCE AND TIMING FOR FULL ACTUATED CONTROL (COORDINATED)

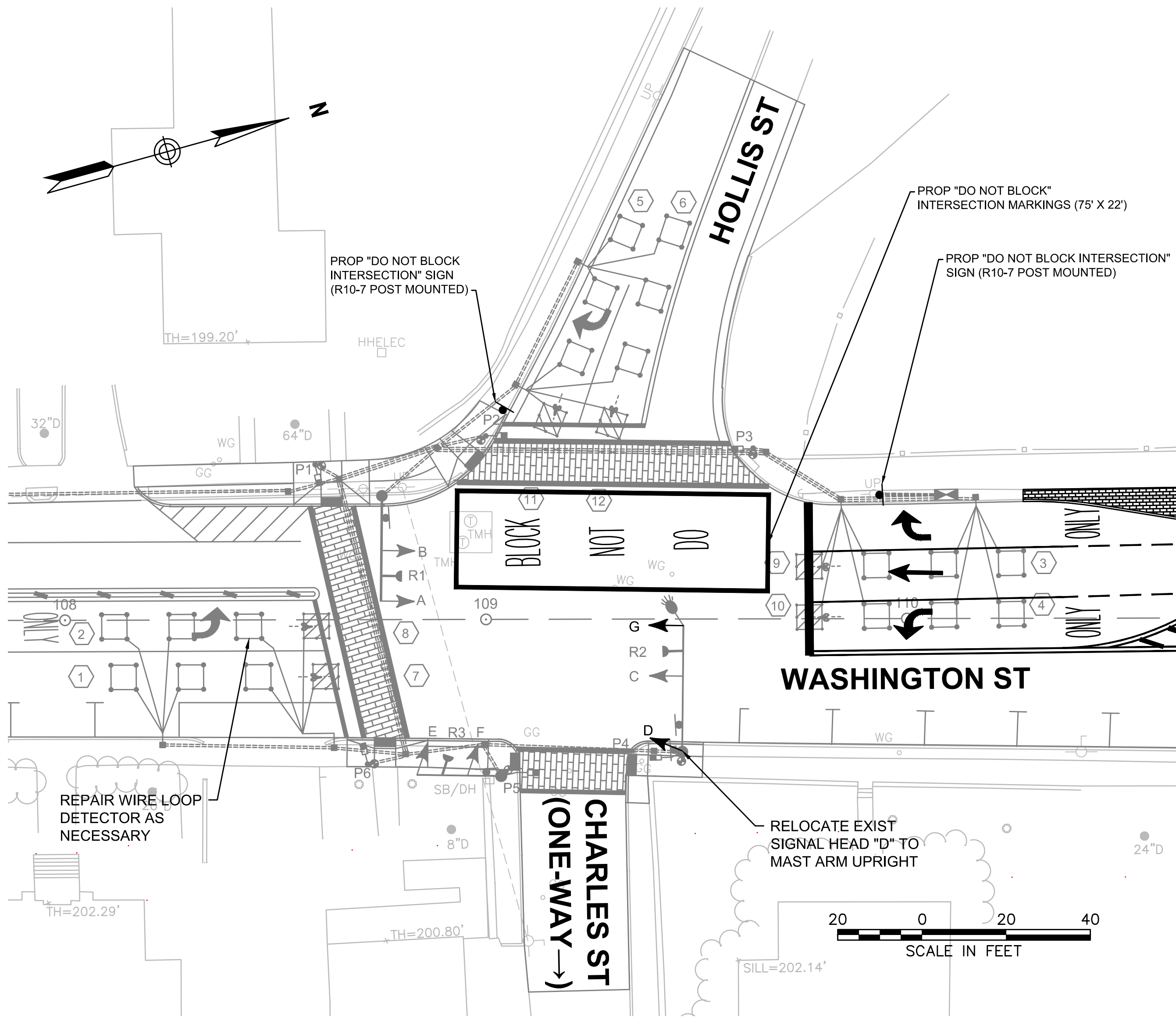
STREET		DIRECTION	HSGS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	FLASH OP
WASHINGTON ST		SB	A,B	R	R	R	G	Y	R	R	R	R	FY	Y	R	R	R	R	FY
WASHINGTON ST		NB	G	G	Y	R	R	R	R	R	R	R	G	Y	R	R	R	R	FY
WASHINGTON ST		NB	C,D	R	R	R	R	R	R	R	R	R	G	Y	R	R	R	R	FY
HOLLIS ST		EB	E,F	R	R	R	R	R	R	G	Y	R	R	R	R	R	R	R	FR
PEDESTRIAN		P1 - P6	ALL	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	W	FDW	DW	OUT
MINIMUM GREEN (INITIAL)				4			10			7			10						EMERGENCY ONLY
PASSAGE TIME (VEHICLE)				2			4			4			4						
MAXIMUM 1				8			25			10			25						
MAXIMUM 2				6			59			16			59						
YELLOW CLEARANCE					3			3			3			3					
RED CLEARANCE						1			1			1			1				
WALK (W)															7				
PEDESTRIAN CLEARANCE																13	4		
RECALL				NONE		SOFT		NONE		SOFT		NONE		LOCK					
MEMORY				NON-LOCK		NON-LOCK		NON-LOCK		NON-LOCK		NON-LOCK		LOCK					
COORDINATION DATA				COORDINATION PHASE TIMING (SEC)															
TIMING PLAN	CYCLE LENGTH	REF/OFFSET	Ø 1		Ø 2		Ø 4		Ø 6		Ø 9								
TP1 (M-F 6 AM - 9 AM)	95	0	10		36		24		36		25								
TP2 (M-F 3 PM - 6 PM)	95	80	9		37		24		37		25								
TP3 (ALL OTHER TIMES)	FREE	-																	

