

ROAD SAFETY AUDIT

Cambridge Street at Windsor Street
Cambridge Street at Willow Street
Cambridge Street at Hunting Street
Cambridge Street at Harding Street

City of Cambridge

September 2020

Prepared For:
MassDOT



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Background

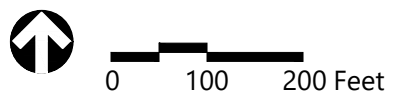
The Federal Highway Administration (FHWA) defines a Road Safety Audit (RSA) as the formal safety examination of an existing or future road or intersection by an independent, multidisciplinary team. The purpose of an RSA is to identify potential safety issues and possible countermeasures to improve safety considering all roadway users. As part of MassDOT's guidelines, RSAs are required for Highway Safety Improvement Program (HSIP) eligible locations and should be conducted prior to the development of the 25% design submission or prior to the submission of a Draft Environmental Impact Report (DEIR) for a project of regional impact. This RSA was conducted prior to the submission of the DEIR for the redevelopment project at Boynton Yards, EEA No. 16195. This RSA evaluates the intersections of Cambridge Street at Windsor Street, Willow Street, Hunting Street, and Harding Street in Cambridge, Massachusetts, as shown in Figure 1. These intersections have been identified by MassDOT as part of a 2008-2017 HSIP Bicycle Cluster. In addition, the intersections of Cambridge Street at Windsor Street and Cambridge Street at Harding Street have been identified as part of separate 2008-2017 HSIP Pedestrian Clusters. A HSIP-eligible location is defined as a crash cluster based on crash incidence and severity that ranks within top 5% of each Regional Planning Agency. The City of Cambridge is located in the regions of the Metropolitan Area Planning Council (MAPC) and the Boston Region Metropolitan Planning Organization (MPO).

Project Data

A Road Safety Audit was conducted for the high crash cluster of Cambridge Street from Windsor Street to Harding Street on September 17, 2020. The RSA was held over teleconference due to the COVID-19 pandemic. A copy of the agenda for the meeting is provided in Appendix A. The road safety audit team, as shown in Table 1, was comprised of representatives from state, regional, and local agencies, and included a cross-section of the engineering, planning, advocacy groups, emergency responders, and law enforcement fields. A complete list of the contact information of all attendees can be found in Appendix B.

Intersections

1. Cambridge Street at Windsor Street
2. Cambridge Street at Willow Street
3. Cambridge Street at Hunting Street
4. Cambridge Street at Harding Street



Locus Map
Road Safety Audit

Cambridge, Massachusetts

Figure 1

Table 1: Participating Audit Team Members

Audit Team Member	Agency/Affiliation
Tess Benson	VHB, Inc.
Matt Duranleau	VHB, Inc.
Ashley Domogala	VHB, Inc.
Kathleen Keen	VHB, Inc.
Kevin Fitzgerald	MassDOT Traffic Safety
Ana Fill	MassDOT Traffic Safety
Ranjit Singanayagam	MassDOT Traffic Safety
Shania Ruiz	MassDOT Traffic Safety Intern
Jesus Bastardo	MassDOT District 6 Traffic
Brian Levine	MassDOT District 6 Projects
Bryan Sutherland	MassDOT District 6 Projects
Maddie DeClerk	MassDOT Highway
Andrew Wilkins	MassDOT Highway
Curley Champion	MBTA
Casey Claude	CTPS
Patrick Baxter	City of Cambridge – Traffic Department
Bill Deignan	City of Cambridge – Transportation Planning
Cara Seiderman	City of Cambridge – Transportation Planning
Andy Reker	City of Cambridge – Transportation Planning
Jerry Friedman	City of Cambridge – Department of Public Works
Rick Riley	City of Cambridge – Police Department
Paul Sheehan	City of Cambridge – Fire Department

Prior to the meeting, VHB distributed a copy of the agenda, crash diagrams, crash summary tables, and video footage (with 360 degrees capability) of the intersections to all RSA attendees. Crash diagrams and summary tables for 2010-2019 pedestrian and bicycle crash data as well as 2016-2018 vehicle-only crash data were compiled from local police crash reports obtained from Massachusetts Department of Transportation (MassDOT) and Cambridge Police Department (CPD) using the most recent crash data available. All attendees were encouraged to visit the study area intersections and/or view the provided video footage prior to the meeting.

The teleconference meeting started with a brief description of the agenda of the RSA meeting, followed by introductions and a description of the RSA process. During the pre-audit meeting, using the crash materials provided in advance, VHB facilitated the discussion of existing safety issues with all RSA attendees. RSA attendees were encouraged to bring their local knowledge and expertise to the discussion on existing safety and operational issues for the study area intersection.

