

# ROAD SAFETY AUDIT

Watertown Street (Route 16) at Galen Street

Town of Watertown

November 4, 2016

Prepared For:  
MassDOT



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## Background

Howard Stein Hudson (HSH) is assisting the Massachusetts Department of Transportation (MassDOT) District 6 with Road Safety Audits (RSA's) at High Crash Locations in District 6. The intersection of Watertown Street (Route 16)/Galen Street, named as Route 16 at Galen Street in this report, is a High Crash Location, with an Equivalent Property Damage Only (EPDO) score of 99 from 2012-2014, including 16 injury crashes, based on MassDOT data.. The intersection is also a Highway Safety Improvement Plan (HSIP) Crash Cluster from 2012-2014, an HSIP Pedestrian Crash Cluster from 2005-2014, and was listed as a statewide Top 200 Crash Location from 2012-2014.

This RSA focuses on the intersection of Watertown Street (Route 16)/Nonantum Road/Galen Street, as well as the intersection of California Street/Watertown Street to the west of Route 16. The RSA does not include the intersection of Main Street/North Beacon Street (Route 20)/Galen Street/Mount Auburn Street, also known as Watertown Square. This intersection is a separate crash cluster than the intersection of Route 16/Galen Street. However, because the traffic operations at Watertown Square affect those at Route 16/Galen Street, the RSA does suggest some improvements at the Watertown Square intersection that may improve safety at Route 16/Galen Street.

## Project Data

The Road Safety Audit was conducted on Friday, November 4, 2016 at 10:00 a.m. at Watertown Town Hall. Table 1 shows the participating members of the audit.

Crash data was compiled at the intersection for the time period from 2012-2015. During this period, 50 crashes occurred at the intersection, including 24 crashes (or 48%) that resulted in personal injury. Of the 50 crashes, 19 (38%) were angle crashes; 10 (20%) were rear-end crashes, nine (18%) were single-vehicle crashes, seven (14%) were sideswipe crashes, three (6%) were head-on crashes, and two (4%) had an unknown crash type. Thirteen crashes (26%) occurred after dark. Most crashes (43, or 86%) occurred on dry pavement. Seven crashes (14%) involved a pedestrian, and three crashes (6%) involved a bicyclist.

**Table 1: Participating Audit Team Members**

<b>Audit Team Member</b>	<b>Agency/Affiliation</b>
Ryan Nicholson	Watertown Fire Department
Charles Samios	Watertown Police Department
David Sampson	Watertown Police Department
Gideon Schriber	Watertown Planning Department
Matt Shurman	Watertown DPW
Casey Claude	CTPS
David Loutzenheiser	MAPC
Calvin Thomas	MBTA – Cabot
Tammie Burton	MBTA – Bennett
Amitai Lipton	MassDOT District 6
Eric Hogan	MassDOT District 6
Saleema Mohamed	MassDOT District 6
Courtney Dwyer	MassDOT District 6
Michael Clark	MassDOT Planning
Elsa Chan	MassDOT Traffic Safety
Kevin T. Fitzgerald	MassDOT Traffic Safety
Christopher Falcos	MassDOT Traffic Safety
Connor Keating	MassDOT Traffic Safety
Michael Pompili	WorldTech Engineering
Rich Benevento	WorldTech Engineering
Jessica Lizza	Howard Stein Hudson
Mike Tremblay	Howard Stein Hudson

## Project Location and Description

**Watertown Street** runs east-west beginning at the study area intersection to the east and Washington Street in Newton to the west. It is also state numbered **Route 16** throughout its length. Watertown Street is classified by MassDOT as an urban principal arterial and is under the jurisdiction of the Town of Watertown. Watertown Street generally runs with one travel lane in each direction. Sidewalks are provided along both sides of Watertown Street; in the vicinity of the intersection, the northern sidewalk is part of the Charles River Greenway, which is used by both pedestrians and by bicyclists in either direction. Aside from the Charles River Greenway, there are no bicycle accommodations in the vicinity of the intersection on Watertown Street.

**Nonantum Road** is classified by MassDOT as an urban minor arterial and is under the jurisdiction of the Department of Conservation and Recreation (DCR). Nonantum Road runs northwest-southeast, closely along the Charles River, for its entire length, from Soldier’s Field Road in Boston to the east, where it becomes North Beacon Street, to Galen Street at the study area intersection to the west. It generally runs with one travel lane in each direction, separated by a painted or raised median, with intermittent auxiliary

left-turn lanes. The Paul Dudley White Bike Path, which is a shared-use path, runs along the north/east side of Nonantum Road; otherwise, no pedestrian or bicycle accommodations are provided.

**Galen Street** is classified by MassDOT as an urban principal arterial under the jurisdiction of the Town of Watertown. North of Watertown Street, it is also state numbered **Route 16**. Galen Street generally runs with two travel lanes in each direction between Carleton Street at the Newton City Line to the south and Watertown Square to the north, where it becomes Mount Auburn Street. Sidewalks are provided along both sides of Galen Street, but they are largely not compliant with current Americans with Disabilities Act (ADA)/MassDOT standards. Dedicated bicycle accommodations are not provided.

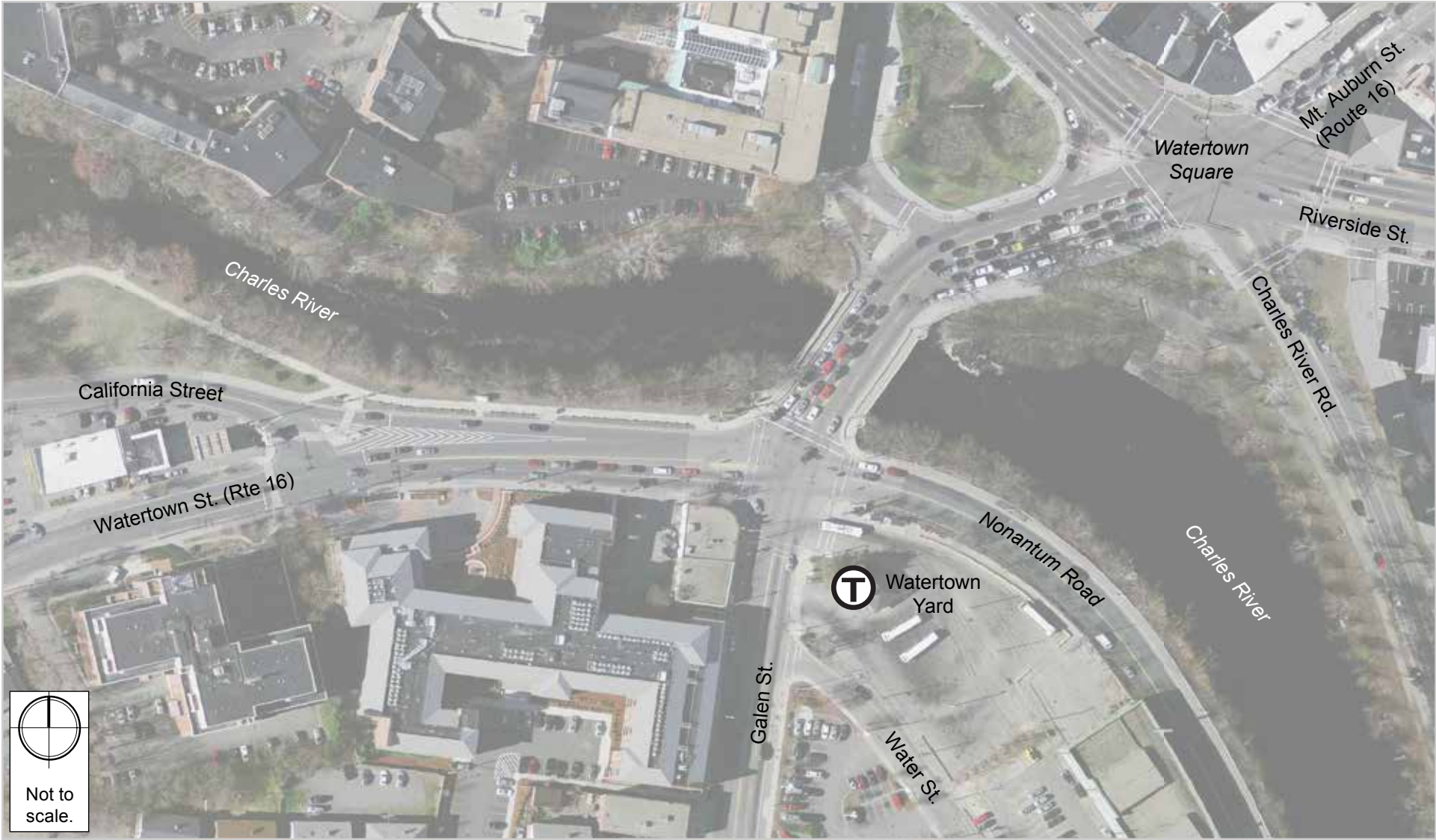
**California Street** is classified by MassDOT as an urban collector and, within the study area, under the jurisdiction of the Town of Watertown. California Street runs east-west with one travel lane in each direction between Watertown Street to the east and Crafts Street in Newton to the west. Sidewalks are provided along both sides of California Street, but dedicated bicycle accommodations are not provided within the study area.

The intersection of **Watertown Street/Nonantum Road/Galen Street** (Route 16 at Galen Street) is a four-legged intersection with four approaches. The Watertown Street eastbound approach consists of a dedicated left-turn lane and a shared through/right-turn lane. A lagging protected left-turn phase is provided on the Watertown Street eastbound approach. The Nonantum Road westbound approach consists of two undesignated travel lanes that operate as a shared left-turn/through lane and a shared through/right-turn lane. The Galen Street northbound approach consists of two undesignated travel lanes that operate as a shared left-turn/through lane and a shared through/right-turn lane. The Galen Street southbound approach consists of a shared left-turn/through lane, a through lane, and an approximately 130-foot dedicated right-turn lane. Left turns from Galen Street northbound and southbound are prohibited during peak hours. The bus-only exit for Watertown Yard intersects Galen Street from just south of Nonantum Road, and is included in the signal operations. Pedestrian indications, curb ramps, and crosswalks are provided across all legs of the intersection. Pedestrians cross in an exclusive pedestrian phase, with the exception of the southern crosswalk leg across Galen Street and the crosswalk across the Watertown Yard exit driveway, which cross concurrently with Watertown Street eastbound and Nonantum Road westbound vehicles. Buses exiting Watertown Yard do so during the exclusive pedestrian phase. All buses exiting the terminal turn left onto Galen Street southbound during their own phase, and do not conflict with pedestrians during that phase.