EMERGENCY PREEMPTION SCHEDULE

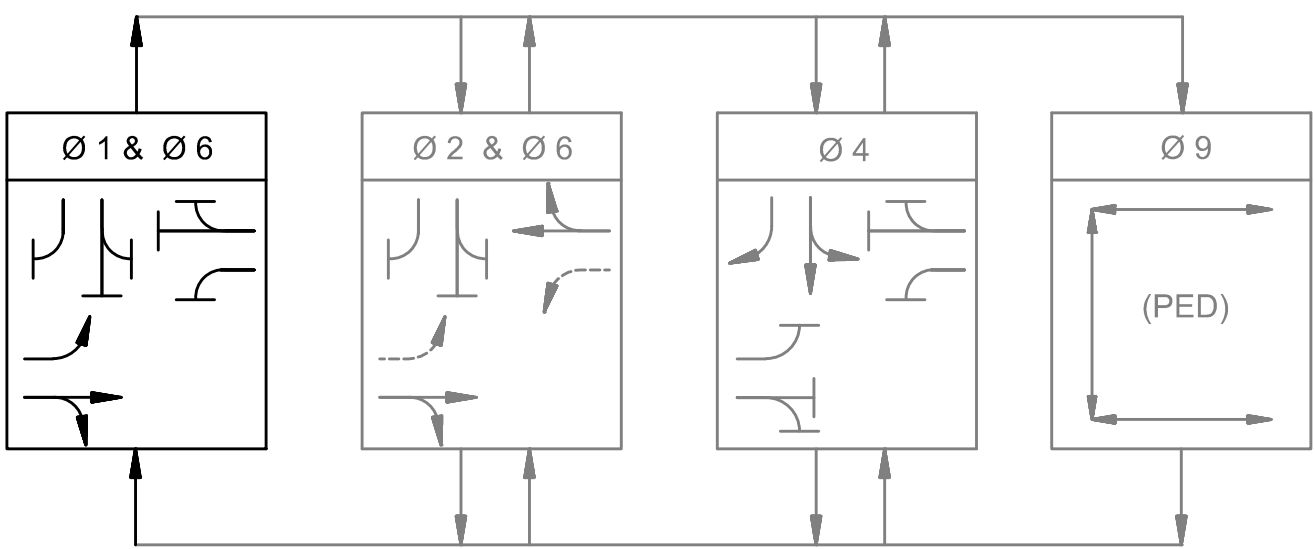
APPROACH	PREEMPTION PHASE	NEXT PHASE CALLED
NORTHBOUND	Ø 1 & Ø 6	Ø 2 & Ø 6
SOUTHBOUND	Ø 2	Ø 2 & Ø 6
EASTBOUND	Ø 4	Ø 2 & Ø 6