Following the pre-audit meeting, the audit team watched video footage of the intersection to identify additional safety concerns. The team then discussed potential solutions, ranging from short-term to long-term, and low cost to high cost countermeasures for each identified safety concern.

Project Location and Description

Cambridge Street

Cambridge Street runs in a generally east/west direction and consists of one travel lane in both directions in the study area. It is classified as a minor arterial roadway and is under local City of Cambridge jurisdiction. In the school zone between Evereteze Way and Berkshire Street, the speed limit is 20-mph in both directions when the sign is flashing. The minimum default (statutory) speed limit in Cambridge is 25 mph unless otherwise posted. On-street parking is provided along both sides of the roadway. Sidewalks are provided along both sides of the roadway. Within the study area, crosswalks are provided across Cambridge Street at the Windsor Street, Willow Street, and Hunting Street intersections. While some existing curb ramps are not ADA-compliant at the Windsor Street and Willow Street intersections, the sidewalk in front of King Open School as well as the crossings at the Hunting Street and Harding Street intersections were recently reconstructed. On-road bike lanes are provided along both sides of the roadway. The eastbound bike lane is raised in front of King Open School. MBTA Bus Route 69 travels down Cambridge Street and bus stops in each direction are located east of Windsor Street in the study area. Land use along Cambridge Street is a mixture of commercial, residential, and institutional uses with the King Open School located south of Cambridge Street between Willow Street and Berkshire Street.

Cambridge Street at Windsor Street

Cambridge Street and Windsor Street intersect to form a four-legged unsignalized intersection. Cambridge Street runs east/west and Windsor Street runs north/south. The Windsor Street south leg is one-way departing the intersection. All approaches consist of one general purpose lane. The Windsor Street southbound approach is under stop-sign control. Sidewalks are provided along both sides of all approaches. Crosswalks are provided across all approaches. The curb ramps are not ADA-compliant. On-road bike lanes are provided along Cambridge Street in both directions. On-street parking is provided along both sides of Cambridge Street, both sides of the Windsor Street south of the intersection, and the west side of the Windsor Street north of the intersection. Bus stops for MBTA Bus Route 69 are located on the north and south sides of the Cambridge Street eastern leg. The bus stop on the westbound side of Cambridge Street is on the near-side of the intersection and has a bus shelter with an in-line bus stop, while the stop on the eastbound side of the roadway is on the far-side of the intersection and does not have a shelter but provides a curbside pull-out stop in the parking lane. Land use within the vicinity of the intersection is a mixture of commercial and residential uses.

Cambridge Street at Willow Street

Cambridge Street and Willow Street intersect to form a four-legged signalized intersection. Cambridge Street runs east/west and Willow Street runs north/south. All approaches consist of one general purpose lane. The Willow Street north and south legs are both one way departing the intersection. The pedestrian traffic signal serves to assist pedestrians crossing Cambridge Street. Sidewalks are provided along both sides of all approaches. Crosswalks are provided across all approaches. The curb ramps in the southeast corner of the intersection are ADA-compliant as part of the sidewalk reconstruction in front of King Open School, while the other ramps are not ADA-compliant. On-road bike lanes are provided on Cambridge Street in both directions. On-street parking is provided along both sides of Cambridge Street, both sides of Willow Street south of the intersection, and the east side of Willow Street north of the intersection. On the eastbound side of Cambridge Street east of the intersection, parking is available beyond the raised bicycle lane during non-school hours in front of the school and library with the curbside limited to school

pick-up and drop-off operations during school hours. Land use within the vicinity of the intersection is a mixture of commercial, residential, and institutional uses with the King Open School located on the southeast corner of the intersection.

Cambridge Street at Hunting Street

Cambridge Street and Hunting Street intersect to form a three-legged unsignalized intersection. Cambridge Street runs east/west and Hunting Street intersects from the north. This intersection was reconstructed as a raised intersection and the existing traffic signal was removed in 2019 as part of the King Open School reconstruction. All approaches consist of one general purpose lane. Hunting Street is one way southbound approaching the intersection. Sidewalks are provided along both sides of all approaches. Crosswalks are provided across the north and east legs of the intersection. Bike lanes are provided on Cambridge Street in both directions with the westbound bike lane on-road and the eastbound bike lane slightly raised from the roadway with a 4-inch mountable curb. On-street parking is provided on the westbound side of Cambridge Street and both sides of Hunting Street. The eastbound side of Cambridge Street provides restricted on-street parking beyond the raised bicycle lane in front of the school and library with the curbside limited to school bus pick-up and drop-off operations during school hours. Land use around the intersection is a mixture of commercial, residential, and institutional uses with the King Open School located south of Cambridge Street.