The intersection of **Watertown Street/California Street** is a four-legged intersection with four approaches, including a residential driveway. The Watertown Street eastbound approach consists of a through lane and a shared through/right-turn lane. Left turns are prohibited from Watertown Street eastbound onto California Street. The Watertown Street westbound approach consists of a shared left-turn/through lane and a channelized right-turn lane onto California Street. The residential driveway northbound approach consists of a single travel lane. The California Street southeast-bound approach consists of a single travel lane. Pedestrian crosswalks are provided across the western and northern legs of the intersection and across the Watertown Street westbound channelized right-turn lane.



Figure 1. *Locus Map*



# Audit Observations and Potential Safety Enhancements

The following sections will identify the safety issues at the intersection of Route 16/Galen Street and the possible potential safety enhancements discussed during the audit.

## **Safety Issue #1: Traffic Signal**

### **Issues**

Twelve crashes occurred between vehicles turning left from Watertown Street eastbound and vehicles traveling through on Nonantum Road westbound. Watertown Street eastbound left-turns operate with a protected-permissive left-turn phase, where the protected left-turn phase is lagging, occurring after the permissive phase. These crashes may occur for several reasons. Motorists may not be aware that a protected phase is upcoming after the permissive phase, and may feel the need to eventually find a gap in opposing westbound traffic.



**Watertown Street eastbound receives a lagging left-turn phase. Vehicles may get stuck in the intersection, or unable to proceed, during this phase due to congestion north of the intersection.**

Nonantum Road has two lanes that can proceed through the intersection, with a posted speed limit of 40 mph. Additionally, the Nonantum Road westbound approach is on an incline and a horizontal curve. The alignment, speed, and two lanes of through traffic on Nonantum Road may make it difficult to perceive oncoming vehicles to left-turning Watertown Street motorists. Finally, motorists may prefer to turn left during the permissive phase because right-turning Nonantum Road westbound vehicles may fill the entire storage area on Galen Street north of the intersection, leaving no room for Watertown Street eastbound vehicles once the protected phase begins. Vehicles who begin to turn left during the permissive phase, but then stop due to a lack of a gap, may

have contributed to the three rear-end crashes along the Watertown Street eastbound approach to the intersection.

Left turns are restricted during peak hours (7:00-9:00 a.m. and 4:00-7:00 p.m.) on Galen Street northbound and southbound. While only one crash occurred involving a Galen Street northbound or southbound left-turn vehicle, left turns at the intersection are a safety concern due primarily to congestion. Because there are no dedicated left-turn lanes on the Galen Street northbound and southbound approaches, vehicles waiting in the travel lane to make left turns block one of the two through lanes on each approach, which can create significant congestion, including sideswipe and rear-end crashes. Three sideswipe crashes occurred along the Galen Street southbound approach to the intersection, which may have occurred due to vehicles shifting lanes to get around vehicles stopped in the travel lane.

The alignment of Nonantum Road may make it difficult for westbound motorists to see the signal indication at the intersection. A horizontal curve about 400 feet upstream of the intersection blocks the signal indications from view, and vehicles traveling towards the intersection may not have time to stop for

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a red indication or vehicles queued at the stop line. Tree growth along the inside of this horizontal curve may further impede visibility of the signal indications.

Tree growth obscures the view of the traffic signals along the Watertown Street eastbound approach to the intersection. Lack of signal visibility may contribute to rear-end crashes or red light running.

RSA attendees reported that solar glare makes it difficult to see traffic signal indications on the Watertown Street eastbound approach during the morning peak period and on the Nonantum Road westbound approach during the evening peak period.



**A horizontal curve on Nonantum Road may make it difficult for motorists to see the signal indications at the intersection.**

The traffic signal indications are mounted on a span wire. Signals mounted on span wires are susceptible to twisting in the wind so that they don't face the desired direction, especially if the signal indications are equipped with backplates. The signal heads at the intersection have broken tethers, which may allow them to sway or twist in the wind, reducing signal visibility.

At the intersection of Watertown Street/California Street, queues along Watertown Street eastbound approaching Galen Street may spill back to California Street during peak periods. These queues may block the intersection of Watertown Street/California Street, making it difficult for California Street southeast-bound vehicles to turn onto Watertown Street eastbound even when they have a green indication.

There is no emergency vehicle preemption at the intersection. Mount Auburn Hospital is located three miles east of the intersection, and Town of Watertown police and fire stations are located along Main Street west of Watertown Square.



## Potential Enhancements:

1. Consider the possible operational and safety benefits of switching to a leading left-turn phase on Watertown Street eastbound to allow left turning vehicles to turn left without conflict before conflicting vehicles enter the intersection. Consider possible impacts to signal coordination and queue lengths from the Watertown Square intersection.
2. Consider installing a flashing yellow arrow indication at the Watertown Street eastbound approach to the intersection so that motorists are aware when they may freely turn left and when they must yield to oncoming traffic.
3. Consider the safety benefits of converting to protected-only left turns on the Watertown Street eastbound approach. Consider potential operational implications, including increases in delay for all approaches to the intersection as well as queue lengths on Watertown Street. This improvement may also allow for concurrent pedestrian phasing at the intersection, which may improve operations and improve pedestrian mobility.
4. Evaluate the coordination between Route 16/Galen Street and the Watertown Square intersection so that vehicle queues do not accumulate on the bridge over the Charles River and block the Route 16 at Galen Street intersection.
5. Consider the use of adaptive signal control at the intersections in the area, including at Watertown Square, to improve the efficiency of traffic operations in the area.
6. Consider extending the left-turn restriction on Galen Street northbound and southbound, or restricting during all periods of the day, rather than during peak hours only, to reduce the occurrence of sideswipe and rear-end crashes along these approaches. Consider potential operational improvements, but also consider potential wayfinding issues that may be caused by this enhancement.
7. Consider placing “(Red) Signal Ahead” signs with illuminating “Red” text on the Nonantum Road westbound approach to the intersection so that westbound vehicles can anticipate a red indication as they approach the intersection.
8. Consider installing mast arms at the intersection so that signals can be more visible to motorists. Consider the presence of the overhead catenary wires.
9. If mast arms are installed, consider installing retroreflective backplates on the signal indications so that they are more visible at night and during periods of solar glare.
10. Trim trees along the Watertown Street eastbound approach and the Nonantum Road westbound approach to the intersection so that the signal indications are visible to motorists.
11. Consider installing “Don’t Block the Intersection” signs and markings at the intersection of Watertown Street/California Street so that vehicles may turn from California Street onto Watertown Street during periods of congestion.

12. As part of long-term planning efforts, consider implementing a single-lane roundabout at the intersection of Watertown Street/California Street. Consider potential impacts to the adjacent Charles River and property in the vicinity of the intersection.
13. Consider the safety benefits and operational impacts of switching to split phasing for the Watertown Street eastbound and Nonantum Road westbound approaches to the intersection.
14. Consider installing post-mounted signal indications to supplement overhead signal indications to improve signal visibility.
15. Consider designating the left approach lane on Nonantum Road westbound as a dedicated left-turn lane and reducing the Watertown Street westbound departure from two travel lanes to one in order to allocate additional space for pedestrian and bicycle accommodations or for a third Watertown Street eastbound travel lane.
16. As an alternative to the above enhancement, consider restriping Nonantum Road to create dedicated left-turn lane while maintaining two through lanes and reducing the Nonantum Road eastbound departure to one travel lane to improve the capacity of the Nonantum Road westbound approach.
17. As part of long-term reconstruction efforts, consider implementing a quadrant roadway in the southeast corner of the intersection using a portion of MBTA land in Watertown Yard in order to relocate the turning movements away from the intersection and allowing a two-phase operations. The Watertown Yard bus station and the intersection of Water Street/Galen Street could be implemented into the quadrant roadway.
18. Consider clarifying lane assignments for Galen Street northbound at Watertown Square, with two left-turn lanes onto Main Street, a bear-right-only lane onto Mount Auburn Street, and a hard-right-only lane onto Arsenal Street in order to reduce queuing onto the bridge between Watertown Square and Route 16/Galen Street. Advanced lane use signage and pavement markings should be placed at the Route 16/Galen Street northbound departure.
19. Consider providing emergency vehicle preemption at the intersection to allow emergency vehicles to travel through the intersection more quickly.

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## Safety Issue #2: Pedestrian and Bicycle Accommodations

### Issues

Pedestrian and bicyclists have a heavy presence at the intersection, as the Charles River Greenway runs along the north side of the intersection, and the Watertown Yard bus terminal is located in the southeastern corner of the intersection. Another high-traffic bus stop is located at Watertown Square to the north, and the Watertown Square area is a popular downtown crossroads that generates significant pedestrian and bicycle traffic.

Six crashes involving pedestrians occurred at the intersection of Route 16/Galen Street, and one additional crash involving a pedestrian occurred at Watertown Street/California Street. RSA attendees reported that there is a strong desire line between the northwest and southeast corner of the intersection of Route 16/Galen Street due to the bus terminal at Watertown Yard. Pedestrians approaching the intersection from the north can often see their bus boarding at the terminal, and try to cross the intersection however they can, including diagonally and through queued vehicles. Police officers attending the RSA reported that, during educational enforcement sessions, pedestrians reported crossing illegally because it was more convenient than waiting two or more signal cycles to cross multiple legs of the intersection. During field observations, pedestrians were observed crossing roadways against the walk signal when they perceived it to be safe to do so, such as when traffic was stopped due to congestion. Crossing through traffic queues can leave pedestrians vulnerable to other motorists who do not expect or see pedestrians crossing through queues.

