Functional Design Report

Bikeway Connection at Massachusetts Avenue, Pleasant Street, and Mystic Street

Arlington, Massachusetts

Prepared for

Massachusetts Department of Transportation

Prepared by

Howard/Stein-Hudson Associates, Inc.

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Howard/Stein-Hudson Associates, Inc.

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Introduction

This report presents the functional design to connect the gap in the Minuteman Bikeway as it traverses the intersection of Massachusetts Avenue and Route 60 in Arlington Center (see **Figure 1**). In order to continue along the bikeway, bicyclists are encouraged to either walk their bikes on the sidewalk or ride on the street following traffic rules.

During a road safety audit conducted at this location in March 2012, several safety issues with respect to pedestrians and cyclists were noted.

The standards used for analysis and signal design conform to the *2009 Manual on Uniform Traffic Control Devices* (MUTCD); the 2000 *Highway Capacity Manual* (HCM); the American Association of State Highway and Transportation Officials (AASHTO) manual *A Policy on Geometric Design of Highways and Streets,* 5th Edition; and the MassDOT *Project Development and Design Guide* (2006).

Study Area

The following 5 intersections constitute the study area for this report, as shown in **Figure 1**:

- Massachusetts Avenue (Route 2A)/Pleasant Street (Route 60)/Mystic Street (Route 60, 2A and US Route 3);
- Massachusetts Avenue (Route 2A)/Medford Street;
- Chestnut Street (Route 60)/Mystic Street (Route 60, 2A and US Route 3);
- Massachusetts Avenue (Route 2A)/Swan Place; and
- Massachusetts Avenue (Route 2A)/Railroad Avenue.

Figure 1. Locus Map and Study Area Intersections

Existing Conditions

This section describes existing study area roadway geometry, intersection conditions with existing traffic volumes and intersection geometry, average daily traffic levels, and peak-hour vehicular volumes.

Existing Roadway Conditions

The intersections are the junctions of the following roadways, which are categorized according to MassDOT Office of Transportation Planning functional classifications:

Massachusetts Avenue (Route 2A)

Massachusetts Avenue is an urban principal arterial running in a northwest–southeast direction, providing access between Boston, Cambridge, and Arlington. Massachusetts Avenue is Route 2A from Commonwealth Avenue in Boston to the intersection of Mystic Street in Arlington. Massachusetts Avenue mainly consists of two travel lanes in both directions with turn lanes at specific intersections. The speed limit along Massachusetts Avenue, while not posted along the entire corridor, is posted in selected locations for 30 mph. In the vicinity of the project site, one and two-hour on-street parking is provided on both sides of the street. Sidewalks are provided on both sides of Massachusetts Avenue throughout the study area.

Mystic Street (Route 60,2A/US Route 3)

Mystic Street is a two-way urban arterial located in Arlington that extends north–south from Massachusetts Avenue in the south to the Winchester Town line in the north. Mystic Street is Route 60 from Massachusetts Avenue to Chestnut Street; Route 2A from Massachusetts Avenue to the intersection with Summer Street in Arlington; and US Route 3 from Massachusetts Avenue to the Winchester Town line. Within the study area, the street is approximately 65 feet wide with 2 travel lanes in each direction. Travel lanes are 12 feet wide with a 16-foot median located between the northbound and southbound lanes. The posted speed limit in the vicinity of the project site is 25 mph. Concrete sidewalks are provided on both sides of Mystic Street within the study area. On-street parking is not allowed on both sides of the road within the study area.

Chestnut Street (Route 60)

Mystic Street is a two-way urban arterial located in Arlington that extends north–south from Massachusetts Avenue in the south to the Winchester Town line in the north. Chestnut Street is Route 60 from Mystic Street to Medford Street in Arlington. Within the study area, the street is approximately 65 feet wide with 2 travel lanes in each direction. Travel lanes are 12 feet wide with a 16-foot median located between the northbound and southbound lanes. The posted speed limit in the vicinity of the project site is 25 mph. Concrete sidewalks are provided on both sides of Mystic Street within the study area. On-street parking is not allowed on both sides of the road within the study area.

Pleasant Street (Route 60)

Pleasant Street is a two-way urban arterial located in Arlington that extends from north-south from Massachusetts Avenue to the intersection with Trapelo Road in Belmont. This stretch of roadway is also Route 60. The posted speed limit in the vicinity of the project site is 35 mph. Concrete sidewalks are provided on both sides of Pleasant Street within the study area. On-street parking is not allowed on both sides of the road within the study area.

Existing Traffic Conditions

Signalized Intersection Geometry

Massachusetts Avenue (Route 2A)/Pleasant Street (Route 60)/Mystic Street (Route 60,2A/ US Route 3) is a signalized intersection with four approaches. The eastbound Massachusetts Avenue approach consists of an exclusive 10-foot left-turn only lane with 140-feet of storage, two 11-foot through lanes, and an exclusive 11-foot right-turn only lane with 160-feet of storage. A 5-foot raised median is located between the eastbound and westbound lanes at the eastbound approach. The westbound Massachusetts Avenue approach consists of an exclusive 11-foot left-turn only lane with 125-feet of storage, two 11-foot through lanes, and an exclusive 12-foot right-turn only lane with 125-feet of storage. A 5-foot raised median is located between the eastbound and westbound lanes at the westbound approach. The Pleasant Street northbound approach consists of a 12-foot exclusive left-turn only lane with 150-feet of storage, one 11-foot through lane, and an exclusive 11-foot right-turn only lane with 180-feet of storage. The Mystic Street southbound approach consists of an exclusive 12-foot left-turn only lane with 180-feet of storage, one 13-foot through lane, and an exclusive 14-foot right-turn only lane. A 7-foot raised median is located between the northbound and southbound lanes at the southbound approach. Access to the Minuteman bikeway is on Mystic Street just north of the intersection. A Massachusetts Bay Transportation Authority (MBTA) bus stop is located on the north side of Massachusetts Avenue west of Mystic Street. 2-hour parking is allowed along both sides of Massachusetts Avenue. Parking is not allowed near the intersection on Mystic Street and Pleasant Street approaches. Crosswalks and wheel chair ramps are provided across all approaches and sidewalks are provided on both sides of the streets.

The existing phasing diagram for Massachusetts Avenue/Pleasant Street/Mystic Street can be found in **Figure 2.**

Massachusetts Avenue (Route 2A)/Medford Street is a signalized intersection with 2 approaches. The Massachusetts Avenue eastbound approach consists of a 12-foot exclusive left-turn only lane with 100-feet of storage and two 12-foot through lanes. A 3-foot raised median is located between the eastbound and westbound lanes at the eastbound approach. The Massachusetts Avenue westbound approach consists of a 15-foot through lane and a 15-foot shared through/right-turn lane. A 7-foot raised median is located between the eastbound and westbound lanes at the westbound approach. An MBTA bus stop is located on the north side of Massachusetts Avenue west of Medford Street and on the east side of Medford Street north of Massachusetts Avenue. The Massachusetts Avenue eastbound approach provides an 8-foot 2-hour parking lane and the westbound approach provides an 8-foot curb cut for a taxi cab stand area. On both sides of Medford Street is an 8-foot parking lane for 1-hour parking. Crosswalks and wheel chair ramps are provided across all approaches and sidewalks are provided on both sides of the streets.

The existing phasing diagram for Massachusetts Avenue/Medford Street can be found in **Figure 2.**

Chestnut Street (Route 60)/Mystic Street (Route 60, 2A/US Route 3) is a signalized intersection with 3 approaches. The Chestnut Street westbound approach consists of two 13-foot left-turn only lanes and a channelized traffic signal controlled 12-foot right-turn lane. The Mystic Street northbound approach consists of a 12-foot through lane and a channelized traffic signal controlled 12-foot right-turn lane. A 16-foot raised median is located between the northbound and southbound lanes at the northbound approach. The Mystic Street southbound approach consists of an exclusive left-turn only lane with 100-feet of storage and a through lane. No parking is allowed on either of the approaches of the intersection. Crosswalks and wheel chair

ramps are provided across the westbound and southbound approaches and sidewalks are provided on both sides of the street.

The existing phasing diagram for Mystic Street/Chestnut Street can be found in **Figure 2.**

Massachusetts Avenue (Route 2A)/Swan Place is an unsignalized intersection with 3 approaches. The Massachusetts Avenue eastbound approach consists of a 12-foot through lane and a shared 12-foot through/right-turn lane. A 12-foot raised median is located between the eastbound and westbound lanes at the eastbound approach. The Massachusetts Avenue westbound approach consists of a shared 13-foot left-turn/through lane and a through lane. A 10-foot raised median is located between the eastbound and westbound lanes at the westbound approach. The Swan Place northbound approach is stop sign controlled and consists of a shared 12-foot left-turn/right-turn lane. Two-hour parking is provided on both approaches of Massachusetts Avenue. No parking is allowed on the Swan Place northbound approach. A taxi cab stand is provided on the Massachusetts Avenue eastbound approach just west of Swan Place. Bicycle shared lane pavement markings are provided on the northbound approach and access to the Minuteman bikeway is on Swan Place just south of Massachusetts Avenue. Crosswalks and wheel chair ramps are provided across the northbound approach and sidewalks are provided on both sides the streets.