Cambridge Street at Harding Street

Cambridge Street and Harding Street intersect to form a three-legged unsignalized intersection. Cambridge Street runs east/west and Harding Street intersects from the north. All approaches consist of one general purpose lane. Harding Street is one way departing the intersection. Sidewalks are provided along both sides of all approaches. A crosswalk is provided across Harding Street and was reconstructed in 2019 to be a raised crosswalk. Bike lanes are provided along Cambridge Street in both directions with the westbound bike lane on-road and the eastbound bike lane slightly raised from the roadway with a 4-inch mountable curb. On-street parking is provided along the westbound side of Cambridge Street and both sides of Harding Street. The eastbound side of Cambridge Street provides restricted on-street parking beyond the raised bicycle lane in front of the school and library with the curbside limited to school bus pick-up and drop-off operations during school hours. Land use within the vicinity of the intersection is a mixture of commercial, residential, and institutional uses with the King Open School located south of Cambridge Street.

Crash Data

Crash data provided by the City of Cambridge Police Department and MassDOT shows that a total of 35 crashes involving bicycles or pedestrians were reported in the study area corridor in the ten-year period of 2010-2019. For the three-year period of 2016-2018, 17 vehicle-only crashes and 8 non-motorist (pedestrian or bicycle) crashes involving vehicles occurred. Crash data summaries and collision diagrams are provided in the Appendix.

The greatest number of pedestrian and bicycle crashes (18 crashes) occurred at the intersection of Cambridge Street at Windsor Street, 11 involving bicycles and 7 involving pedestrians. Seven of the 11 bicycle crashes involved eastbound-traveling cyclists. Three eastbound cyclists were struck by eastbound vehicles turning right onto Windsor Street, and four eastbound cyclists were struck by southbound vehicles traveling through the intersection on Windsor Street. Adjacent to the Windsor Street intersection, four crashes occurred turning into the gas station located in the northwest corner of the intersection, where a left-turning vehicle struck a westbound-traveling cyclist or moped. Along the corridor, there were four cyclist crashes by dooring, two by parked vehicles and two by vehicles stopped in traffic.

For 2010-2019 pedestrian and bicycle crashes, 60% occurred during daylight, while 37% occurred during dusk or dark conditions (and 3% unknown). Analysis of weather conditions found that 80% of crashes occurred during clear or cloudy conditions, while another 14% were during rainy conditions (and 6% unknown). 69% of crashes occurred when the roadway surface was dry, 20% when it was wet or snowy, and 11% in unknown conditions. Additionally, August was the month with the highest percentage of crashes (17%). The time period with the most crashes was from 4:00 pm to 8:00 pm (40%). 68% of all crashes resulted in an injury. It should be noted that none of the crashes resulted in a fatal injury.

For 2016-2018 crashes, the most prevalent crash type (when including pedestrian and bicycle crashes) was single-vehicle crashes, accounting for 36% of the total crashes along the corridor. When pedestrian and bicycle crashes are not considered, the most prevalent crash types are angle crashes followed by rear-end crashes. 12 of the 25 crashes including pedestrian and bicycle crashes in this time period occurred at the intersection of Cambridge Street at Windsor Street. The most frequent crash incident not involving pedestrians or cyclists involved eastbound vehicles and southbound vehicles colliding at the intersection of Cambridge Street at Windsor Street (5 instances). 52% of crashes occurred during daylight, while 48% of crashes occurred during dusk or dark conditions. Analysis of weather conditions found that 92% of crashes occurred during clear or cloudy conditions, and another 8% were during rain or snow conditions. 76% of crashes occurred when the roadway surface was dry, 20% when it was wet, snowy, or icy, and 4% in unknown conditions. Additionally, the highest percentage of crashes (16%) occurred during the months of May and December. The time period with the most crashes was from 4 pm to 8 pm (40%). 36% of all crashes involved an injury.

Audit Observations and Potential Safety Enhancements

During the RSA meeting, a brief introduction of the RSA process was presented to the audit team members. Following this brief presentation, the members of the audit team were asked to discuss the existing issues that may affect safety at the intersection using the provided crash data and summaries. The audit team then watched footage of the study area intersections (in lieu of a site walk due to the COVID 19 crisis), at which time observations of various safety concerns and deficiencies were identified and documented. Provided below is a list of the safety concerns that were identified during the RSA for the intersection along with potential enhancements identified during the RSA.