The two crosswalks that are not permitted to cross during the exclusive pedestrian phase are the crosswalks across the Watertown Yard exit driveway and across the southern leg of Galen Street. Pedestrians may mistakenly assume it is safe to cross these legs during the exclusive pedestrian phase. Pedestrians, including those who just got off a bus, hoping to cross the southern leg of Galen Street must first cross the Watertown Yard driveway first, forcing a compliant pedestrian to wait an additional signal cycle to cross Galen Street.

Most of the crosswalks at the intersection of Route 16/Galen Street are striped with transverse crosswalk markings only, with the exception of the crosswalk across Nonantum Road, where longitudinal lines were used. Combined with the “Do Not Block the Intersection” markings at the intersection, the location of the marked crosswalk can be unclear to pedestrians and motorists. Motorists may be more likely to block a marked crosswalk in this case, causing pedestrians to cross in locations where they may not be expected.



**The Watertown Yard bus terminal is a heavy pedestrian generator at the southeast corner of the intersection. Pedestrians often cross the intersection from all directions to get to the bus terminal.**



**Crosswalk markings are not easily distinguishable from “Do Not Block Intersection” markings. Vehicles often stop in the crosswalks, forcing pedestrians to walk between queued vehicles.**

Similarly, pedestrians may be more likely to cross in locations where they are not intended to cross if crossing locations are not marked clearly.

The pedestrian clearance interval is not sufficient given the length of the crosswalks at the intersection of Route 16/Galen Street. The crosswalk across the western leg of Watertown Street is 93 feet long, requiring a minimum of 27 seconds of pedestrian clearance interval to cross using the Manual on Uniform Traffic Control Devices (MUTCD) standard walking speed of 3.5 feet per second. Currently, only 17 seconds of clearance is provided, which is insufficient to cross the western leg of the intersection in one stage, and is too short to accommodate the diagonal pedestrian movement that some pedestrians make across the intersection, resulting in pedestrians still in the intersection during vehicular phases. Clearance intervals longer than what is required may be beneficial if larger groups of people are crossing the intersection, which may apply to Route 16/Galen Street due to the Charles River Greenway and the Watertown Yard bus terminal. There is also no “Don’t Walk”/all-red clearance interval; a 3-second clearance interval is required by the MUTCD. A “Walk” time of greater than the seven seconds provided at the intersection is warranted given the high levels of pedestrian and bicycle traffic in the area.

The pedestrian signal at Route 16/Galen Street is not on recall, despite the heavy pedestrian traffic at the intersection. Countdown timers are not provided during the clearance interval.

The audible indications at the intersection of Route 16/Galen Street are confusing, as the crosswalk across the Watertown Yard terminal exit and across the southern leg of Galen Street emit the same noise indication as the all-pedestrian phase, despite occurring at different stages of the signal cycle. The noise indications for both crossing phases were discernable from the corner of Nonantum Road/Galen Street at the Watertown Yard exit. Visually impaired pedestrians, or pedestrians who are distracted while walking, may hear the audible indications and step into the crosswalk despite not having the “walk” indication. Typically, audible indications have different noises if there are multiple pedestrian phases at the same

intersection, and the noises are not audible more than 10 feet away from the signal. The Perkins School for the Blind is located under a mile from the intersection. The lack of clear audible indications make it difficult and unsafe for students to cross.



**The “Don’t Walk” indication at the pedestrian signal across California Street does not work.**

The “Don’t Walk” signal on the Watertown Street westbound right-turn approach onto California Street at the intersection of Watertown Street/California Street was not working at the time of the audit. The “Walk” indication was functional, and sufficient clearance times were provided. The missing “Don’t Walk” indication may signal to pedestrians that they have the right-of-way even when motorists have a green indication. One crash involving a pedestrian occurred on this approach.

RSA attendees noted that sidewalks in the area do not always get cleared of snow during the winter, which causes pedestrians to walk in the roadway.

Three crashes involving bicyclists occurred at the intersection of Route 16/Galen Street. There are no bicycle accommodations at the intersection. The Charles River Greenway along the northwest section of the intersection is used by bicyclists. There are no accommodations across Galen Street connecting the Charles River Greenway and the Paul Dudley White Bike Path.

### **Potential Enhancements:**

1. Provide at least 27 seconds of pedestrian clearance time at the intersection of Route 16/Galen Street to allow pedestrians to safely cross all legs of the intersection. Consider providing additional clearance time to accommodate larger clusters of pedestrians. Include a three second solid “Don’t Walk”/all-red clearance interval per MUTCD requirements. Consider increasing the “Walk” interval to accommodate heavy pedestrian traffic.
2. Restripe the crosswalks at the intersection of Route 16/Galen Street with high-visibility continental crosswalks to differentiate the crosswalk from the “Do Not Block the Intersection” markings and make them more visible to motorists, pedestrians, and bicyclists.
3. Consider moving the crosswalk across the southern leg of Galen Street to begin north of the Watertown Yard busway so that pedestrians do not have to cross the busway driveway and so that the crossing can be included in the exclusive pedestrian phase. Consider that this enhancement would require a new pedestrian ramp on the eastern side of the crossing.
4. Consider the safety and pedestrian mobility benefits of placing the exclusive pedestrian signal at Route 16/Galen Street on recall.
5. Consider replacing the pedestrian indications at Route 16/Galen Street with countdown timers for improved pedestrian awareness.
6. Consider the safety benefits of switching from an exclusive pedestrian phase to concurrent pedestrian phases during parallel through traffic so that pedestrians do not have to wait for multiple cycles to cross the intersection or cross diagonally through the intersection. This change may have operational benefits as time allocated to the exclusive pedestrian phase can be removed from the cycle or distributed to vehicular phases. It may also improve pedestrian compliance with pedestrian indications. If this enhancement is implemented, consider the use of leading pedestrian intervals (LPI’s) to allow pedestrians to enter the intersection before turning vehicles. Include officials from Perkins School for the Blind in discussions regarding changes to pedestrian signal phasing.
7. Consider continued educational enforcement of pedestrians who jaywalk or cross diagonally at the intersection of Route 16/Galen Street to encourage pedestrians to cross when and where it is safe to do so.
8. Replace the malfunctioning “Don’t Walk” signal at the pedestrian crossing across California Street.
9. Consider placing “Use Ped Signal” (R9-5) signs to inform bicyclists to use the pedestrian signal when crossing Galen Street along the Charles River Greenway.

10. Consider replacing existing pedestrian buttons and audible “Walk” tone with Accessible Pedestrian Signal (APS) push buttons with vibrotactile arrows and speech messages, each properly aligned with the crosswalk it serves, for improved utility and safety for pedestrians with disabilities.

11. Clear sidewalks of snow during the winter so that pedestrians have a safe place to walk.

## **Safety Issue #3: Signage and Pavement Markings**

### **Issues**

The lane use along the Galen Street southbound approach to the intersection of Route 16/Galen Street is unclear. There is a right-turn lane on the approach, but it may not be clear to motorists that a third lane has formed, particularly in periods of congestion. The right-turn lane forms abruptly, and the alignment to enter the lane is poor. RSA attendees reported that vehicles often form only two lanes on this approach, and vehicles in the center lane have been seen making right turns. There are no advanced lane use signs or pavement markings along this approach, and the sign at the intersection states “Right Lane Must Turn Right” rather than showing a lane use diagram. RSA attendees noted that the lane use at the Watertown Square intersection may be inefficient, and that one of the four northbound approach lanes could be reallocated to the southbound side in order to extend the southbound right-turn lane to clarify lane use approaching Route 16/Galen Street. It was noted that it is difficult to weave on the bridge over the Charles River on Galen Street southbound due to the short distance, the horizontal curve, and the presence of queued vehicles, so entering the approach in the proper lane is of heightened importance. Five sideswipe crashes (three southbound, two northbound) occurred along the bridge between these intersections.



**Guide signs on Nonantum Road is difficult to read and located close to the intersection.**

The radius of the northwest corner of the intersection is relatively large, which allows vehicles to make right turns from Galen Street southbound at high speeds. A larger radius may be necessary to facilitate MBTA #57 bus turns. One crash involving a pedestrian and a southbound right-turning vehicle was reported.

The “Left Turn Yield on Green” (R10-12) sign on the Watertown Street eastbound approach to Galen Street is located in the median island, upstream of the stop line. It is not visible to vehicles making a left turn. This may contribute to crashes involving left-turning vehicles from Watertown Street eastbound.

Lane use on the Route 16 eastbound approach to the intersection of Route 16/Galen Street is also not clear. While lane use signage is provided, it is placed close to the stop line, where motorists may already be proceeding through the intersection in the incorrect lane. There are no advanced pavement markings or guide signs that indicate to motorists that the left lane is a left-turn only lane. The dashed white lane lines along the Route 16 eastbound approach to the intersection are faded and difficult to see. Similarly, there is a lack of pavement markings and lane use signage along the Galen Street northbound approach to the intersection.

RSA attendees noted that vehicles sometimes speed on Nonantum Road westbound approaching the intersection, which may contribute to angle crashes with left-turning Watertown Street eastbound vehicles as well as one sideswipe crash along the Nonantum Road westbound approach to the intersection. While the 40 mph speed limit may be appropriate along much of Nonantum Road, this speed may not be appropriate for the horizontal curve approaching the intersection.

Guide signs at the intersection are generally sufficient; however, some signs may not be clear to motorists. On Nonantum Road westbound, a guide sign refers to locations in text, with small Route 16 markers alongside the text. The sign is located just 100 feet from the intersection, so motorists may not be able to see the guide sign in time to position themselves in the proper travel lane. Guide signs for I-90 facing the Galen Street southbound approach south of the intersection use text saying “Mass Pike” rather than an Interstate Highway shield image.