- EMERGENCY PREEMPTION OPERATION:
- EMERGENCY VEHICLE PREEMPTION SHALL BE ACTUATED BY AN OPTICAL SIGNAL FROM AN OPTICAL EMITTER MOUNTED ON AN EMERGENCY VEHICLE AND RECEIVED BY AN OPTICAL DETECTOR LOCATED AT THE INTERSECTION. A SEPARATE RECEIVING DETECTOR IS REQUIRED FOR EACH DETECTED APPROACH.
 - PREEMPTION SIGNALS FROM MULTIPLE APPROACHES SHALL BE SERVICED ON A FIRST DETECTED FIRST SERVED BASIS.
 - IN RESPONSE TO A PREEMPTION SIGNAL RECEIVED AT AN INTERSECTION BY AN OPTICAL DETECTOR, THE CONTROLLER SHALL TIME THE CLEARANCE INTERVALS OF THE ACTIVE PHASE (IF DIFFERENT FROM THAT TO BE SERVICED) AND ADVANCE TO AND/OR HOLD IN EMERGENCY VEHICLE PREEMPTION PHASE UNTIL PREEMPTION SIGNAL CEASES. THE CONTROLLER SHALL THEN TIME CLEARANCES AND SIMILARLY SERVICE OTHER EMERGENCY VEHICLE PREEMPTION SEQUENCES IN THE ORDER RECEIVED (IF RECEIVED). OTHERWISE, RESUME NORMAL PREFERENTIAL PHASE SEQUENCE.
 - PREEMPTION MINIMUM GREENS SHALL BE 6 SECONDS.
 - NORMAL CLEARANCES SHALL BE PROVIDED ON PHASES THAT ARE TERMINATED BY PREEMPTION DEMAND.
 - ACTUAL TIMING FOR PREEMPTION SHALL BE DETERMINED IN THE FIELD IN COORDINATION WITH THE FIRE DEPARTMENT.