Study Area-Wide

Safety Issue #1: School Pick-Up/Drop-Off Patterns

The King Open School at 850 Cambridge Street creates a lot of activity during morning drop-off and afternoon pick-up times with school buses, pedestrians, bicyclists, and vehicles. Audit team members noted that drivers often stop in the middle of the roadway, crosswalk, or non-designated area to drop-off or pick-up students. Two bicycle crashes were reported involving vehicles stopped in traffic on Cambridge Street opening their passenger doors near possible pick-up or drop-off times. It was also noted that the crossing guards could not effectively enforce driver behavior and that police enforcement was more effective. However, it is unsustainable to have a police detail during daily drop-off and pick-up. It should be noted that the school was closed for construction starting in 2017 and re-opened for the 2019-2020 school year. Audit team members mentioned that changes to pick-up/drop-off patterns from Cambridge Street to the side streets as well as provision of a raised turn-out for school buses has improved conditions but not completely eliminated the driver behavior. Crash data within the vicinity of the school is from before the opening of the school and, therefore, may not be reflective of current crash conditions.

Proposed Enhancements:

- Increase driver education on new school operations to encourage drop-off/pick-up in designated areas. An audit team member noted that this has been pursued in the past, without much success.
- Encourage mode shifts from vehicle to pedestrian and bicycle trips.
- Increase enforcement during school drop-off/pick-up times.
- Consider bicycle lane designs that prevent parking in bike lanes.

Safety Issue #2: Traffic Circulation

Audit team members noted that the side streets intersecting with Cambridge Street, including, but not limited to Windsor Street, Willow Street, Hunting Street, and Harding Street, are frequently used as cut-through roadways by vehicles that are not coming from or headed towards the surrounding neighborhood. The nearby Boynton Yards development is also likely to add vehicle trips to these streets.

Additional traffic volumes on side streets and Cambridge Street may have the potential to increase the frequencies of angle and sideswipe crashes along the Cambridge Street corridor as vehicles turn onto the side streets.

Proposed Enhancements:

- Evaluate traffic calming measures on side streets to discourage cut-through traffic to/from Cambridge Street and implement if determined feasible.
- Evaluate the directionality of side streets into and out of the neighborhood.
- Evaluate time of day restrictions. Although the City of Cambridge no longer creates new time of day restrictions, this could be evaluated if policies change.

Safety Issue #3: Bicycle Accommodations

From 2010 to 2019, 25 crashes involving bicycles were reported throughout the study area, including four doorings and three sideswipe crashes. Within the past year, Cambridge Street from Willow Street to Berkshire Street (approximately 200 feet east of Harding Street) was rebuilt as part of the King Open School re-construction to include raised eastbound bicycle lanes separated from the travel lane by a 4-inch mountable curb. However, audit team members noted that the westbound bicycle lane remains as it was pre-construction, an exclusive bike lane at grade without separation from the roadway. Audit team members also noted that the 2015 Cambridge Bicycle Plan proposes separated bicycle facilities on Cambridge Street from Quincy Street to Monsignor O'Brien Highway.

In addition, audit team members noted faded or missing bicycle pavement markings, in particular conflict markings, throughout the corridor.

Proposed Enhancements:

- Consider providing separated bike lanes including buffered bike lanes or cycle tracks along both sides of the Cambridge Street corridor, keeping consistent with recommendations in the 2015 Cambridge Bike Plan and the City's Cycling Safety Ordinance.
- Evaluate the feasibility of raising the westbound bike lane on Cambridge Street, with the potential to reduce doorings and sideswipe crashes involving bicyclists.
- Refresh bicycle pavement markings where faded or missing.

Safety Issue #4: Pedestrian Accommodations

From 2010 to 2019, 9 crashes involving pedestrians were reported throughout the study area. Audit team members observed pedestrian accommodations, including detectable warning panels and curb ramps, throughout the study area were not ADA-compliant. In addition, crosswalk markings were faded in some locations. Insufficient pedestrian accommodations contribute to inequitable accessibility and could potentially contribute to pedestrian crashes.

Proposed Enhancements:

- Install detectable warning panels on all curb ramps and upgrade existing curb ramps to meet current ADA standards.
- Restripe crosswalks with high visibility markings as appropriate.