### **Potential Enhancements:**

1. Provide diagrammatic lane use signage and pavement markings in advance of the intersection of Route 16/Galen Street along the Route 16 eastbound approach and the Galen Street southbound approach to the intersection so that motorists can position themselves in the proper lane in advance of the intersection. Consider placing additional guide signage on the Galen Street southbound approach to that motorists turning onto Galen Street from Watertown Square know which lane to turn into.
2. Replace text guide signs with clear signage using route number shields where applicable. Guide signs should be placed in advance of the intersection so that motorists can shift into the appropriate lane.
3. In the short term, relocate the “Left Turn Yield on Green” (R10-12) sign on the Watertown Street eastbound approach to Galen Street to a more visible location on the span wire or on the far side of the intersection.
4. As part of long-term design considerations, consider reducing the radius of the northwest corner of the intersection to force passenger vehicles to make turns more slowly. Consider the need for MBTA buses to safely turn right onto Watertown Street from Galen Street southbound.
5. Provide advance warning signage on Galen Street for the left-turn restrictions at the intersection to reduce confusion and improve compliance with the restrictions. Supplement with wayfinding signage for alternate routes to Route 16 and points east along the Charles River.
6. Consider placing a speed feedback sign on the Nonantum Road westbound approach to the intersection. Consider placing curve warning signage (W1-2) and reduce speed advisory signage along the approach.
7. Consider installing lane use signage overhead on future mast arms to reinforce lane use for motorists at the intersection. Consider also placing overhead lane use signage for both directions of Galen Street over the bridge north of the intersection.
8. Provide lane use pavement markings and diagrammatic lane use signage along the Galen Street northbound approach to the intersection and along the Galen Street northbound departure leading into Watertown Square.
9. Consider using blankout signs for left-turn restrictions at the intersection so that motorists are aware of the restriction when it is active.
10. Restripe faded lane line markings in the study area, including along the Route 16 eastbound approach to Galen Street.



## **Safety Issue #4: Bus Operations**

### **Issues**



**The Watertown Yard bus terminal exit is located just south of Nonantum Road.**

The Watertown Yard bus terminal is located in the southeast corner of the intersection of Route 16/Galen Street and is a heavy generator of pedestrians at the intersection. The bus terminal serves MBTA bus routes 52, 57, 502, and 504. The exit driveway for the terminal is located just south of Nonantum Road, within the functional area of the intersection. These buses turn left from Watertown Yard onto Galen Street southbound, and do not travel through the intersection of Route 16/Galen Street. North of the intersection, at Watertown Square, another bus terminal serves MBTA bus routes 59, and 71, while routes 70 and 70A stop along Main Street.

RSA attendees noted that many passengers travel between the Watertown Square terminal and the Watertown Yard terminal as they switch between the local buses at Watertown Square and the express buses at Watertown Yard. The fastest route between the stations is along the west side of Galen Street, which is difficult for unfamiliar users to perceive when exiting buses at Watertown Yard on foot.

The bus terminal's exit is located just south of Nonantum Road. RSA attendees noted that it may appear to Galen Street northbound motorists that the bus terminal exit is actually the eastbound side of Nonantum Road, as the driveway is located north of the stop line for that approach. One-way and Do Not Enter signs at the exit is aging and may not be visible to motorists.

The bus terminal's entrance is located just north of Water Street and about 100 feet south of Nonantum Road. The presence of the entrance and exit driveways to the station within 100 feet of the major intersection of Route 16/Galen Street means that pedestrians must cross both driveways in succession, exposed to turning buses.

MBTA officials stated that MBTA bus drivers are prohibited from turning left from Galen Street southbound into Watertown Yard or turning right from Watertown Yard onto Galen Street northbound. However, during the RSA, an MBTA bus driver was seen turning left from Galen Street southbound into Watertown Yard. A right-turn indication is provided for the Watertown Yard exit driveway, though MBTA officials stated that buses no longer turn right out of the driveway.

## Potential Enhancements:

1. Consider placing pedestrian-scale wayfinding signs at the Watertown Yard and Watertown Square bus terminals, as well as along the desired pedestrian route between the two stations, so that pedestrians can find the best route between the two stations more easily.
2. Replace aging One Way and Do Not Enter signs at the Watertown Yard exit driveway so that motorists are less likely to mistakenly enter the driveway.
3. Consider making geometrical changes to the Watertown Yard exit driveway to reduce the overall driveway width and make the driveway look less like a roadway.
4. As part of long-term planning efforts, consider relocating the entrance to Watertown Yard to Water Street to reduce the number of curb cuts along the east side of Galen Street.
5. Work with the MBTA to ensure that buses do not turn left from Galen Street southbound into Watertown Yard, or turn right onto Galen Street northbound out of Watertown Yard, to avoid traffic congestion and conflicts with pedestrians that may result.

## Summary of Road Safety Audit

Table 2 below shows the estimated time frames of short-term, mid-term, and long-term solutions, as well as the cost ranges of low-cost, medium-cost, and high-cost projects. On the following pages, Table 3 provides an estimate of the time frame and cost of each potential safety issue that may address each of the identified safety issues. Safety payoff determinations are also provided in Table 3, and are based on engineering judgment.

**Table 2: Estimated Time Frame and Costs Breakdown**

Time Frame		Costs	
Short-Term	<1 Year	Low	<\$10,000
Mid-Term	1-3 Years	Medium	\$10,001-\$50,000
Long-Term	>3 Years	High	>\$50,000

Table 3: Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Traffic Signal	Consider the possible operational and safety benefits of switching to a leading left-turn phase on Watertown Street eastbound to allow left turning vehicles to turn left without conflict before conflicting vehicles enter the intersection. Consider possible impacts to signal coordination and queue lengths from the Watertown Square intersection.	Low	Short-term	Low	Town of Watertown
Traffic Signal	Consider installing a flashing yellow arrow indication at the Watertown Street eastbound approach to the intersection so that motorists are aware when they may freely turn left and when they must yield to oncoming traffic.	Low	Short-term	Low	Town of Watertown
Traffic Signal	Consider the safety benefits of converting to protected-only left turns on the Watertown Street eastbound approach. Consider potential operational implications, including increases in delay for all approaches to the intersection as well as queue lengths on Watertown Street. This improvement may also allow for concurrent pedestrian phasing at the intersection, which may improve operations and improve pedestrian mobility.	High	Short-term	Low	Town of Watertown
Traffic Signal	Evaluate the coordination between Route 16/Galen Street and the Watertown Square intersection so that vehicle queues do not accumulate on the bridge over the Charles River and block the Route 16 at Galen Street intersection.	Medium	Short-term	Low	Town of Watertown
Traffic Signal	Consider the use of adaptive signal control at the intersections in the area, including at Watertown Square, to improve the efficiency of traffic operations in the area.	Medium	Mid-term	High	Town of Watertown
Traffic Signal	Consider extending the left-turn restriction on Galen Street northbound and southbound, or restricting during all periods of the day, rather than during peak hours only, to reduce the occurrence of sideswipe and rear-end crashes along these approaches. Consider potential operational improvements, but also consider potential wayfinding issues that may be caused by this enhancement.	Low	Short-term	Low	Town of Watertown

Table 3: Potential Safety Enhancement Summary (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Traffic Signal	Consider placing “(Red) Signal Ahead” signs with illuminating “Red” text on the Nonantum Road westbound approach to the intersection so that westbound vehicles can anticipate a red indication as they approach the intersection.	Medium	Short-term	Low	Town of Watertown/DCR
Traffic Signal	Consider installing mast arms at the intersection so that signals can be more visible to motorists. Consider the presence of the overhead catenary wires.	Medium	Long-term	High	Town of Watertown
Traffic Signal	If mast arms are installed, consider installing retroreflective backplates on the signal indications so that they are more visible at night and during periods of solar glare.	Low	Long-term	Low	Town of Watertown
Traffic Signal	Trim trees along the Watertown Street eastbound approach and the Nonantum Road westbound approach to the intersection so that the signal indications are visible to motorists.	Low	Short-term	Low	Town of Watertown
Traffic Signal	Consider installing “Don’t Block the Intersection” signs and markings at the intersection of Watertown Street/California Street so that vehicles may turn from California Street onto Watertown Street during periods of congestion.	Low	Short-term	Low	Town of Watertown
Traffic Signal	As part of long-term planning efforts, consider implementing a single-lane roundabout at the intersection of Watertown Street/California Street. Consider potential impacts to the adjacent Charles River and property in the vicinity of the intersection.	Medium	Long-term	High	Town of Watertown
Traffic Signal	Consider the safety benefits and operational impacts of switching to split phasing for the Watertown Street eastbound and Nonantum Road westbound approaches to the intersection.	High	Short-term	Low	Town of Watertown
Traffic Signal	Consider installing post-mounted signal indications to supplement overhead signal indications to improve signal visibility.	Medium	Mid-term	Medium	Town of Watertown

Table 3: Potential Safety Enhancement Summary (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Traffic Signal	Consider designating the left approach lane on Nonantum Road westbound as a dedicated left-turn lane and reducing the Watertown Street westbound departure from two travel lanes to one in order to allocate additional space for pedestrian and bicycle accommodations or for a third Watertown Street eastbound travel lane.	Medium	Short-term	Low	DCR/Town of Watertown
Traffic Signal	As an alternative to the above enhancement, consider restriping Nonantum Road to create a dedicated left-turn lane while maintaining two through lanes and reducing the Nonantum Road eastbound departure to one travel lane to improve the capacity of the Nonantum Road westbound approach.	Medium	Short-term	Low	DCR/Town of Watertown
Traffic Signal	As part of long-term reconstruction efforts, consider implementing a quadrant roadway in the southeast corner of the intersection using a portion of MBTA land in Watertown Yard in order to relocate the turning movements away from the intersection and allowing a two-phase operations. The Watertown Yard bus station and the intersection of Water Street/Galen Street could be implemented into the quadrant roadway.	High	Long-term	High	DCR/Town of Watertown/ MBTA
Traffic Signal	Consider clarifying lane assignments for Galen Street northbound at Watertown Square, with two left-turn lanes onto Main Street, a bear-right-only lane onto Mount Auburn Street, and a hard-right-only lane onto Arsenal Street in order to reduce queuing onto the bridge between Watertown Square and Route 16/Galen Street. Advanced lane use signage and pavement markings should be placed at the Route 16/Galen Street northbound departure.	Medium	Short-term	Low	Town of Watertown
Traffic Signal	Consider providing emergency vehicle preemption at the intersection to allow emergency vehicles to travel through the intersection more quickly.	Medium	Short-term	Low	Town of Watertown