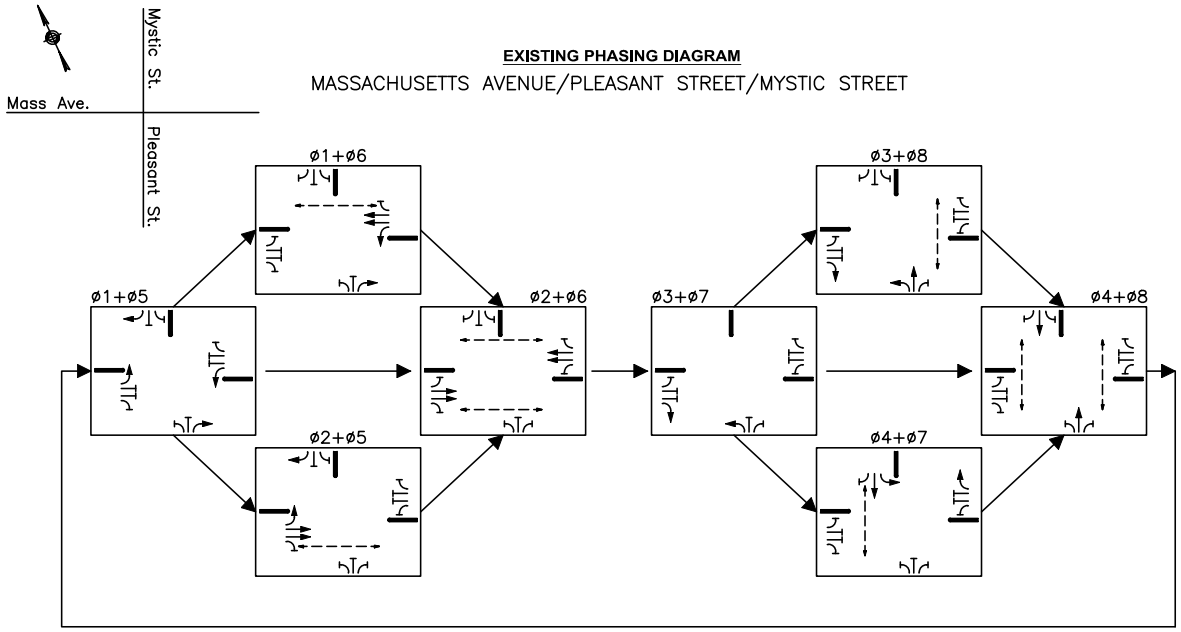
Massachusetts Avenue (Route 2A)/Railroad Avenue is an unsignalized driveway with 3 approaches. The Massachusetts Avenue eastbound approach consists of an exclusive 10-foot left-turn only lane with 50-feet of storage and two 11-foot through lanes. The Massachusetts Avenue westbound approach consists of a 12-foot through lane and a shared 12-foot through/right-turn lane. The Railroad Avenue southbound approach is stop sign controlled and consists of a right-turn only lane. Two-hour parking is provided on Massachusetts Avenue and no parking is allowed on the Railroad Avenue approach.

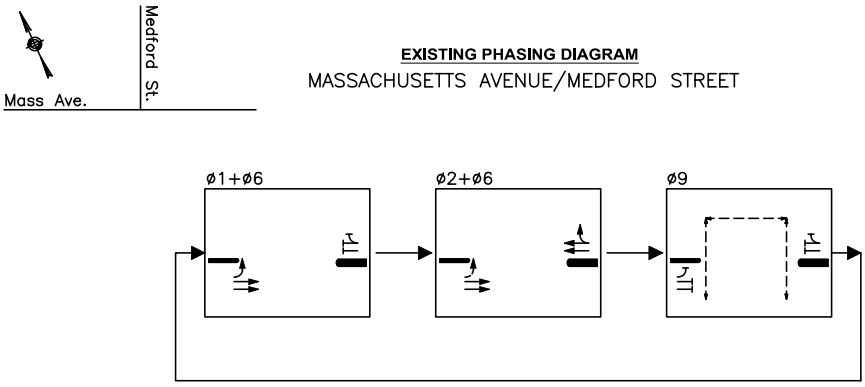
Peak Hour Volumes

Manual Turning Movement Counts (TMCs) were recorded during the weekday a.m. (6:30 – 9:30 AM), weekday afternoon (4:00 – 7:00 PM), and Saturday midday (11 AM – 2 PM) peak traffic periods on June 11 and June 16, 2011. The results of the counts indicate that the morning peak period occurs between 7:30 – 8:30 AM, the evening peak period occurs between 4:45 – 5:45 PM, and the Saturday midday peak period occurs between 11:45 AM – 12:45 PM. The peak-hour volumes are shown in **Figure 3.**

Pedestrian and bicycle counts for the study area intersections were during the same periods as the vehicular counts and will be discussed later is this report.

Figure 2. Existing Phasing Diagrams





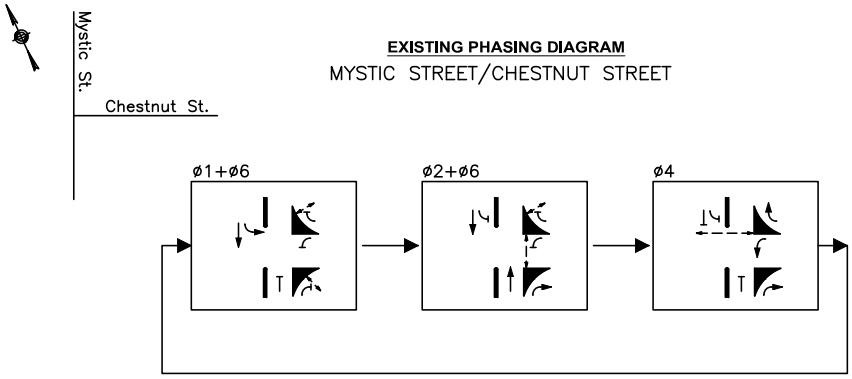
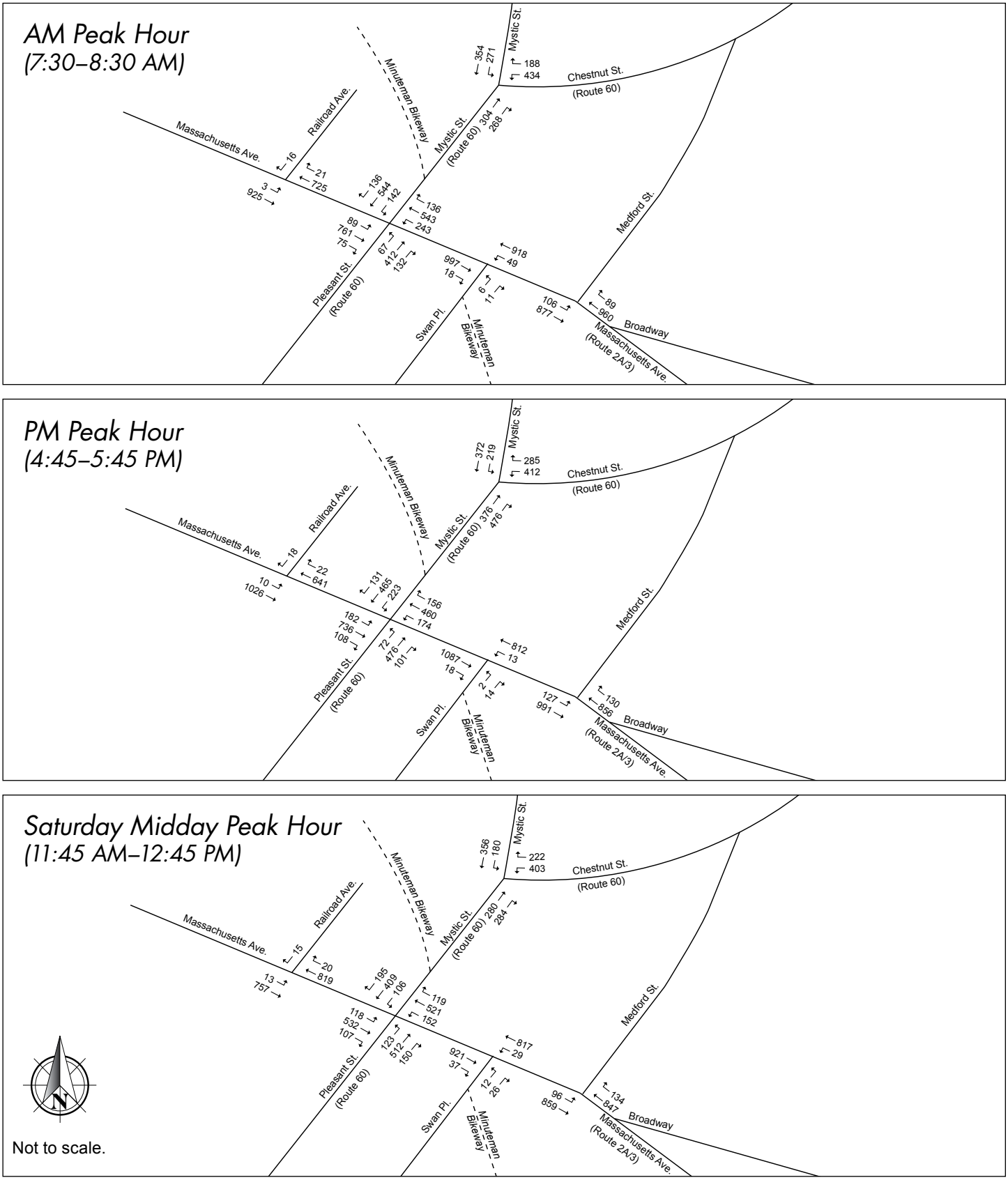


Figure 3. Existing Conditions (2011) Peak Hour Traffic Volumes



Capacity Analysis

Traffic operations are determined through an analysis of intersection Level of Service (LOS) calculations. LOS at all study area intersections was calculated using Synchro 6.0, which is based on the traffic operational analysis methodology of the Transportation Research Board's 2000 *Highway Capacity Manual* (HCM). The LOS and delay (in seconds) are based on intersection geometry and traffic volume. **Table 1,** an excerpt from the HCM, provides LOS criteria for signalized intersections. LOS A defines the most favorable condition, with minimum traffic delay. LOS F represents the worst condition, with significant traffic delay. LOS D is generally considered acceptable for urban environments.