Safety Issue #5: Lighting

For 2016-2018, 48% of all crashes (vehicular and non-motorist) occurred during dusk or dark conditions. Audit team members observed the intersection of Windsor Street had pedestrian-scale acorn lights, but no roadway-scale lights (1907 teardrop replica style). In addition, four of the six pedestrian and bicycle crashes occurring at the intersection of Harding Street occurred during dusk or dark conditions.

Proposed Enhancements:

- Evaluate light conditions along the corridor and consider installing more roadway-scale lighting (1907 teardrop replica style).
- Ensure that crosswalks are well-lit.

Cambridge Street at Windsor Street

Safety Issue #1: Intersection Operations & Roadway Geometry

From 2010 to 2019, ten bicycle or pedestrian crashes were reported involving southbound vehicles at the intersection of Cambridge Street at Windsor Street, of which four crashes involved southbound vehicles and eastbound cyclists. In addition, five vehicle-only crashes were reported involving southbound and eastbound-traveling vehicles from 2016-2018. Audit team members noted that these crashes involving southbound vehicles may be partly due to drivers looking for gaps in vehicle traffic, becoming impatient, and attempting to take gaps in traffic when there are no adequate gaps available. Eastbound vehicles may also stop for southbound vehicles to cross the intersection and block the view of eastbound bicyclists who do not stop. Also, until recently, eastbound parking was available right up to the crosswalk, which could have affected drivers' ability to observe bicycles in the bike lane and pedestrians on the sidewalk until they were entering the intersection. Additionally, westbound traffic queues from the intersection of Cambridge Street at Columbia Street (located approximately 250 feet west of this intersection) were observed to be blocking the view of eastbound traffic for drivers exiting Windsor Street.

Audit team members noted that the MBTA bus stop on the northeast corner of the intersection may cause a sight distance issue for southbound-traveling vehicles. This may have contributed to the crash that occurred involving a southbound vehicle and a westbound-traveling bicyclist.

Solar glare may also be contributing to southbound vehicle crashes, especially in the afternoon.

Adjacent to the intersection, four crashes were reported between 2010 and 2019 at the gas station located on the northwest corner of the intersection, involving a left-turning eastbound vehicle striking a westbound cyclist or moped. Audit team members noted that the gas station has three access points: two driveways on Cambridge Street within 150 feet west of the intersection, and one driveway on Windsor Street within 75 feet north of the intersection. Multiple access points increases the number of potential conflict points within the vicinity of the intersection.



Image 1: Westbound traffic queue on Cambridge Street blocks view of eastbound traffic for drivers exiting Windsor Street.

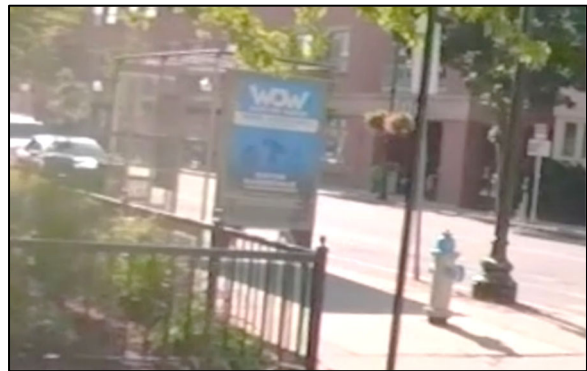


Image 2: MBTA bus stop on northeast corner of intersection may be a potential sight distance issue.

Audit team members noted that southbound vehicles often roll through the STOP sign. From 2010-2019, one crash was reported involving southbound vehicle and a pedestrian on the north leg crosswalk, and another crash involved a southbound vehicle and a westbound bicyclist, which may have resulted from the southbound vehicles failing to stop properly.

Additionally, two sideswipe same direction crashes were reported on the southbound approach. Audit team members observed that the receiving leg is very wide (approximately 32 feet wide when no vehicle is occupying the loading zone parking space on the east side of Windsor Street), which could cause driver confusion on the number of receiving lanes and encourage higher speeds departing the intersection. Also, the southbound approach widens significantly for southbound vehicles just before the intersection. Prior to the southbound parking lane ending, Windsor Street provides a width of approximately 18 feet for both directions of travel. However, after the parking lane ends, the southbound lane becomes approximately 15 feet wide, which could confuse drivers on the number of departing lanes. On the other hand, the receiving northbound lane is only approximately 9 feet wide at the intersection, which may have contributed to the sideswipe opposite direction crash between a southbound right-turning vehicle and an eastbound left-turning vehicle.