Table 3: Potential Safety Enhancement Summary (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Pedestrian and Bicycle Accommodations	Provide at least 27 seconds of pedestrian clearance time at the intersection of Route 16/Galen Street to allow pedestrians to safely cross all legs of the intersection. Consider providing additional clearance time to accommodate larger clusters of pedestrians. Include a three second solid "Don't Walk"/all-red clearance interval per MUTCD requirements. Consider increasing the "Walk" interval to accommodate heavy pedestrian traffic.	Medium	Short-term	Low	Town of Watertown
Pedestrian and Bicycle Accommodations	Restripe the crosswalks at the intersection of Route 16/Galen Street with high-visibility continental (ladder) crosswalks to differentiate the crosswalk from the "Do Not Block the Intersection" markings and make them more visible to motorists, pedestrians, and bicyclists.	Low	Short-term	Low	Town of Watertown
Pedestrian and Bicycle Accommodations	Consider moving the crosswalk across the southern leg of Galen Street to begin north of the Watertown Yard busway so that pedestrians do not have to cross the busway driveway and so that the crossing can be included in the exclusive pedestrian phase. Consider that this enhancement would require a new pedestrian ramp on the eastern side of the crossing.	Low	Short-term	Low	Town of Watertown
Pedestrian and Bicycle Accommodations	Consider the safety and pedestrian mobility benefits of placing the exclusive pedestrian signal at Route 16/Galen Street on recall.	Low	Short-term	Low	Town of Watertown
Pedestrian and Bicycle Accommodations	Consider replacing the pedestrian indications at Route 16/Galen Street with countdown timers for improved pedestrian awareness.	Low	Short-term	Medium	Town of Watertown

Table 3: Potential Safety Enhancement Summary (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Pedestrian and Bicycle Accommodations	Consider the safety benefits of switching from an exclusive pedestrian phase to concurrent pedestrian phases during parallel through traffic so that pedestrians do not have to wait for multiple cycles to cross the intersection or cross diagonally through the intersection. This change may have operational benefits as time allocated to the exclusive pedestrian phase can be removed from the cycle or distributed to vehicular phases. It may also improve pedestrian compliance with pedestrian indications. If this enhancement is implemented, consider the use of leading pedestrian intervals (LPI's) to allow pedestrians to enter the intersection before turning vehicles. Include officials from Perkins School for the Blind in discussions regarding changes to pedestrian signal phasing.	Medium	Short-term	Low	Town of Watertown
Pedestrian and Bicycle Accommodations	Consider continued educational enforcement of pedestrians who jaywalk or cross diagonally at the intersection of Route 16/Galen Street to encourage pedestrians to cross when and where it is safe to do so.	Medium	Short-term	Low	Town of Watertown
Pedestrian and Bicycle Accommodations	Replace the malfunctioning "Don't Walk" signal at the pedestrian crossing across California Street.	Low	Short-term	Low	Town of Watertown
Pedestrian and Bicycle Accommodations	Consider placing "Use Ped Signal" (R9-5) signs to inform bicyclists to use the pedestrian signal when crossing Galen Street along the Charles River Greenway.	Low	Short-term	Low	Town of Watertown
Pedestrian and Bicycle Accommodations	Consider replacing existing pedestrian buttons and audible "Walk" tone with Accessible Pedestrian Signal (APS) push buttons with vibrotactile arrows and speech messages, each properly aligned with the crosswalk it serves, for improved utility and safety for pedestrians with disabilities.	Medium	Mid-term	Medium	Town of Watertown
Pedestrian and Bicycle Accommodations	Clear sidewalks of snow during the winter so that pedestrians have a safe place to walk.	Low	Short-term	Low	Town of Watertown

Table 3: Potential Safety Enhancement Summary (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Signage and Pavement Markings	Provide diagrammatic lane use signage and pavement markings in advance of the intersection of Route 16/Galen Street along the Route 16 eastbound approach and the Galen Street southbound approach to the intersection so that motorists can position themselves in the proper lane in advance of the intersection. Consider placing additional guide signage on the Galen Street southbound approach to that motorists turning onto Galen Street from Watertown Square know which lane to turn into.	Medium	Short-term	Low	Town of Watertown
Signage and Pavement Markings	Replace text guide signs with clear signage using route number shields where applicable. Guide signs should be placed in advance of the intersection so that motorists can shift into the appropriate lane.	Low	Short-term	Low	Town of Watertown/ DCR/MassDOT
Signage and Pavement Markings	In the short term, relocate the “Left Turn Yield on Green” (R10-12) sign on the Watertown Street eastbound approach to Galen Street to a more visible location on the span wire or on the far side of the intersection.	Low	Short-term	Low	Town of Watertown
Signage and Pavement Markings	As part of long-term design considerations, consider reducing the radius of the northwest corner of the intersection to force passenger vehicles to make turns more slowly. Consider the need for MBTA buses to safely turn right onto Watertown Street from Galen Street southbound.	Medium	Long-term	Medium	Town of Watertown
Signage and Pavement Markings	Provide advance warning signage on Galen Street for the left-turn restrictions at the intersection to reduce confusion and improve compliance with the restrictions. Supplement with wayfinding signage for alternate routes to Route 16 and points east along the Charles River.	Low	Short-term	Low	Town of Watertown
Signage and Pavement Markings	Consider placing a speed feedback sign on the Nonantum Road westbound approach to the intersection. Consider placing curve warning signage (W1-2) and reduce speed advisory signage along the approach.	Low	Short-term	Low	Town of Watertown/DCR



Table 3: Potential Safety Enhancement Summary (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Signage and Pavement Markings	Consider installing lane use signage overhead on span wires or future mast arms to reinforce lane use for motorists at the intersection. Consider also placing overhead lane use signage for both directions of Galen Street over the bridge north of the intersection.	Low	Short-term	Low	Town of Watertown
Signage and Pavement Markings	Consider using blankout signs for left-turn restrictions at the intersection so that motorists are aware of the restriction when it is active.	Medium	Short-term	Low	Town of Watertown
Signage and Pavement Markings	Restripe faded lane line markings in the study area, including along the Route 16 eastbound approach to Galen Street.	Low	Short-term	Low	Town of Watertown
Bus Operations	Consider placing pedestrian-scale wayfinding signs at the Watertown Yard and Watertown Square bus terminals, as well as along the desired pedestrian route between the two stations, so that pedestrians can find the best route between the two stations more easily.	Low	Short-term	Low	Town of Watertown/ MBTA
Bus Operations	Replace aging One Way and Do Not Enter signs at the Watertown Yard exit driveway so that motorists are less likely to mistakenly enter the driveway.	Low	Short-term	Low	MBTA
Bus Operations	Consider making geometrical changes to the Watertown Yard exit driveway to reduce the overall driveway width and make the driveway look less like a roadway.	Low	Long-term	Medium	MBTA
Bus Operations	As part of long-term planning efforts, consider relocating the entrance to Watertown Yard to Water Street to reduce the number of curb cuts along the east side of Galen Street.	Medium	Long-term	High	MBTA/Town of Watertown
Bus Operations	Work with the MBTA to ensure that buses do not turn left from Galen Street southbound into Watertown Yard, or turn right onto Galen Street northbound out of Watertown Yard, to avoid traffic congestion and conflicts with pedestrians that may result.	Low	Short-term	Low	MBTA

## Appendix A. RSA Meeting Agenda

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# Agenda

## Road Safety Audit

Watertown, MA

Route 16 at Galen Street, Watertown

Meeting Location: Watertown Town Hall Admin Bldg, 3<sup>rd</sup> Floor  
149 Main Street, Watertown, MA

Friday, November 4, 2016

10:00 PM – 12:00 PM

**Type of meeting:** High Crash Location – Road Safety Audit  
**Attendees:** Invited Participants to Comprise a Multidisciplinary Team  
**Please bring:** Thoughts and Enthusiasm!!

**10:00 AM** Welcome and Introductions

**10:15 PM** Discussion of Safety Issues

- Crash history, Speed Regulations – provided in advance
- Existing Geometries and Conditions

**11:00 AM** Site Visit

- Walk to the intersection of Route 16/Galen Street
- As a group, identify areas for improvement

**12:00 PM** Discussion of Potential Improvements

- Discuss observations and finalize safety issue areas
- Discuss potential improvements and finalize recommendations

**1:00 PM** Adjourn for the Day – but the RSA has not ended

### Instructions for Participants:

- Before attending the RSA on November 4, participants are encouraged to drive/walk through the intersection and complete/consider elements on the RSA Prompt List with a focus on safety.
- All participants will be actively involved in the process throughout. Participants are encouraged to come with thoughts and ideas, but are reminded that the synergy that develops and respect for others' opinions are key elements to the success of the overall RSA process.
- After the RSA meeting, participants will be asked to comment and respond to the document materials to assure it is reflective of the RSA completed by the multidisciplinary team.