Table 1. Level of Service Criteria

Level of Service	Average Stopped Delay (sec./veh.)	
	Signalized Intersection	Unsignalized Intersection
A	0.0–10.0	0.0-10.0
B	10.1–20.0	10.1-15.0
C	20.1–35.0	15.1-25.0
D	35.1–55.0	25.1-35.0
E	55.1–80.0	35.1-50.0
F	>80.0	>50.0

Source: Highway Capacity Manual, 2000. *Transportation Research Board.*

In accordance with MassDOT guidelines, the peak 15 minutes of data collected during the peak hour were isolated in order to calculate the peak-hour factors for each approach. The percentage of heavy vehicles was noted for each approach as well. All LOS analyses were checked against actual conditions in the field. Details of the Synchro analysis are provided in **Appendix B.**

Table 2, Table 3, and **Table 4** summarizes the existing LOS, volume to capacity, and queue analysis for the study area intersections during the morning, evening, and Saturday midday peak hours.

Table 2. Capacity Analysis Summary (2011): Existing Volumes, Existing Geometry, AM Peak Hour

Intersection/Movement	LOS	Delay (sec)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Signalized Intersections					
Massachusetts Avenue/Pleasant Street/Mystic Street	**E**	**58.3**			
Massachusetts Ave EB left	D	44.7	0.44	65	118
Massachusetts Ave EB thru | thru	E	56.8	0.94	313	#433
Massachusetts Ave EB right	D	50.9	0.56	56	103
Massachusetts Ave WB left	F	140.2	1.12	#234	#375
Massachusetts Ave WB thru | thru	D	36.6	0.67	213	263
Massachusetts Ave WB right	E	56.9	0.73	107	#183
Pleasant Street NB left	D	47.4	0.44	49	93
Pleasant Street NB thru	D	51.1	0.88	310	#482
Pleasant Street NB right	D	51.4	0.67	100	#182
Mystic Street SB left	D	51.4	0.66	104	#176
Mystic Street SB thru	E	60.4	0.95	412	#674
Mystic Street SB right	D	52.7	0.67	100	168
Massachusetts Avenue/Medford Street	**A**	**4.9**			
Massachusetts Ave EB left	A	5.3	0.46	23	39
Massachusetts Ave EB thru | thru	A	3.5	0.43	137	161
Massachusetts Ave WB thru | thru/right	A	6.1	0.58	210	262
Chestnut Street/Mystic Street	**B**	**14.4**			
Chestnut Street WB left |left	B	19.0	0.56	71	151
Chestnut Street WB right	B	16.5	0.13	0	49
Mystic Street NB thru	B	19.0	0.64	99	206
Mystic Street NB right	A	5.4	0.33	42	95
Mystic Street SB left	C	21.0	0.64	88	208
Mystic Street SB thru	A	5.4	0.35	55	115
Unsignalized Intersections					
Massachusetts Avenue/Swan Place					
Massachusetts Avenue EB thru| thru/right	A	0.0	0.43	—	0
Massachusetts Avenue WB left/thru| thru	A	1.3	0.40	—	8
Swan Place NB left/right	C	18.2	0.11	—	9
Massachusetts Avenue/Railroad Avenue					
Massachusetts Avenue EB left	A	9.5	0.00	—	0
Massachusetts Avenue EB thru| thru	A	0.0	0.30	—	0
Massachusetts Avenue WB thru| thru/right	A	0.0	0.31	—	0
Railroad Avenue SB right	B	10.3	0.05	—	4

# = 50th/95th percentile volume exceeds capacity. Queue may be longer. Queue shown is maximum after 2 cycles.
m = Volume for the 95th percentile queue is metered by the upstream signal.

Table 3. Capacity Analysis Summary (2011): Existing Volumes, Existing Geometry, PM Peak Hour

Intersection/Movement	LOS	Delay (sec)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Signalized Intersections					
Massachusetts Avenue/Pleasant Street/Mystic Street	**D**	**53.3**			
Massachusetts Ave EB left	E	64.7	0.82	138	#261
Massachusetts Ave EB thru | thru	D	48.7	0.89	285	#390
Massachusetts Ave EB right	D	48.5	0.59	78	138
Massachusetts Ave WB left	E	59.9	0.79	132	#242
Massachusetts Ave WB thru | thru	D	35.8	0.58	162	218
Massachusetts Ave WB right	E	55.8	0.74	118	#224
Pleasant Street NB left	D	43.4	0.33	49	94
Pleasant Street NB thru	E	61.0	0.94	344	#550
Pleasant Street NB right	D	44.2	0.48	70	127
Mystic Street SB left	F	95.8	0.98	#184	#334
Mystic Street SB thru	D	47.6	0.87	363	#537
Mystic Street SB right	D	47.2	0.60	101	164
Massachusetts Avenue/Medford Street	**A**	**7.7**			
Massachusetts Ave EB left	A	7.7	0.48	26	46
Massachusetts Ave EB thru | thru	A	5.9	0.48	142	182
Massachusetts Ave WB thru | thru/right	A	9.6	0.50	182	230
Chestnut Street/Mystic Street	**B**	**14.1**			
Chestnut Street WB left |left	B	19.6	0.54	75	147
Chestnut Street WB right	B	17.7	0.21	0	55
Mystic Street NB thru	B	19.8	0.68	129	259
Mystic Street NB right	A	5.9	0.51	82	189
Mystic Street SB left	C	21.6	0.58	82	174
Mystic Street SB thru	A	5.6	0.35	67	118
Unsignalized Intersections					
Massachusetts Avenue/Swan Place					
Massachusetts Avenue EB thru| thru/right	A	0.0	0.46	—	0
Massachusetts Avenue WB left/thru| thru	A	0.4	0.33	—	2
Swan Place NB left/right	B	14.0	0.06	—	5
Massachusetts Avenue/Railroad Avenue					
Massachusetts Avenue EB left	A	9.4	0.01	—	1
Massachusetts Avenue EB thru| thru	A	0.0	0.33	—	0
Massachusetts Avenue WB thru| thru/right	A	0.0	0.27	—	0
Railroad Avenue SB right	B	10.3	0.04	—	3

# = 50th/95th percentile volume exceeds capacity. Queue may be longer. Queue shown is maximum after 2 cycles.
m = Volume for the 95th percentile queue is metered by the upstream signal.

Table 4. Capacity Analysis Summary (2011): Existing Volumes, Existing Geometry, Saturday Midday Peak Hour

Intersection/Movement	LOS	Delay (sec)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Signalized Intersections					
Massachusetts Avenue/Pleasant Street/Mystic Street	**D**	**54.4**			
Massachusetts Ave EB left	D	41.8	0.51	82	150
Massachusetts Ave EB thru | thru	D	39.1	0.71	193	255
Massachusetts Ave EB right	D	44.9	0.55	75	139
Massachusetts Ave WB left	D	49.2	0.68	111	#206
Massachusetts Ave WB thru | thru	D	39.9	0.72	193	251
Massachusetts Ave WB right	D	47.4	0.62	86	153
Pleasant Street NB left	D	46.7	0.62	97	151
Pleasant Street NB thru	F	98.7	1.09	#496	#635
Pleasant Street NB right	E	60.4	0.80	123	#209
Mystic Street SB left	D	43.4	0.51	79	135
Mystic Street SB thru	D	38.0	0.78	298	#413
Mystic Street SB right	E	68.8	0.87	155	#283
Massachusetts Avenue/Medford Street	**A**	**8.0**			
Massachusetts Ave EB left	A	7.1	0.38	19	36
Massachusetts Ave EB thru | thru	A	5.7	0.42	115	151
Massachusetts Ave WB thru | thru/right	A	10.0	0.53	190	241
Chestnut Street/Mystic Street	**B**	**13.2**			
Chestnut Street WB left |left	B	17.7	0.58	72	133
Chestnut Street WB right	B	15.5	0.18	0	31
Mystic Street NB thru	B	18.2	0.61	87	193
Mystic Street NB right	A	5.1	0.33	40	103
Mystic Street SB left	B	18.2	0.51	63	135
Mystic Street SB thru	A	6.0	0.39	67	113
Unsignalized Intersections					
Massachusetts Avenue/Swan Place					
Massachusetts Avenue EB thru| thru/right	A	0.0	0.37	—	0
Massachusetts Avenue WB left/thru| thru	A	0.6	0.33	—	4
Swan Place NB left/right	C	16.2	0.15	—	13
Massachusetts Avenue/Railroad Avenue					
Massachusetts Avenue EB left	B	10.0	0.02	—	1
Massachusetts Avenue EB thru| thru	A	0.0	0.24	—	0
Massachusetts Avenue WB thru| thru/right	A	0.0	0.35	—	0
Railroad Avenue SB right	B	10.5	0.04	—	3

# = 50th/95th percentile volume exceeds capacity. Queue may be longer. Queue shown is maximum after 2 cycles.
m = Volume for the 95th percentile queue is metered by the upstream signal.