Proposed Enhancements:

- Consider conducting a signal warrant analysis under existing conditions and future conditions with new developments in place and, if warranted, signalizing the intersection.
- Consider adding “Do Not Block Intersection” signage and pavement markings.
- Evaluate signal timings along the Cambridge Street corridor, specifically at the intersection of Cambridge Street at Columbia Street, with the potential to reduce queueing along Cambridge Street.
- Consider removing or relocating the advertisement on the MBTA bus shelter on the northeast corner of the intersection to improve sight distance for southbound vehicles.
- Evaluate existing access/egress to/from the gas station and consider driveway consolidation to reduce the number or width of conflict points.
- Consider a modified raised side street crossing to slow southbound vehicles at the intersection. This would also address pedestrian ramp compliancy issues.
- Consider a raised intersection to slow all vehicles at intersection, with confirmation from the fire department. This would also address pedestrian ramp compliancy issues.
- Consider curb extensions to narrow the southbound lane of both Windsor Street legs and reduce pedestrian crossing distance. However, these curb extensions cannot interfere with bicycle facilities along Cambridge Street.
- Consider implementing bicycle lanes including a contraflow bike lane on Windsor Street south of Cambridge Street to narrow vehicle travel lane. This would be consistent with the City of Cambridge’s bicycle network vision.
- Ensure all signage is sufficiently retroreflective.

Safety Issue #2: Pavement Markings

Audit team members noted that pavement markings, including bicycle pavement markings (especially green conflict markings) and crosswalks at the intersection were faded. It was noted that there are no green bicycle conflict markings at the gas station driveways adjacent the intersection of Cambridge Street at Windsor Street, where four crashes were reported between 2010 and 2019. In addition, 10 bicycle crashes and 7 pedestrian crashes were reported at the intersection of Cambridge Street at Windsor Street from 2010-2019, so the area may benefit from refreshed pavement markings to indicate conflict points to motorists.

Audit team members noted that the double solid yellow line pavement marking on the southbound Windsor Street approach is faded. This also could have contributed to the two sideswipe same direction crashes on the southbound approach, as well as the sideswipe opposite direction crash between a southbound right-turning vehicle and an eastbound left-turning vehicle.

Proposed Enhancements:

- Refresh pavement markings at this intersection and throughout the study area. Specifically refresh the double solid yellow line on the southbound Windsor Street approach.
- Consider adding green bicycle conflict markings at entrance/exit points for the gas station to remind drivers to yield to bicyclists.
- Refresh green bicycle conflict markings at Windsor Street intersection.
- Refresh crosswalks with high visibility markings.

Safety Issue #3: Drainage

Audit team members noted water pooling at the pedestrian crossings. This may obstruct pedestrian crossings, causing pedestrians to cross out of the crosswalk.

Proposed Enhancements:

- Evaluate drainage and pavement conditions at the intersection. Ensure catch basins are well-maintained and move drainage infrastructure locations if necessary.

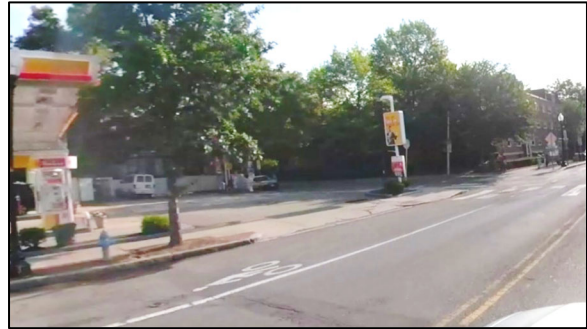


Image 3: East gas station driveway (also west driveway) does not have bicycle markings at conflict point.



Image 4: Faded pavement markings can be observed, especially green bicycle pavement markings.

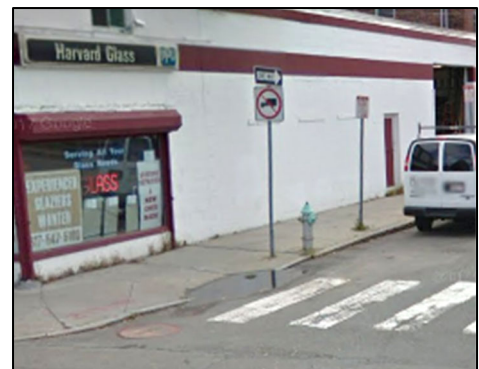


Image 5: Water pools at a pedestrian ramp on the southeast corner of the Windsor Street intersection.