## Appendix B. RSA Audit Team Contact List

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## Participating Audit Team Members

Date: Friday, November 4, 2016

Location: Watertown Town Hall, Watertown, MA

<b>Audit Team Members</b>	<b>Agency/Affiliation</b>	<b>Email Address</b>	<b>Phone Number</b>
Ryan Nicholson	Watertown Fire Department	rnicholson@fire.watertown-ma.gov	617-972-6510
Charles Samios	Watertown Police Department		617-972-6594
David Sampson	Watertown Police Department	dsampson@police.watertown-ma.gov	
Gideon Schriber	Watertown Planning Department	gschriber@watertown-ma.gov	617-972-6417 x12164
Matt Shurman	Watertown DPW	mshuman@watertown-ma.gov	617-972-6420
Casey Claude	CTPS	cclaude@ctps.org	857-702-3707
David Loutzenheiser	MAPC	dloutzenheiser@mapc.org	617-933-9743
Calvin Thomas	MBTA – Cabot	calvinthomas@mbta.com	617-222-6138
Tammie Burton	MBTA – Bennett	tburton@mbta.com	
Amitai Lipton	MassDOT District 6	Amitai.lipton@state.ma.us	857-368-6313
Eric Hogan	MassDOT District 6	eric.hogan@state.ma.us	
Saleema Mohamed	MassDOT District 6	saleema.mohamed@dot.state.ma.us	
Courtney Dwyer	MassDOT District 6	Courtney.dwyer@dot.state.ma.us	857-368-6165
Michael Clark	MassDOT Planning	Michael.clark@state.ma.us	857-368-8867
Elsa Chan	MassDOT Traffic Safety	elsa.chan@state.ma.us	857-368-9648
Kevin T. Fitzgerald	MassDOT Traffic Safety	Kevin.T.Fitzgerald@dot.state.ma.us	857-368-9619
Christopher Falcos	MassDOT Traffic Safety	Christopher.falcos@dot.state.ma.us	
Connor Keating	MassDOT Traffic Safety	connor.keating@dot.state.ma.us	
Michael Pompili	WorldTech Engineering	mpompili@worldtecheng.com	781-933-4800
Rich Benevento	WorldTech Engineering	rbenevento@worldtecheng.com	781-933-4800
Jessica Lizza	Howard Stein Hudson	jlizza@hshassoc.com	617-348-3330
Mike Tremblay	Howard Stein Hudson	mtremblay@hshassoc.com	617-348-3347

## Appendix C. Detailed Crash Data

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SYMBOLS		TYPE OF CRASH	SEVERITY		
→	Moving Vehicle	↔	Head on	#	Injury
←	Backing Vehicle	→	Rear End	#	Fatal
- - -	Non-Involved Vehicle	↘	Angle	#	Property Damage Only
→	Involved Pedestrian	↪	Turning Movement	■	Night Time Crash
→	Non-Involved Bicycle	↔	Sideswipe		
→	Non-Involved Animal	↔	Out of Control		
→	Direction of Motion	○ ○	Out of Control		
→	Parked Vehicle	■	Night Time Crash		
□	Fixed Object				

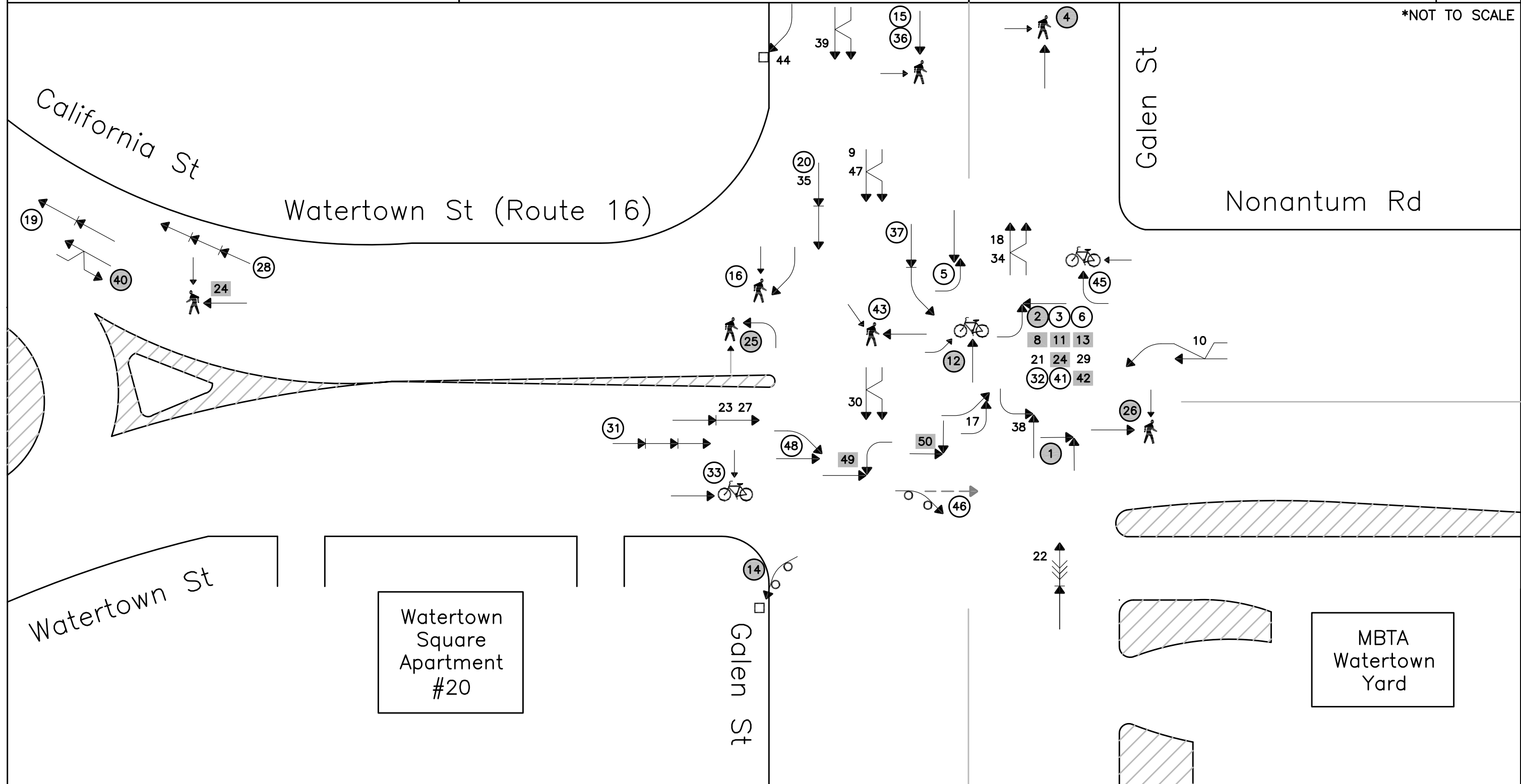
Watertown, MA  
Route 16 (Watertown Street)/ Galen Street  
REGION: MAPC

TIME PERIOD ANALYZED: 2012-2015  
SOURCE OF CRASH REPORTS: WATERTOWN POLICE DEPARTMENT  
DATE PREPARED: 9/1/2016  
PREPARED BY: Jinkun Yuan