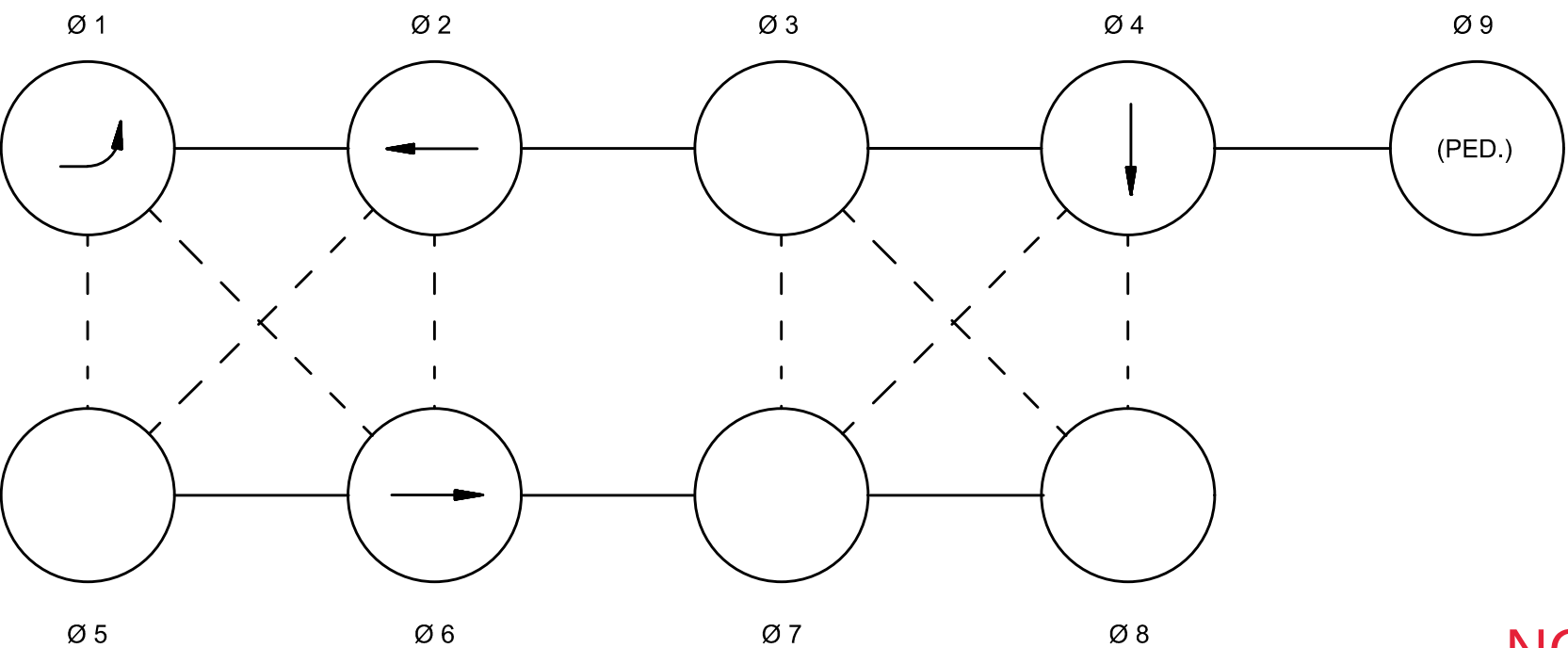
- COORDINATION NOTES:
- OFFSET TO BEGINNING OF FIRST COORDINATED PHASE TO THE BEGINNING OF GREEN.
 - PHASES 2 AND 6 TO BE COORDINATED PHASES.
 - ALL COORDINATION PHASE TIMES INCLUDE YELLOW AND RED CLEARANCE TIME.
 - COORDINATED PHASE DETECTORS SHALL BE DISABLED DURING COORDINATION.
 - COORDINATION MODE SHALL BE PERMISSIVE. FLOATING FORCE OFFS SHALL BE IN EFFECT DURING COORDINATION.
 - OFFSET SEEKING SHALL BE THE SHORTWAY METHOD.
 - MAXIMUM GREEN #1 FOR FREE OPERATION. MAXIMUM GREEN #2 IN EFFECT DURING COORDINATION.



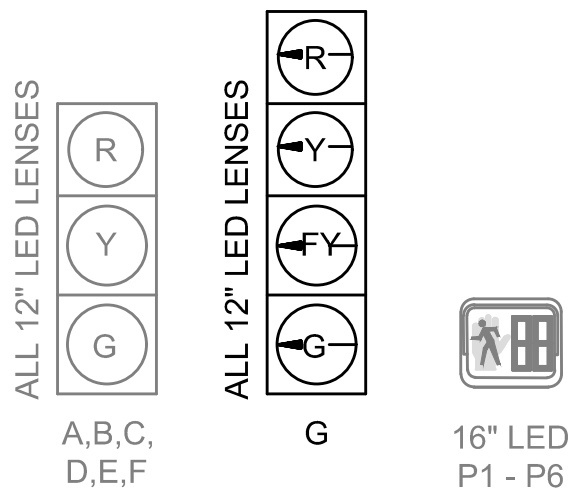
PREFERENTIAL PHASING SEQUENCE



NEMA DUAL RING PHASING NOTES:



SIGNAL IDENTIFICATION



- NOTES:
- ALL SIGNALS SHALL HAVE CUT AWAY VISORS.
 - ALL SIGNALS SHALL HAVE 5" LOUVERED BACK PLATES WITH 3" RETROREFLECTIVE BORDERS.

- PHASES ASSOCIATED BY A SOLID LINE SHALL NOT OPERATE CONCURRENTLY.
- PHASES ASSOCIATED BY A DASHED LINE MAY OPERATE CONCURRENTLY.
- THROUGH MOVEMENTS MAY INCLUDE RIGHT TURNS.
- IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT SHALL NOT CHANGE DURING THE CHANGE INTERVAL(S) UNLESS OTHERWISE NOTED.

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