Cambridge Street at Willow Street

Safety Issue #1: Signal Visibility

One three-car rear-end occurred in the westbound direction at the intersection of Cambridge Street at Willow Street. In addition, a pedestrian crash was reported at the east leg crosswalk. Audit team members noted that overgrown foliage makes it difficult for motorists to see the westbound signal head, especially when the signal is green. It was also noted that the signal heads are not up to standard and are missing backplates. Audit team members also noted that the post-mounted signal heads on both Cambridge Street approaches are difficult to see.

Proposed Enhancements:

- Trim vegetation, specifically on the westbound approach, to improve signal head visibility.
- Install 12-inch signal heads and backplates to increase signal head visibility and comply with current standards.
- Consider adding additional mast-arm signal heads to reduce driver confusion and increase signal head visibility.



Image 6: Westbound signal head is difficult to see due to overgrown foliage, lack of backplates, and signal head size.

Cambridge Street at Hunting Street

This intersection was reconstructed in 2019 as a raised intersection with rectangular rapid flashing beacons (RRFBs) at the crosswalk as part of the reconstruction of the King Open School. Before reconstruction, this intersection was signalized. It should be noted that while one crash involving a bicyclist occurred at this intersection in 2010, this was before the intersection was reconstructed so crash data is not reflective of current conditions.

Safety Issue #1: Sight Distance

Audit team members noted that the Hunting Street southbound approach has limited sight distance looking right due to a building on the northwest corner of the intersection (871 Cambridge Street). No sight distance obstruction is present looking to the left because a building recently burned down on the northeast corner of the intersection (851 Cambridge Street). Depending on setbacks, sight distance may become obstructed once the site is redeveloped. Obstructed sight lines have the potential to introduce angle crashes at this intersection among vehicles and non-motorists alike. Given that a traffic signal was present at this location for the periods of crash data available, it is unclear whether a lack of adequate sight distance may contribute to crashes in the future.



Image 7: The Hunting Street southbound approach has limited sight distance looking right due to a building on the northwest corner of the intersection.

Proposed Enhancements:

- Ensure acceptable sight distance is maintained when 851 Cambridge Street is rebuilt.

Safety Issue #2: Drainage

Audit team members observed drainage issues on the crosswalk across Hunting Street. This may interfere with pedestrian crossings, potentially resulting in pedestrians crossing outside of the crosswalk.

Proposed Enhancements

- Evaluate drainage and grading at the intersection. Ensure catch basins are well maintained and move drainage infrastructure locations if necessary.



Image 8: Water pools on the crosswalk across Hunting Street.

Cambridge Street at Harding Street

As part of the 2019 reconstruction of the King Open School, the intersection of Cambridge Street at Harding Street was reconstructed to include a setback raised crossing across the southbound Hunting Street approach. Prior to implementation of the raised crossing, one pedestrian crash was reported 2010-2019 at that crossing.

Safety Issue #1: Drainage

Audit team members observed drainage issues at the raised side street crossing across Harding Street. This may interfere with pedestrian crossings, potentially resulting in pedestrians crossing outside of the crosswalk.

Proposed Enhancements

- Evaluate drainage and grading at the intersection. Ensure catch basins are well maintained and move drainage infrastructure locations if necessary.



Image 9: Water pools at the raised side street crossing across Harding Street.

Summary of Road Safety Audit

Following the virtual site visit and discussion of existing safety issues, audit team members were asked to consider various safety related improvements. The audit team members were encouraged to consider both short-term and long-term improvements for each of the existing safety issues. Each improvement considered has been categorized as short-term, mid-term, or long-term based on the definitions shown in Table 2. Additionally, a cost category has been assigned to each improvement based on the parameters set forth in Table 2. The safety payoff is a subjective judgement of the potential effectiveness of the safety recommendations listed below.

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	Jurisdiction
Study Area-Wide					
School Pick-up/ Drop-Off Patterns	Increase driver education on new school operations to encourage drop-off/pick-up in designated areas. An audit team member noted that this has been pursued in the past, without much success.	Low	On-going	Low	City of Cambridge
	Encourage mode shifts from vehicle to pedestrian and bicycle trips.	Medium	On-going	Low	City of Cambridge
	Increase enforcement during school drop-off/pick-up times.	Medium	On-going	Low	City of Cambridge
	Consider bicycle lane designs that prevent parking in bike lanes.	High	Mid-Term	High	City of Cambridge
Traffic Circulation	Evaluate traffic calming measures on side streets to discourage cut-through traffic to/from Cambridge Street and implement if determined feasible.	Medium	Long-Term	High	City of Cambridge
	Evaluate the directionality of side streets into and out of the neighborhood.	Medium	Short-Term	Medium	City of Cambridge
	Evaluate time of day restrictions. Although the City of Cambridge no longer creates new time of day restrictions, this could be evaluated if policies change.	Medium	Short-Term	Low	City of Cambridge