SHEET 1 OF 1

COLLISION DIAGRAM

\*NOT TO SCALE



## Crash Data Summary Table

Route 16 (Watertown Street) at Galen Street, MA  
2012-2015

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision <i>Type</i>	Light Condition <i>Type</i>	Weather Condition <i>Type</i>	Road Surface <i>Type</i>	Driver Contributing Code <i>Type</i>	Driver Ages				Comments
	<i>m/d/y</i>								<i>D1</i>	<i>D2</i>	<i>D3</i>	<i>D4</i>	
1	1/6/12	Friday	10:03 PM	Angle	Dark - lighted roadway	Clear	Dry	Disregarded traffic signs, signals, road markings	28	25			MV 1 from Galen St NB ran red light
2	1/23/12	Monday	12:33 AM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	65	44			
3	2/7/12	Tuesday	2:33 PM	Head on	Daylight	Cloudy	Dry	Unknown	32	42			Unable to determine who ran red light
4	3/13/12	Tuesday	5:53 AM	Head on	roadway	Cloudy	Dry	No Improper Driving	52	90			Pedestrian was not in crosswalk
5	4/14/12	Saturday	12:32 PM	Angle	Daylight	Unknown	Dry	Made an improper turn	55	32			MV 2 from EB on Watertown st turned left into Galen St and hit MV 1 which was stopped in traffic. After crashed with MV 1, MV 2 then crashed with MV 3 which was turning right from WB of Watertown into Galen St.
6	5/27/12	Sunday	12:19 PM	Angle	Daylight	Clear	Dry	Failed to yield right of way	45	56			
7	6/5/12	Tuesday	9:37 PM	Unknown	Dark - lighted roadway	Other	Dry	No Improper Driving	44	18			Pedestrian ran across the crosswalk and was hit by MV 1 (MV 1 has green light)
8	6/17/12	Sunday	9:15 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	83	40			
9	7/9/12	Monday	2:55 PM	Sideswipe, same direction	Daylight	Clear	Dry	No Improper Driving	37	75			Operator of MV 1 states MV 2 was trying to squeeze by him
10	7/9/12	Monday	3:48 PM	Sideswipe, same direction	Daylight	Clear	Dry	No Improper Driving	29	50			MV 2 sideswiped MV 1 when making the left turn from the outside lane
11	8/8/12	Wednesday	8:36 PM	Angle	Dark - lighted roadway	Other	Dry	Failed to yield right of way	21	24			
12	9/4/12	Tuesday	7:05 PM	Angle	Dusk	Cloudy	Dry	No Improper Driving	27	26			MV 1 traveling NB on Galen St and attempted to move to the inside lane at the intersection and struck the bicyclist who was making the left turn from Watertown St
13	9/21/12	Friday	11:04 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	34	26			
14	10/28/12	Sunday	7:22 PM	Single Vehicle Crash	Dark - lighted roadway	Rain	Wet	Unknown	78				MV 1 lost control when making a left turn from Nonantum St to Galen St, and hit the sign.
15	11/7/12	Wednesday	7:49 AM	Single Vehicle Crash	Daylight	Cloudy	Dry	No Improper Driving	33	34			Pedestrian was hit by MV 1 when attempting to cross 5 travel lanes while the traffic was moving slowly.
16	12/4/12	Tuesday	1:27 PM	Single Vehicle Crash	Daylight	Rain	Wet	No Improper Driving	52	60			Pedestrian stepped into the crosswalk against the no walk signal, and was struck by a trailer
17	3/29/13	Friday	12:38 PM	Unknown	Daylight	Clear	Dry	No Improper Driving	54	48			MV 2 went around MV 1 when both vehicle were turning left. MV 2 hit and ran
18	5/6/13	Monday	6:45 PM	Sideswipe, same direction	Daylight	Clear	Dry	No Improper Driving	74	UNK			MV 1 turned left from Watertown St onto NB of Galen St, MV 2, a marked Cruiser, sideswiped MV 1 when passing through with emergency light on
19	5/13/13	Monday	11:51 AM	Rear-end	Daylight	Clear	Dry	Other improper action	49	70			
20	5/31/13	Friday	11:06 AM	Rear-end	Daylight	Clear	Dry	Inattention	35	48			
21	8/11/13	Sunday	7:35 AM	Angle	Daylight	Other	Dry	Inattention	23	53			
22	8/21/13	Wednesday	6:31 PM	Rear-end	Daylight	Unknown	Dry	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	24	39			MV 1 struck MV 2 when backing out of the intersection to avoid blocking the intersection
23	8/26/13	Monday	3:29 PM	Rear-end	Daylight	Clear	Dry	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	26	18			
24	9/8/13	Sunday	9:54 PM	Angle	Dark - lighted roadway	Unknown	Dry	Failed to yield right of way	17	34			Left turning MV1 did not yield on right on way
25	9/30/13	Monday	6:09 AM	Head on	Dawn	Fog, Smog, Smoke	Dry	No Improper Driving	35	69			MV 1 struck the pedestrian when the pedestrian walked out from behind of a truck
26	12/9/13	Monday	4:37 PM	Single Vehicle Crash	Dark - lighted roadway	Rain	Wet	No Improper Driving	62	62			
27	1/30/14	Thursday	4:48 PM	Rear-end	Daylight	Clear	Dry	No Improper Driving	44	46			
28	2/11/14	Tuesday	8:15 AM	Rear-end	Daylight	Clear	Dry	Followed too closely	30	29	29		MV 1 rear-ended MV 2 and pushed into MV 3
29	5/17/14	Saturday	4:19 PM	Angle	Daylight	Clear	Dry	Unknown	41	UNK			MV 2 hit and ran
30	7/16/14	Wednesday	2:54 PM	Rear-end	Daylight	Rain	Wet	No Improper Driving	59	56			Sideswipe and rear-end crash
31	8/29/14	Friday	3:12 PM	Rear-end	Daylight	Clear	Dry	Followed too closely	44	55	74		MV 3 rear ended MV 2 and pushed into MV 1
32	9/2/14	Tuesday	11:33 AM	Angle	Daylight	Clear	Dry	Failed to yield right of way	83	26			
33	10/6/14	Monday	5:19 PM	Angle	Daylight	Clear	Dry	No Improper Driving	23	27			Bicyclist ran red light
34	11/3/14	Monday	9:08 AM	Sideswipe, same direction	Daylight	Clear	Dry	Unknown	52	32			
35	12/12/14	Friday	8:21 AM	Rear-end	Daylight	Cloudy	Dry	No Improper Driving	21	68			MV 1 rear-ended MV 2 when MV 2 stopped for a emergency vehicle at the intersection
36	1/8/15	Thursday	3:43 PM	Single Vehicle Crash	Daylight	Cloudy	Dry	No Improper Driving	46	27			Pedestrian was not on crosswalk
37	1/24/15	Saturday	12:36 PM	Rear-end	Daylight	Sleet, Hail, Freezing Rain	Wet	No Improper Driving	56	66			



## Crash Data Summary Table

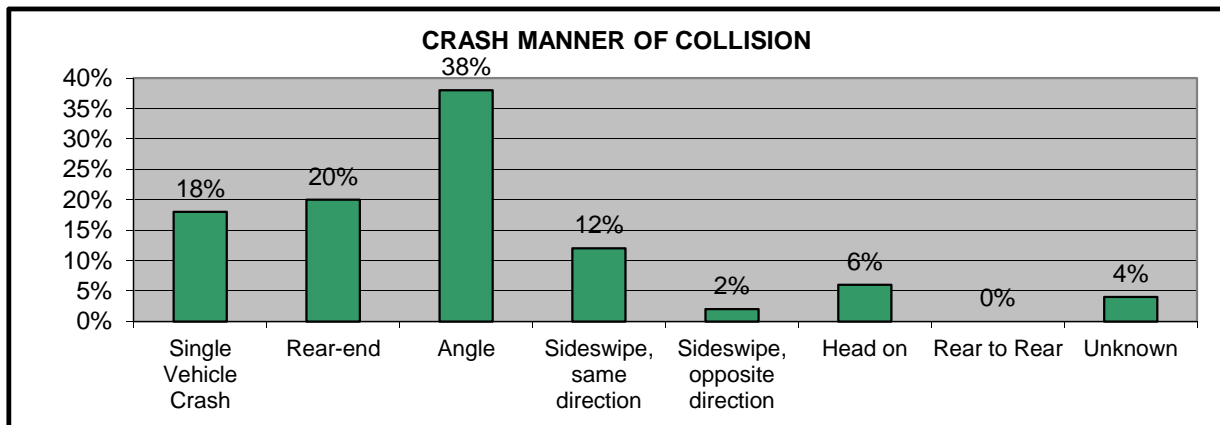
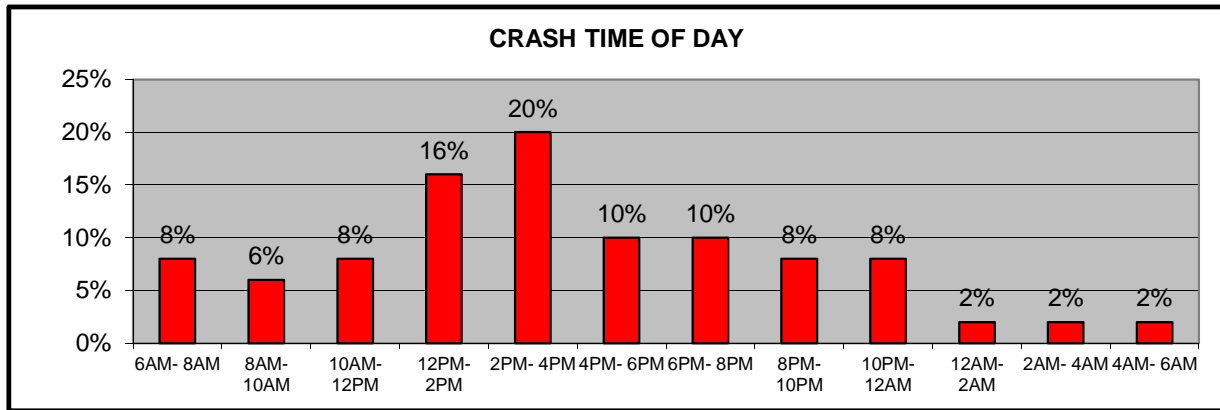
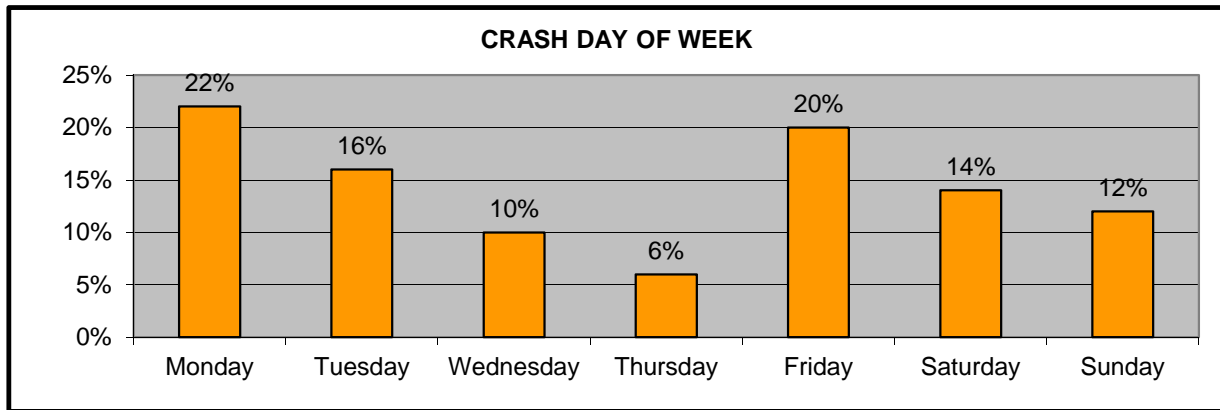
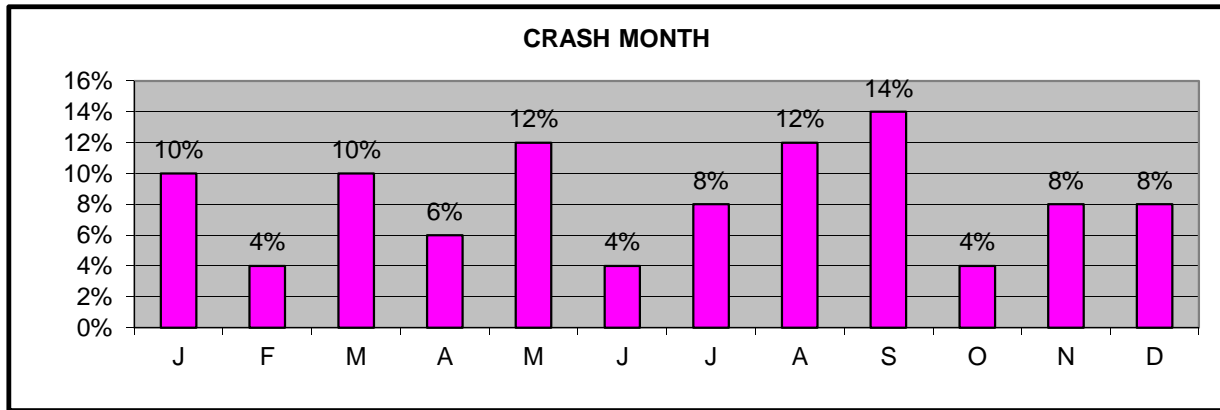
Route 16 (Watertown Street) at Galen Street, MA  
2012-2015