With existing volumes and existing geometry, during the AM, PM, and Saturday midday peak hours, all of the study area intersections operate at an overall LOS D or better, with the exception of Massachusetts Avenue/Pleasant Street/Mystic Street, which operates at an overall LOS E during the AM peak hour.

Massachusetts Avenue/Pleasant Street/Mystic Street
During the morning peak hour, the Massachusetts Avenue westbound left-turn movement operates at LOS F. The eastbound through, westbound right-turn, and southbound through lanes operate at LOS E. During the evening peak hour, the Mystic Street southbound left-turn operates at LOS F. The eastbound left-turn, westbound left-turn, westbound right-turn, and northbound through movements all operate at LOS E. During the Saturday midday peak hour, the Pleasant Street northbound through operates at LOS F. The northbound right-turn and southbound right-turn operate at LOS E.

The delays during all peak hours are mainly attributed the high turning volumes at this intersection.

Pedestrians and Bicyclists

Sidewalks and Crosswalks

There is a lot of pedestrian activity within the study area, with the Arlington Town Hall and the Robbins Library to the west of the study area and Arlington Catholic High School on Medford Street to the east of the study area. The Minuteman Bikeway, which is open for cycling, walking, jogging, and skating, also crosses through the study area.

Sidewalks are made of brick and lined with streetscape. At intersection of Massachusetts Avenue/Pleasant Street/Mystic Street, pedestrian phases run concurrent with the through movement vehicular phases. There are no pedestrian-vehicle conflicts since vehicle turning movements are not allowed during the pedestrian phases. However, pedestrians have been observed crossing diagonally through the intersection during the left-turn phases or crossing the street without a WALK symbol indication. While audible pedestrian signals are provided for each crossing, existing pushbuttons are a mix of button-style and 2-inch plungers.

Pedestrian volume counts can be found in **Figure 4.**

Minuteman Bikeway

The Minuteman Bikeway is an 11-mile path that runs from Alewife Station in Cambridge to South Street in Bedford. The bike path is generally continuous its entire length; however, there is a significant gap in Arlington, where the path meets Mystic Street and Massachusetts Avenue. The west side of the bikeway meets Mystic Street approximately 100 feet north of the intersection at Massachusetts Avenue. On the east side, the bikeway meets Swan Place, which intersects Massachusetts Avenue approximately 300 feet to the east of Mystic Street. There are no bicycle accommodations or connections of the bikeway in this area. The Town of Arlington also has strict regulations prohibiting cyclists from using the sidewalk. There are several signs and marked sidewalks indicating a $20 fine for violators.

As discussed in the Road Safety Audit for this location that was conducted in March 2012, bicycle behavior making the Minuteman Bikeway connection within the study area varies depending on comfort level. Many cyclists that are less comfortable traversing the busy intersection at Massachusetts Avenue/Pleasant Street/Mystic Street walk their bicycles to and from each side of the Minuteman Bikeway. Others more bravely ride diagonally through the intersection during the Mystic Street and Pleasant Street left-turn phases.

Bicycle volumes can be found in **Figure 5.**

Figure 4. Existing Conditions (2011) Peak Hour Pedestrian Volumes

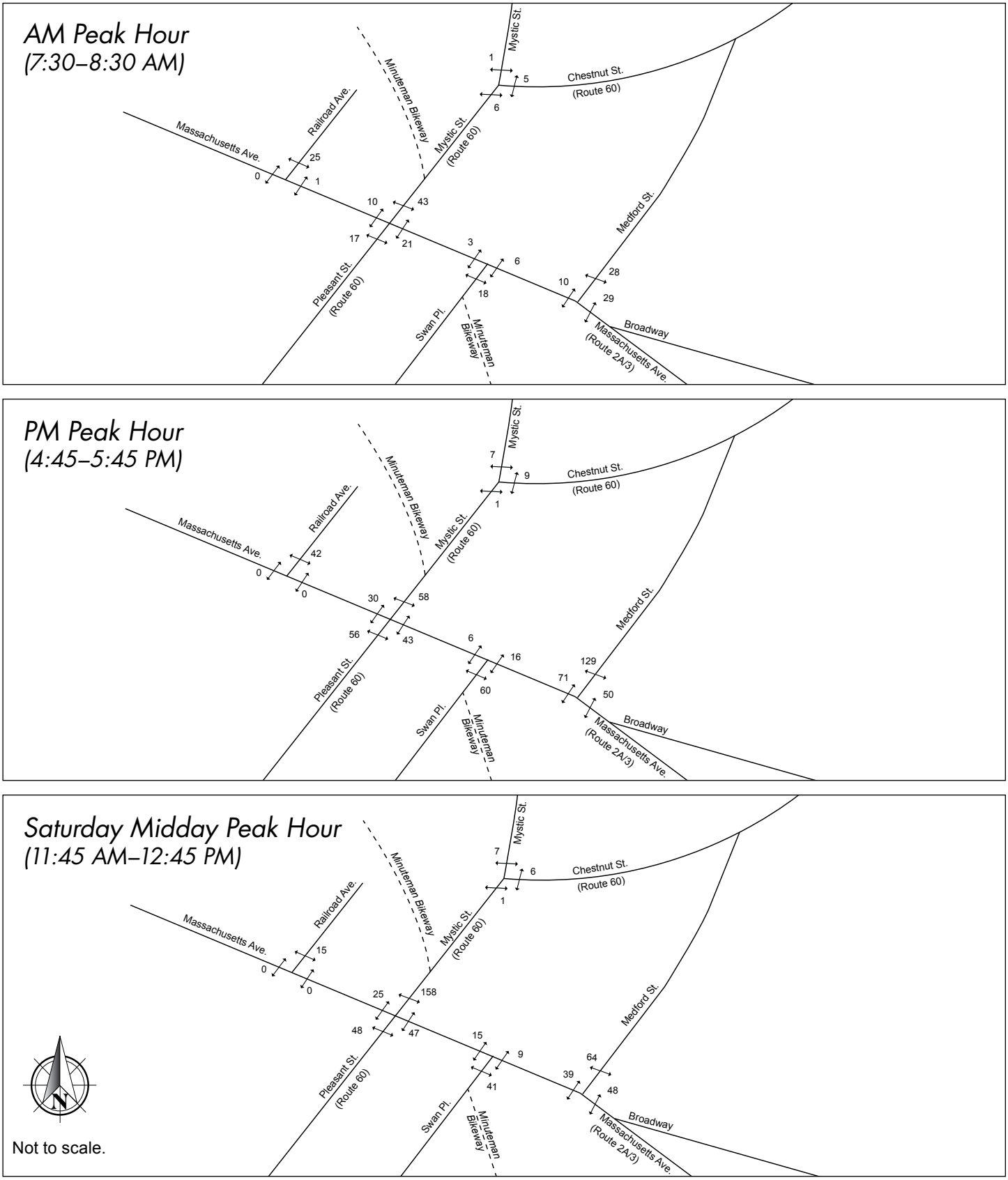
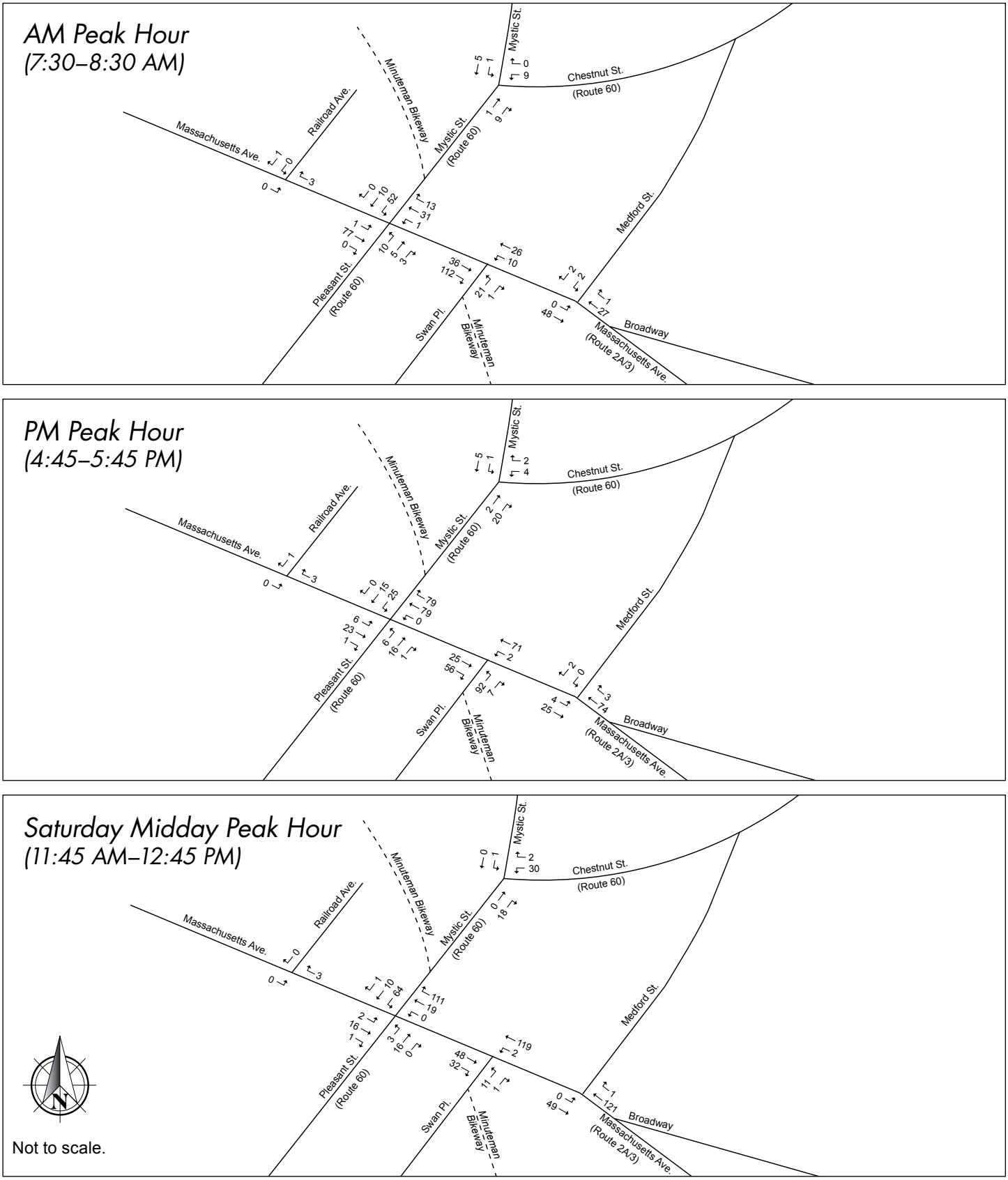


Figure 5. Existing Conditions (2011) Peak Hour Bicycle Volumes



Safety Analysis

The study team performed a safety analysis at the study area intersections to identify and evaluate possible safety issues that exist. Accident data for this location were obtained from MassDOT for the most recent 4-year period available (2007–10). During that period, 127 vehicular accidents were reported within the study area. Within the 117 collisions, 3 accidents involved a pedestrian, and 2 collisions involved a cyclist. **Table 5** summarizes the crashes at the study area intersections.

Table 5. MassDOT Crash Data Summary

	# of Crashes				
Scenario	**Mass. Ave./ Pleasant St./ Mystic St.**	**Mass. Ave./ Medford St.**	**Chestnut St./ Mystic St.**	**Mass. Ave./ Swan Place**	**Mass. Ave./ Railroad Ave.**
			Year		
2007	6	0	2	1	1
2008	25	7	2	2	0
2009	18	3	6	3	0
2010	26	7	6	1	1
			Type		
Single vehicle	5	1	1	0	0
Angle	18	2	7	3	0
Rear-end	33	8	4	3	1
Head-on	17	5	2	1	1
Sideswipe	0	0	0	0	0
Unknown/other	2	1	2	0	0
			Severity		
Property damage only	50	14	13	7	2
Personal injury	15	2	3	0	0
Fatality	0	0	0	0	0
Hit-and-run	0	0	0	0	0
Unknown	10	1	0	1	0
Total	**75**	**17**	**16**	**7**	**2**

Crash rates are determined based on the number of crashes per million vehicles entering the intersection. The average crash rate for Massachusetts Avenue/Pleasant Street/Mystic Street and Massachusetts Avenue/Medford Street are above the MassDOT District 4 average for signalized intersections of 0.78 crashes per million entering vehicle at 1.96 and 1.00, respectively. The crash rate at Mystic Street/Chestnut Street, which is 0.54, is below the district average. The crash rate at Massachusetts Avenue/Swan Place and Massachusetts Avenue/Railroad Avenue are below the MassDOT District 4 average for unsignalized intersections of 0.59 crashes per million entering vehicles at 0.44 and 0.16, respectively.

As shown in the table, the majority of crashes at Massachusetts Avenue/Pleasant Street/Mystic Street are rear-end and angle crashes. A possible cause of these types of crashes at signalized intersections is insufficient clearance times or poor visibility of vehicle indications. The design team considered contributing factors such as insufficient clearance times and insufficient visibility when designing the intersection. Crash rate worksheets and collision diagrams are provided in **Appendix C**.

Future Conditions

Future traffic volumes were estimated and analyzed to determine the number of travel lanes and lane usage that will be required at the study area intersections. Two conditions were examined:

- Future traffic volumes with existing geometry – No-Build; and,
- Future traffic volumes with proposed geometry – Build.

These future conditions are discussed in the sections below.

Future Conditions with Existing Geometry: No-Build

Estimation of Future (2031) Traffic Volumes

Determination of future no-build volumes for the 2031 design year was conducted in a 2-step process, as follows:

- First, the existing 2011 traffic volumes were increased at a rate of 0.5% per year for 20 years.
- Second, the project generated traffic volumes from known projects were added to the network. These projects include a new CVS site at 837 Massachusetts Avenue, the Symmes Hospital redevelopment, and a mixed-use residential and retail development on Mill Street.

This 2-step traffic volume growth captures the increase in traffic volume due to both background growth and project-specific growth. Future 2031 volumes are shown in **Figure 6**.

Capacity Analysis

An analysis was performed to evaluate the effect of accommodating estimated future 2031 traffic with the existing geometries and signal timings, as shown in **Table 6, Table 7,** and **Table 8.**

Figure 6. Future Conditions (2031) Traffic Volumes

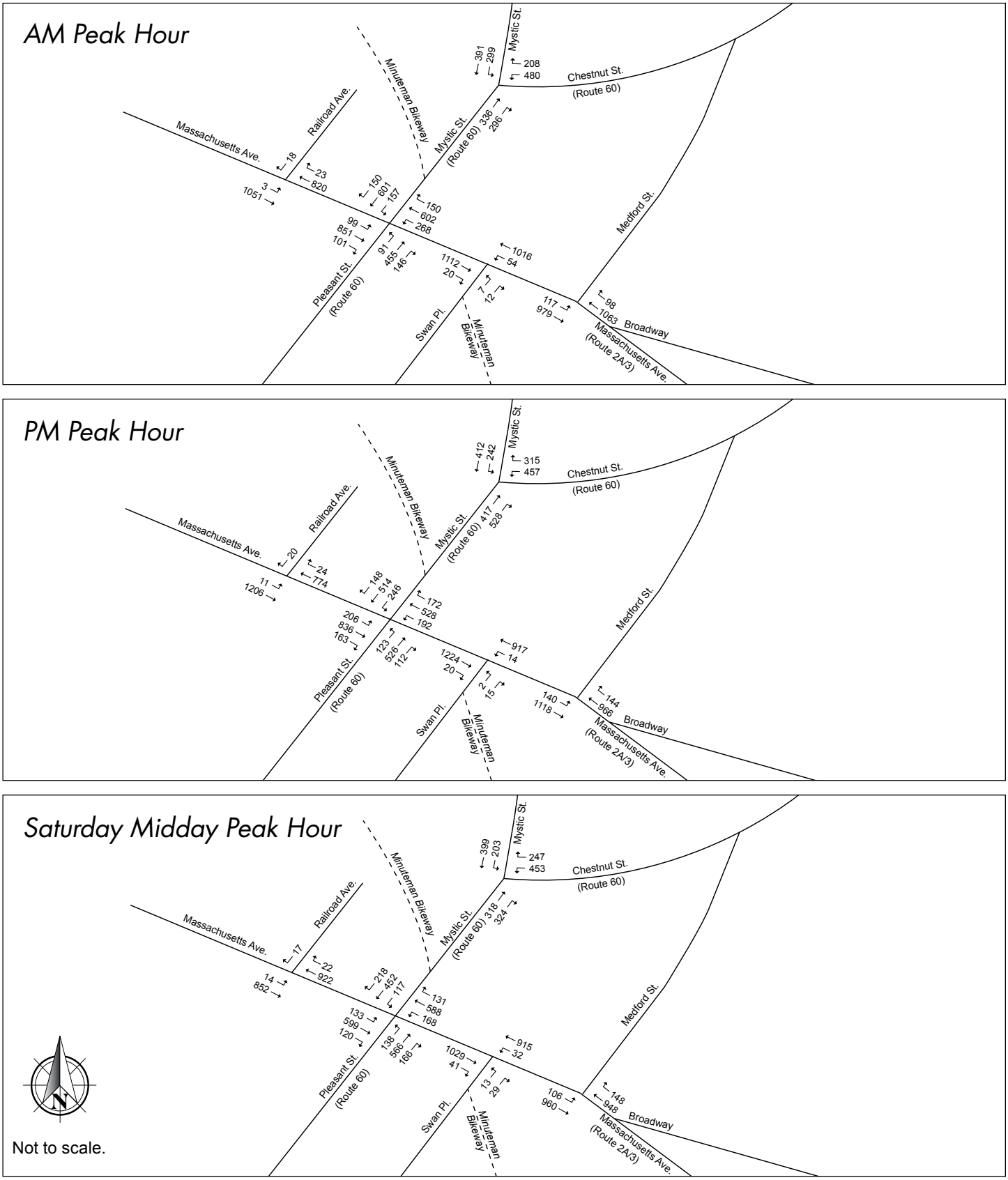


Table 6. Capacity Analysis Summary, No Build (2031): Future Traffic with Existing Geometry, AM Peak Hour