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Driver Ages				Comments
	m/d/y			Type	Type	Type	Type	Type	D1	D2	D3	D4	
38	3/7/15	Saturday	1:44 PM	Angle	Daylight	Clear	Dry	Failed to yield right of way	59	38			V1 was traveling NB in heavy traffic, and struck by SB left turn V2
39	3/13/15	Friday	1:20 PM	Sideswipe, same direction	Daylight	Clear	Dry	Failure to keep in proper lane or running off road	63	58			
40	3/14/15	Saturday	10:30 PM	Sideswipe, opposite direction	Dark - lighted roadway	Cloudy	Wet	Failure to keep in proper lane or running off road	45	50			
41	4/3/15	Friday	12:54 PM	Angle	Daylight	Cloudy	Dry	Inattention	32	46			Courtesy crash
42	4/18/15	Saturday	10:18 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	17	23			Left turning vehicle failed to yield right of way
43	5/1/15	Friday	4:40 PM	Single Vehicle Crash	Daylight	Clear	Dry	No Improper Driving	23	23			No Narrative
44	7/16/15	Thursday	6:21 AM	Single Vehicle Crash	Daylight	Clear	Dry	Unknown	UNK				Unknown vehicle struck the bridge
45	8/31/15	Monday	10:42 AM	Single Vehicle Crash	Daylight	Clear	Dry	Inattention	75	51			
46	9/9/15	Wednesday	6:06 PM	Single Vehicle Crash	Daylight	Clear	Dry	Followed too closely	34				MV 1 was traveling from Watertown St onto Nonantum Rd and was ejected before making contact with the front vehicle
47	9/25/15	Friday	3:43 PM	Sideswipe, same direction	Daylight	Clear	Dry	Visibility Obstructed	52	58			MV 1 was attempting to change lane from the left to right and sideswiped MV 2 which was on the right lane
48	11/22/15	Sunday	3:42 PM	Angle	Daylight	Cloudy	Wet	Made an improper turn	24	50			
49	11/28/15	Saturday	2:21 AM	Angle	Dark - lighted roadway	Clear	Dry	Unknown	45	29			
50	12/8/15	Tuesday	3:52 PM	Angle	Dusk	Clear	Dry	Visibility Obstructed	23	26			MV1 was traveling SB on Galen st, and when an emergency vehicle approached, MV 1 moved to the right(opposite direction of travel) into the intersection, which caused MV2 from Watertown St struck MV1

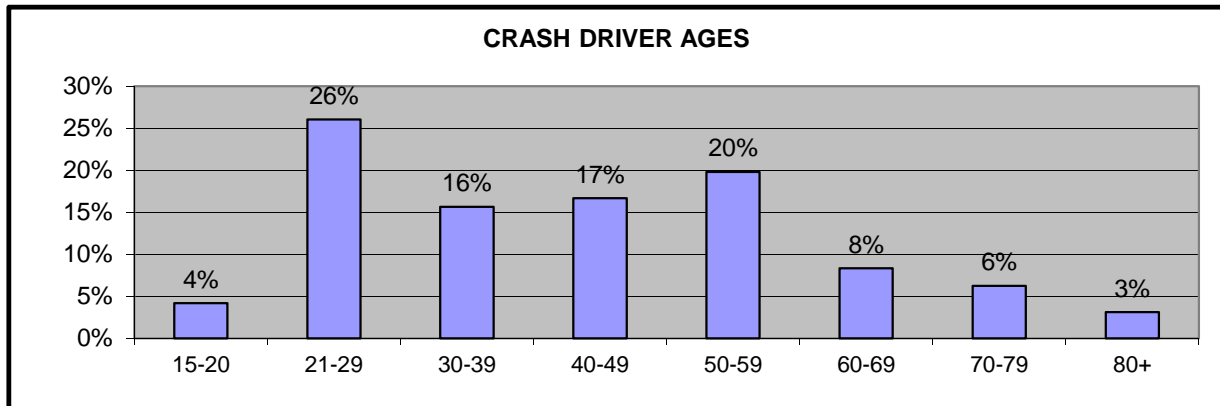
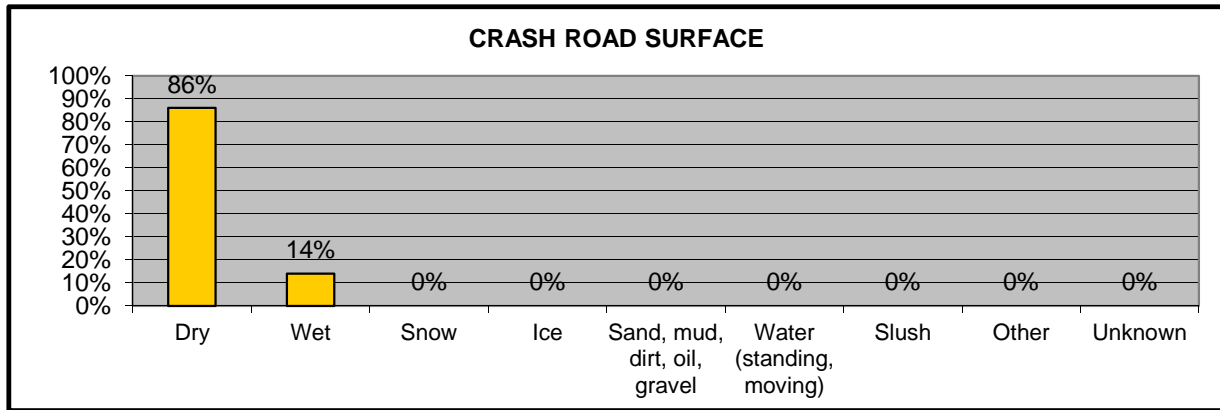
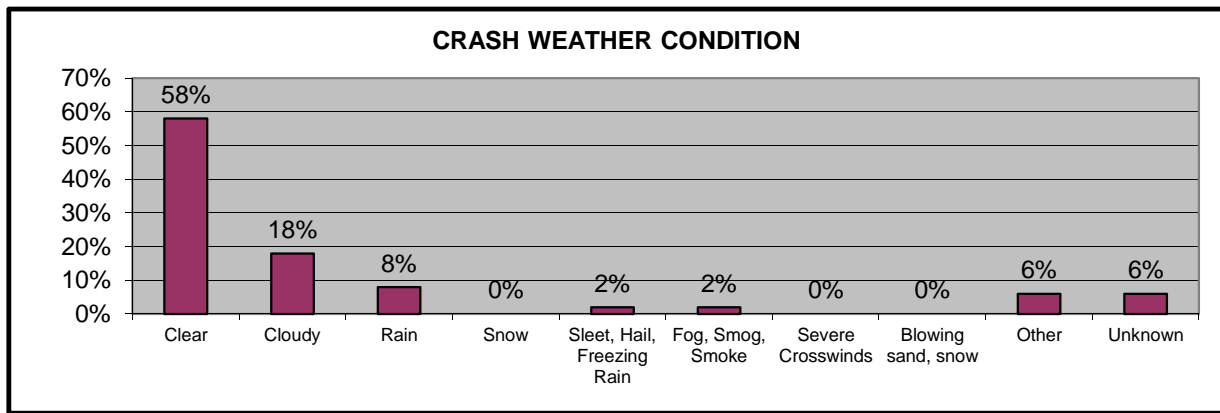
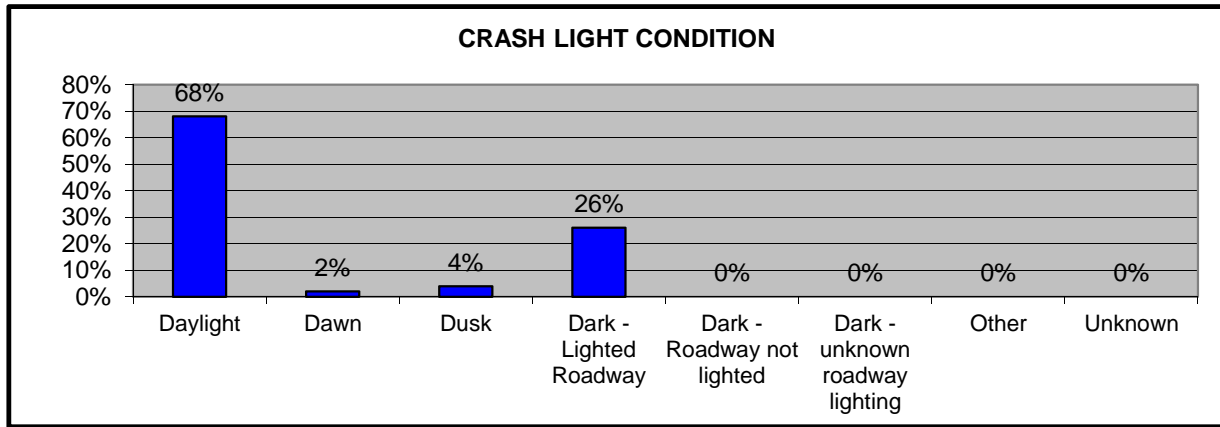
\*Courtesy Crash - A term used to describe a crash that occurs subsequent to a non-involved mainline driver who gives the right of way, contrary to the rules of the road, to another driver.

Summary based on Crash Reports obtained from the Watertown Police Department.

**Crash Data Summary Tables and Charts**  
Route 16 (Watertown Street) at Galen Street, MA



**Crash Data Summary Tables and Charts**  
Route 16 (Watertown Street) at Galen Street, MA



## Road Safety Audit References

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[www.mhd.state.ma.us/safetytoolbox](http://www.mhd.state.ma.us/safetytoolbox).

*Road Safety Audits, A Synthesis of Highway Practice*. NCHRP Synthesis 336. Transportation Research Board, National Cooperative Highway Research Program, 2004.

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*Road Safety Audits*. ITE Technical Council Committee 4S-7. Institute of Transportation Engineers, February 1995.