Intersection/Movement	LOS	Delay (sec)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Signalized Intersections					
Massachusetts Avenue/Pleasant Street/Mystic Street	**E**	**77.5**			
Massachusetts Ave EB left	D	44.8	0.47	72	129
Massachusetts Ave EB thru | thru	F	84.4	1.05	#387	#515
Massachusetts Ave EB right	D	50.8	0.61	74	135
Massachusetts Ave WB left	F	163.6	1.19	#256	#427
Massachusetts Ave WB thru | thru	D	39.1	0.73	228	297
Massachusetts Ave WB right	E	60.0	0.77	114	#217
Pleasant Street NB left	D	45.9	0.49	66	121
Pleasant Street NB thru	E	64.5	0.95	350	#561
Pleasant Street NB right	E	56.7	0.74	111	#213
Mystic Street SB left	E	56.1	0.73	116	#211
Mystic Street SB thru	F	113.2	1.12	#549	#771
Mystic Street SB right	E	55.1	0.71	111	#200
Massachusetts Avenue/Medford Street	**A**	**7.7**			
Massachusetts Ave EB left	B	10.0	0.56	24	43
Massachusetts Ave EB thru | thru	A	5.4	0.47	148	189
Massachusetts Ave WB thru | thru/right	A	9.5	0.57	243	302
Chestnut Street/Mystic Street	**B**	**15.7**			
Chestnut Street WB left |left	C	20.7	0.61	92	174
Chestnut Street WB right	B	17.6	0.15	0	53
Mystic Street NB thru	C	20.5	0.67	129	230
Mystic Street NB right	A	5.7	0.35	56	106
Mystic Street SB left	C	23.8	0.70	113	#243
Mystic Street SB thru	A	5.7	0.38	73	129
Unsignalized Intersections					
Massachusetts Avenue/Swan Place					
Massachusetts Avenue EB thru| thru/right	A	0.0	0.48	—	0
Massachusetts Avenue WB left/thru| thru	A	2.0	0.44	—	10
Swan Place NB left/right	C	19.7	0.08	—	6
Massachusetts Avenue/Railroad Avenue					
Massachusetts Avenue EB left	B	10.0	0.00	—	0
Massachusetts Avenue EB thru| thru	A	0.0	0.34	—	0
Massachusetts Avenue WB thru| thru/right	A	0.0	0.35	—	0
Railroad Avenue SB right	B	10.5	0.03	—	2

# = 50th/95th percentile volume exceeds capacity. Queue may be longer. Queue shown is maximum after 2 cycles.
m = Volume for the 95th percentile queue is metered by the upstream signal.
Cell shading indicates that LOS has worsened from Existing Conditions with Existing Geometry.

Table 7. Capacity Analysis Summary, No Build (2031): Future Traffic with Existing Geometry, PM Peak Hour

Intersection/Movement	LOS	Delay (sec)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Signalized Intersections					
Massachusetts Avenue/Pleasant Street/Mystic Street	**E**	**69.2**			
Massachusetts Ave EB left	F	85.1	0.93	158	#308
Massachusetts Ave EB thru | thru	E	69.2	1.00	338	#479
Massachusetts Ave EB right	E	66.2	0.82	122	#237
Massachusetts Ave WB left	E	69.2	0.85	147	#278
Massachusetts Ave WB thru | thru	D	37.9	0.66	192	254
Massachusetts Ave WB right	E	68.3	0.84	132	#255
Pleasant Street NB left	D	45.5	0.52	85	147
Pleasant Street NB thru	F	86.8	1.04	#422	#634
Pleasant Street NB right	D	45.7	0.53	78	139
Mystic Street SB left	F	123.3	1.07	#214	#379
Mystic Street SB thru	E	68.7	0.98	400	#629
Mystic Street SB right	D	50.3	0.65	111	#194
Massachusetts Avenue/Medford Street	**B**	**10.1**			
Massachusetts Ave EB left	B	17.8	0.70	29	53
Massachusetts Ave EB thru | thru	A	7.4	0.58	170	225
Massachusetts Ave WB thru | thru/right	B	11.9	0.64	215	281
Chestnut Street/Mystic Street	**B**	**14.0**			
Chestnut Street WB left |left	C	21.4	0.60	91	165
Chestnut Street WB right	B	10.2	0.28	27	78
Mystic Street NB thru	C	21.1	0.72	155	294
Mystic Street NB right	A	6.5	0.56	105	222
Mystic Street SB left	C	23.5	0.63	98	193
Mystic Street SB thru	A	5.5	0.37	76	134
Unsignalized Intersections					
Massachusetts Avenue/Swan Place					
Massachusetts Avenue EB thru| thru/right	A	0.0	0.52	—	0
Massachusetts Avenue WB left/thru| thru	A	0.6	0.37	—	3
Swan Place NB left/right	B	14.4	0.05	—	4
Massachusetts Avenue/Railroad Avenue					
Massachusetts Avenue EB left	B	10.1	0.02	—	1
Massachusetts Avenue EB thru| thru	A	0.0	0.39	—	0
Massachusetts Avenue WB thru| thru/right	A	0.0	0.33	—	0
Railroad Avenue SB right	B	10.7	0.03	—	3

# = 50th/95th percentile volume exceeds capacity. Queue may be longer. Queue shown is maximum after 2 cycles.
m = Volume for the 95th percentile queue is metered by the upstream signal.
Cell shading indicates that LOS has worsened from Existing Conditions with Existing Geometry.

Table 8. Capacity Analysis Summary, No Build (2031): Future Traffic with Existing Geometry, Saturday Midday Peak Hour

Intersection/Movement	LOS	Delay (sec)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Signalized Intersections					
Massachusetts Avenue/Pleasant Street/Mystic Street	**E**	**58.0**			
Massachusetts Ave EB left	D	45.2	0.58	98	167
Massachusetts Ave EB thru | thru	D	40.7	0.76	223	290
Massachusetts Ave EB right	D	48.8	0.63	88	153
Massachusetts Ave WB left	E	56.2	0.76	128	#239
Massachusetts Ave WB thru | thru	D	41.1	0.77	220	287
Massachusetts Ave WB right	D	51.3	0.67	98	#171
Pleasant Street NB left	D	48.2	0.63	102	171
Pleasant Street NB thru	F	106.2	1.11	#523	#746
Pleasant Street NB right	E	62.9	0.81	127	#248
Mystic Street SB left	D	44.6	0.53	86	148
Mystic Street SB thru	D	42.2	0.82	333	#516
Mystic Street SB right	F	85.5	0.95	172	#333
Massachusetts Avenue/Medford Street	**A**	**7.7**			
Massachusetts Ave EB left	A	8.0	0.46	21	33
Massachusetts Ave EB thru | thru	A	5.5	0.45	135	386
Massachusetts Ave WB thru | thru/right	A	9.6	0.55	222	594
Chestnut Street/Mystic Street	**B**	**13.3**			
Chestnut Street WB left |left	B	18.2	0.55	70	161
Chestnut Street WB right	B	16.1	0.17	0	57
Mystic Street NB thru	B	18.3	0.63	98	214
Mystic Street NB right	A	5.1	0.36	46	115
Mystic Street SB left	B	19.0	0.52	64	160
Mystic Street SB thru	A	5.8	0.38	66	130
Unsignalized Intersections					
Massachusetts Avenue/Swan Place					
Massachusetts Avenue EB thru| thru/right	A	0.0	0.42	—	0
Massachusetts Avenue WB left/thru| thru	A	0.8	0.37	—	5
Swan Place NB left/right	C	17.4	0.14	—	12
Massachusetts Avenue/Railroad Avenue					
Massachusetts Avenue EB left	B	10.6	0.2	—	2
Massachusetts Avenue EB thru| thru	A	0.0	0.27	—	0
Massachusetts Avenue WB thru| thru/right	A	0.0	0.39	—	0
Railroad Avenue SB right	B	10.8	0.03	—	2

# = 50th/95th percentile volume exceeds capacity. Queue may be longer. Queue shown is maximum after 2 cycles.
m = Volume for the 95th percentile queue is metered by the upstream signal.
Cell shading indicates that LOS has worsened from Existing Conditions with Existing Geometry.

Under No Build Conditions, all study area intersections will continue to operate at LOS D or better, with the exception of Massachusetts Avenue/Pleasant Street/Mystic Street, which operates at an overall LOS E during all peak hours.

Massachusetts Avenue/Pleasant Street/Mystic Street
During the morning peak hour, this intersection continues to operate at LOS E; however, several lane groups worsen to LOS E and F. The Pleasant Street northbound through, Pleasant Street northbound right-turn, Mystic Street southbound left-turn, and Mystic Street southbound right-turn movements worsen from LOD D to LOS E. The Massachusetts Avenue eastbound and Mystic Street southbound through movements worsen from LOS E to LOS F.

During the evening peak hour, the overall operations worsen from LOS D to LOS E. The Massachusetts Avenue eastbound left-turn and Pleasant Street northbound through movements worsen from LOS E to LOS F. The Massachusetts Avenue eastbound through, Massachusetts Avenue eastbound right-turn, and Mystic Street southbound through movements worsen from LOS d to LOS E.

During the Saturday midday peak, the overall operations worsen from LOS D to LOS E. The Massachusetts Avenue westbound left-turn worsens from LOS D to LOS E, while the Mystic Street southbound right-turn worsens from LOS E to LOS F.

Future Conditions with Recommended Geometry: Build Options

Throughout the planning process, several alternatives for bicycle accommodations were considered for the section of Massachusetts Avenue between Mystic Street and Swan Place. Located in Arlington Center where land use is primarily commercial and recreational, the sidewalk widths, which range from 7 to 11 feet, should be maintained where possible.

Option 1 – Shared Lanes

Option 1 would provide wide outside travel lanes with shared lane markings. This option would retain the existing median on Massachusetts Avenue as well as the parking lane on the south side of the street. At the intersection of Massachusetts Avenue/Pleasant Street/Mystic Street, all approach lanes would have shared lane markings with bike boxes at the intersection. All through lanes would be a minimum of 11 feet wide, with the outside travel lanes on Massachusetts Avenue ranging from 13 to 14 feet wide. Turn lanes would range from 10 to 11 feet wide.

Option 2 – Bicycle Lanes

Option 2 would provide 5-foot wide bicycle lanes on each side of Massachusetts Avenue between Mystic Street and Swan Place. In order to maintain a minimum of 11-foot wide through lanes, 10-foot wide turning lanes, and parking on the south side of Massachusetts Avenue, the center median would need to be removed. Similar to Option 1, bike boxes would be provided at Massachusetts Avenue/Pleasant Street/Mystic Street.

Option 3 – Cycle Track with Parking Retained

Option 3 would provide a 10-foot wide 2-way cycle track on the south side of Massachusetts Avenue between Mystic Street and Swan Place. In order to maintain a minimum of 11-foot wide through lanes, 10-foot wide turning lanes, and parking on the south side of Massachusetts Avenue, the center median would need to be removed. The Minuteman Bikeway would be extended, off-street, along the west side of Mystic Street between the existing entrance to the bike path to the

corner at Massachusetts Avenue. At the Massachusetts Avenue/Pleasant Street/Mystic Street, the bike path would cross Massachusetts Avenue diagonally to the southeast corner of the intersection.

Option 4 – Cycle Track with Median Retained.

Option 4 would provide a 10-foot wide 2-way cycle track on the south side of Massachusetts Avenue between Mystic Street and Swan Place. In order to maintain a minimum of 11-foot wide through lanes, 10-foot wide turning lanes, and the center median, the parking on the south side of Massachusetts Avenue would need to be removed. The Minuteman Bikeway would be extended, off-street, along the west side of Mystic Street between the existing entrance to the bike path to the corner at Massachusetts Avenue. At the Massachusetts Avenue/Pleasant Street/Mystic Street, the bike path would cross Massachusetts Avenue diagonally to the southeast corner of the intersection.

Preferred Alternative – Bicycle Lanes with Parking & Median

The preferred alternative will provide 5-foot bicycle lanes on Massachusetts Avenue between Mystic Street and Swan Place. A 7-foot parking lane will be retained on the south side of Massachusetts Avenue, with the center median reduced from 6 feet to 2.5 feet in width. In order to maintain the existing roadway cross-section, the width of the through travel lanes will need to be reduced to 10.5 feet and the shoulder widths will be 0.5 feet. These proposed lane and shoulder widths require a design exception. However, with the introduction of dedicated bicycle facilities being the goal of this project, reallocating the lane and shoulder widths to provide a connection for the Minuteman Bike Path, warrant the design exception.

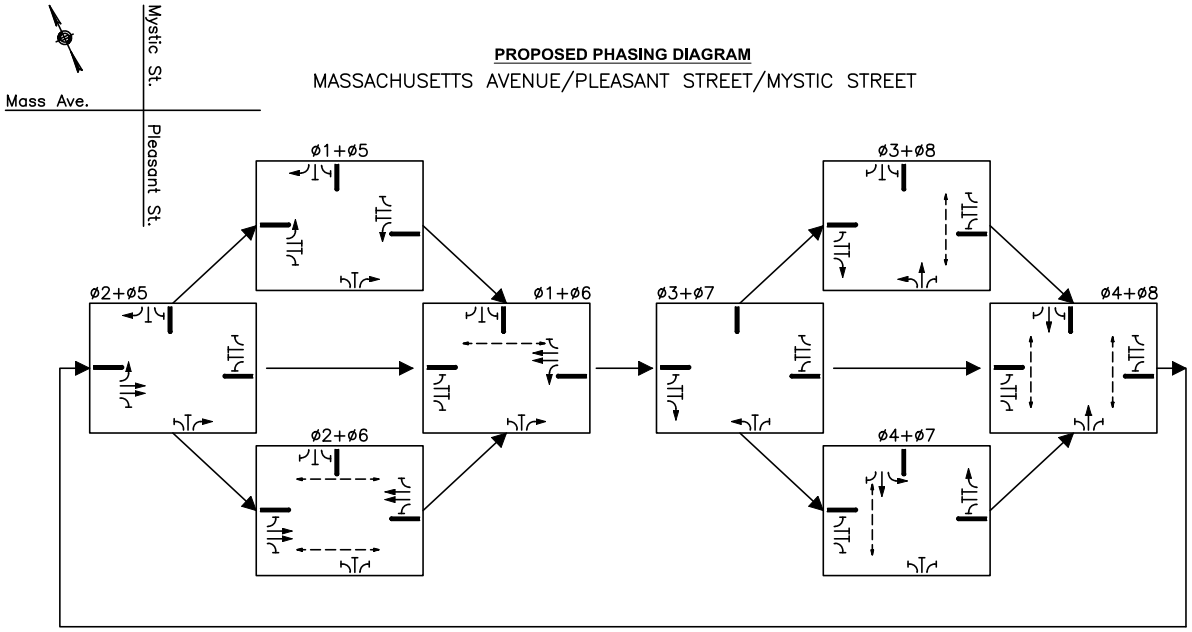
With the adjacent bank on Massachusetts Avenue, the on-street parking spaces on the south side of the street between Mystic Street and Swan Place are heavily utilized throughout the day. Maintaining these spaces is desired by the Town in order to service the bank and patrons of Arlington Center. From a safety standpoint, maintaining the center median is also important. With the width of the roadway in the section varying from 80 to 86 feet in width and heavy volumes along Massachusetts Avenue, providing a physical separation between both directions of traffic is recommended.

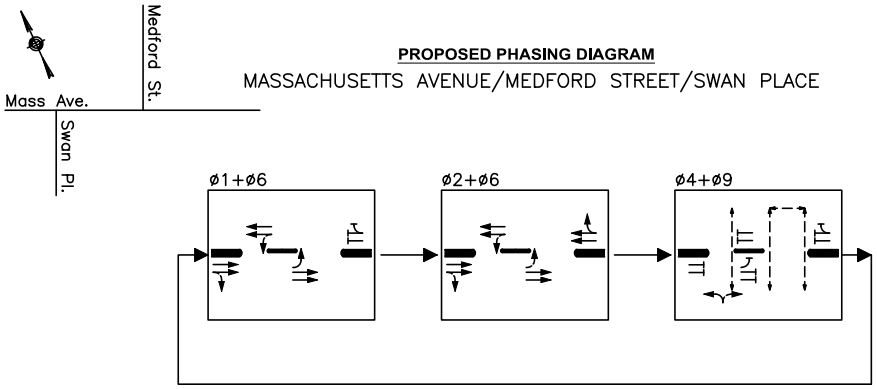
Proposed Traffic Signal Phasing and Capacity Analysis

All of the traffic signals in the study area are proposed to be coordinated to allow for better progression on Massachusetts Avenue and Mystic Street. The proposed phasing at Massachusetts Avenue/Pleasant Street/Mystic Street retains the existing dual ring phasing, with lead/lag left-turn phases for the eastbound and westbound Massachusetts Avenue approaches. This is proposed to allow for better coordination along Massachusetts Avenue. A new signal is proposed at Massachusetts Avenue/Swan Place and will run on the same controller as Massachusetts Avenue/Medford Street. This will allow cyclists coming from the south to cross to the northern side of Massachusetts Avenue more easily. The phasing at Mystic Street/Chestnut Street will remain the same as existing. Cycle length, splits, and offsets will be updated at all signals. The proposed traffic signal phasing for the preferred option is shown in **Figure 7.**

Table 9, Table 10, and **Table 11** summarize the capacity analysis for the morning, evening, and Saturday midday peak hours.

Figure 7. Proposed Phasing Diagrams





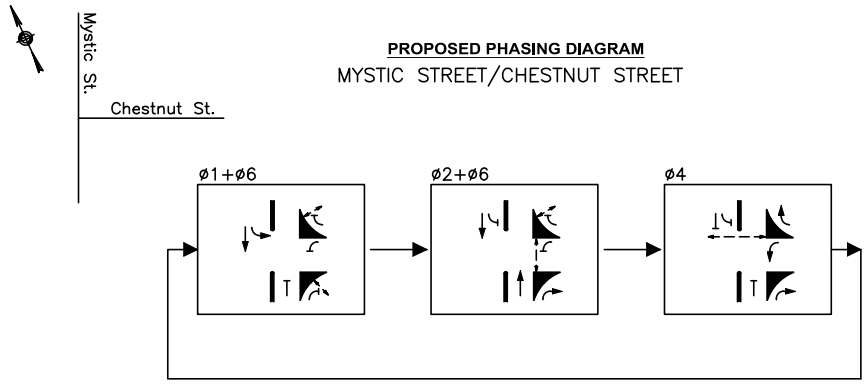


Table 9. Capacity Analysis Summary, Build (2031): Future Traffic with Proposed Geometry, AM Peak Hour

Intersection/Movement	LOS	Delay (sec)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Signalized Intersections					
Massachusetts Avenue/Pleasant Street/Mystic Street	**E**	**68.1**			
Massachusetts Ave EB left	D	48.8	0.46	79	138
Massachusetts Ave EB thru | thru	E	76.8	1.02	#397	#538
Massachusetts Ave EB right	F	162.4	1.07	#96	#215
Massachusetts Ave WB left	F	113.5	1.10	#262	#436
Massachusetts Ave WB thru | thru	C	25.8	0.68	186	247
Massachusetts Ave WB right	D	48.4	0.78	134	#240
Pleasant Street NB left	F	93.3	0.84	79	#182
Pleasant Street NB thru	E	73.8	0.97	389	#613
Pleasant Street NB right	E	55.4	0.68	120	#210
Mystic Street SB left	E	62.7	0.74	136	#232
Mystic Street SB thru	E	66.4	0.97	526	#756
Mystic Street SB right	E	68.1	0.71	129	#208
Massachusetts Avenue/Medford Street	**A**	**9.3**			
Massachusetts Ave EB left	C	26.0	0.40	43	101
Massachusetts Ave EB thru | thru	A	1.1	0.44	5	26
Massachusetts Ave WB thru | thru/right	B	14.6	0.56	316	462
Chestnut Street/Mystic Street	**C**	**24.8**			
Chestnut Street WB left |left	C	25.6	0.37	153	234
Chestnut Street WB right	A	10.0	0.14	0	31
Mystic Street NB thru	C	28.5	0.69	152	m147
Mystic Street NB right	A	1.7	0.30	32	m66
Mystic Street SB left	E	61.9	0.85	250	325
Mystic Street SB thru	B	17.7	0.45	187	202
Massachusetts Avenue/Swan Place	**A**	**4.7**			
Massachusetts Avenue EB thru| thru/right	A	3.8	0.51	73	m76
Massachusetts Avenue WB left/thru| thru	A	5.1	0.60	90	133
Swan Place NB left/right	D	39.3	0.03	5	26
Unsignalized Intersections					
Massachusetts Avenue/Railroad Avenue					
Massachusetts Avenue EB left	B	10.2	0.00	—	0
Massachusetts Avenue EB thru| thru	A	0.0	0.34	—	0
Massachusetts Avenue WB thru| thru/right	A	0.0	0.35	—	0
Railroad Avenue SB right	B	10.8	0.03	—	2

# = 50th/95th percentile volume exceeds capacity. Queue may be longer. Queue shown is maximum after 2 cycles.
m = Volume for the 95th percentile queue is metered by the upstream signal.
Cell shading indicates that LOS has worsened from Existing Conditions with Existing Geometry.

Table 10. Capacity Analysis Summary, Build (2031): Future Traffic with Proposed Geometry, PM Peak Hour

Intersection/Movement	LOS	Delay (sec)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Signalized Intersections					
Massachusetts Avenue/Pleasant Street/Mystic Street	**E**	**64.2**			
Massachusetts Ave EB left	E	73.4	0.86	171	#310
Massachusetts Ave EB thru | thru	E	70.5	0.99	370	#511
Massachusetts Ave EB right	E	72.5	0.83	135	#256
Massachusetts Ave WB left	F	91.4	0.99	165	#327
Massachusetts Ave WB thru | thru	C	32.9	0.74	220	286
Massachusetts Ave WB right	D	54.1	0.77	154	#265
Pleasant Street NB left	D	49.9	0.53	94	159
Pleasant Street NB thru	E	73.4	0.98	424	#656
Pleasant Street NB right	E	55.4	0.61	88	#153
Mystic Street SB left	F	102.1	0.99	220	#397
Mystic Street SB thru	D	52.0	0.89	452	#632
Mystic Street SB right	E	60.8	0.61	129	202
Massachusetts Avenue/Medford Street	**A**	**8.0**			
Massachusetts Ave EB left	C	21.5	0.44	42	94
Massachusetts Ave EB thru | thru	A	1.4	0.48	16	28
Massachusetts Ave WB thru | thru/right	B	13.0	0.50	278	376
Chestnut Street/Mystic Street	**C**	**22.1**			
Chestnut Street WB left |left	C	27.0	0.37	147	229
Chestnut Street WB right	B	13.6	0.26	38	97
Mystic Street NB thru	C	31.3	0.72	215	m227
Mystic Street NB right	A	1.9	0.48	60	m110
Mystic Street SB left	E	61.4	0.82	203	276
Mystic Street SB thru	B	16.3	0.43	194	198
Massachusetts Avenue/Swan Place	**A**	**8.0**			
Massachusetts Avenue EB thru| thru/right	A	5.2	0.53	125	m137
Massachusetts Avenue WB left/thru| thru	A	1.3	0.41	20	23
Swan Place NB left/right	D	39.2	0.02	1	21
Unsignalized Intersections					
Massachusetts Avenue/Railroad Avenue					
Massachusetts Avenue EB left	B	10.1	0.02	—	1
Massachusetts Avenue EB thru| thru	A	0.0	0.39	—	0
Massachusetts Avenue WB thru| thru/right	A	0.0	0.33	—	0
Railroad Avenue SB right	B	10.6	0.03	—	3

# = 50th/95th percentile volume exceeds capacity. Queue may be longer. Queue shown is maximum after 2 cycles.
m = Volume for the 95th percentile queue is metered by the upstream signal.
Cell shading indicates that LOS has worsened from Existing Conditions with Existing Geometry.

Table 11. Capacity Analysis Summary, Build (2031): Future Traffic with Proposed Geometry, Saturday Midday Peak Hour

Intersection/Movement	LOS	Delay (sec)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Signalized Intersections					
Massachusetts Avenue/Pleasant Street/Mystic Street	**D**	**52.5**			
Massachusetts Ave EB left	D	44.4	0.54	96	163
Massachusetts Ave EB thru | thru	D	40.5	0.71	220	286
Massachusetts Ave EB right	E	60.5	0.73	91	#184
Massachusetts Ave WB left	D	41.1	0.77	129	#237
Massachusetts Ave WB thru | thru	C	27.2	0.74	224	271
Massachusetts Ave WB right	F	83.7	0.92	109	#237
Pleasant Street NB left	E	58.8	0.73	106	#201
Pleasant Street NB thru	F	80.2	1.03	#476	#697
Pleasant Street NB right	E	65.7	0.82	128	#248
Mystic Street SB left	E	62.4	0.73	95	#186
Mystic Street SB thru	D	42.2	0.81	360	#500
Mystic Street SB right	E	74.6	0.88	181	#317
Massachusetts Avenue/Medford Street	**A**	**9.1**			
Massachusetts Ave EB left	B	19.9	0.36	20	64
Massachusetts Ave EB thru | thru	A	2.7	0.42	43	47
Massachusetts Ave WB thru | thru/right	B	13.5	0.53	276	365
Chestnut Street/Mystic Street	**C**	**21.1**			
Chestnut Street WB left |left	B	19.6	0.31	117	202
Chestnut Street WB right	A	9.3	0.16	0	37
Mystic Street NB thru	C	33.3	0.67	161	m91
Mystic Street NB right	A	0.4	0.29	0	m27
Mystic Street SB left	D	54.7	0.77	155	221
Mystic Street SB thru	B	19.9	0.48	200	194
Massachusetts Avenue/Swan Place	**A**	**3.8**			
Massachusetts Avenue EB thru| thru/right	A	4.6	0.46	84	111
Massachusetts Avenue WB left/thru| thru	A	1.5	0.45	20	24
Swan Place NB left/right	C	34.7	0.06	7	36
Unsignalized Intersections					
Massachusetts Avenue/Railroad Avenue					
Massachusetts Avenue EB left	B	10.6	0.02	—	2
Massachusetts Avenue EB thru| thru	A	0.0	0.27	—	0
Massachusetts Avenue WB thru| thru/right	A	0.0	0.39	—	0
Railroad Avenue SB right	B	10.8	0.03	—	2

# = 50th/95th percentile volume exceeds capacity. Queue may be longer. Queue shown is maximum after 2 cycles.
m = Volume for the 95th percentile queue is metered by the upstream signal.
Cell shading indicates that LOS has worsened from Existing Conditions with Existing Geometry.

Under Full Build Conditions, several approaches will still operate with LOS E and F. However, the overall delay at Massachusetts Avenue/Pleasant Street/Mystic Street will improve over No Build Conditions.

Traffic Management during Construction

Overall Approach to Traffic Management

The construction of this project will involve the reallocation of roadway width and minor curb work. The construction is proposed to be done during off-peak hours with as little disruption to the flow of traffic as possible. Pedestrian and bicycle access should be retained at all times.

All temporary traffic control will conform to the 2009 MUTCD and Massachusetts Amendments.

Conclusions

This project provides an important connection for the Minuteman Bikeway. With the lack of bicycle facilities on Mystic Street and Massachusetts Avenue, cyclists are forced to walk their bicycles as a pedestrian or maneuver dangerously through the intersection at Massachusetts Avenue/Pleasant Street/Mystic Street with vehicular traffic. The project will provide bicycle lanes to connect the ends of the Minuteman Bikeway through Arlington Center while improving vehicle and pedestrian mobility.

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Appendix A. Traffic Volume Counts

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Appendix B. Synchro Analysis

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Appendix C. MassDOT Crash Rate Worksheets and Crash Data

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Appendix D. Preferred Build Option 2 Geometry and Signal Plan

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www.hshassoc.com