Table 3: Potential Safety Enhancement Summary (Cont.)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Jurisdiction
Study Area-Wide (Cont.)					
Bicycle Accommodations	Consider providing separated bike lanes including buffered bike lanes or cycle tracks along both sides of the Cambridge Street corridor, keeping consistent with recommendations in the 2015 Cambridge Bike Plan and the City’s Cycling Safety Ordinance.	High	Mid-Term	High	City of Cambridge
	Evaluate the feasibility of raising the westbound bike lane on Cambridge Street, with the potential to reduce doorings and sideswipe crashes involving bicyclists.	High	Mid-Term	Medium	City of Cambridge
	Refresh bicycle pavement markings where faded or missing.	Medium	Short-Term	Low	City of Cambridge
Pedestrian Accommodations	Install detectable warning panels on all curb ramps and upgrade existing curb ramps to meet current ADA standards.	Medium	Mid-Term	Medium	City of Cambridge
	Restripe crosswalks with high visibility markings as appropriate.	Medium	Short-Term	Low	City of Cambridge
Lighting	Evaluate light conditions along the corridor and consider installing more roadway-scale lighting (1907 teardrop replica style).	Medium	Mid-Term	High	City of Cambridge
	Ensure that crosswalks are well-lit.	High	Mid-Term	High	City of Cambridge

Table 3: Potential Safety Enhancement Summary (Cont.)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Jurisdiction
Cambridge Street at Windsor Street					
Intersection Operations & Roadway Geometry	Consider conducting a signal warrant analysis under existing conditions and future conditions with new developments in place and, if warranted, signalizing the intersection.	High	Long-Term	High	City of Cambridge
	Consider adding "Do Not Block Intersection" signage and pavement markings.	Low	Short-Term	Low	City of Cambridge
	Evaluate signal timings along the corridor, specifically at the intersection of Cambridge Street at Columbia Street, with the potential to reduce queueing along Cambridge Street.	Medium	Short-Term	Low	City of Cambridge
	Consider removing or relocating the advertisement on the MBTA bus shelter on the northeast corner of the intersection to improve sight distance for southbound vehicles.	Medium	Short-Term	Low	City of Cambridge
	Evaluate existing access/egress to/from the gas station and consider driveway consolidation to reduce the number or width of conflict points.	High	Mid-Term	Medium	City of Cambridge
	Consider a modified raised side street crossing to slow southbound vehicles at the intersection. This would also address pedestrian ramp compliancy issues.	High	Mid-Term	High	City of Cambridge
	Consider a raised intersection to slow all vehicles at intersection, with confirmation from the fire department. This would also address pedestrian ramp compliancy issues.	High	Long-Term	High	City of Cambridge

Table 3: Potential Safety Enhancement Summary (Cont.)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Jurisdiction
Cambridge Street at Windsor Street (Cont.)					
Intersection Operations & Roadway Geometry, cont.	Consider curb extensions to narrow the southbound lane of both Windsor Street legs and reduce pedestrian crossing distance. However, these curb extensions cannot interfere with bicycle facilities along Cambridge Street.	High	Mid-Term	High	City of Cambridge
	Consider implementing bicycle lanes including a contraflow bike lane on Windsor Street south of Cambridge Street to narrow vehicle travel lane. This would be consistent with the City of Cambridge’s bicycle network vision.	Medium	Mid-Term	Medium	City of Cambridge
	Ensure all signage is sufficiently retroreflective.	Low	Short-Term	Low	City of Cambridge
Pavement Markings	Refresh pavement markings at this intersection and throughout the study area. Specifically refresh the double solid yellow line on the southbound Windsor Street approach.	Medium	Short-Term	Low	City of Cambridge
	Consider adding green bicycle conflict markings at entrance/exit points for the gas station to increase bicycle visibility.	Medium	Short-Term	Low	City of Cambridge
	Refresh green bicycle conflict markings at Windsor Street intersection.	Medium	Short-Term	Low	City of Cambridge
	Refresh crosswalks with high visibility markings.	Medium	Short-Term	Low	City of Cambridge
Drainage	Evaluate drainage and pavement conditions at the intersection. Ensure catch basins are well-maintained and move drainage infrastructure locations if necessary.	Medium	Short-Term	Medium	City of Cambridge

Table 3: Potential Safety Enhancement Summary (Cont.)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Jurisdiction
Cambridge Street at Willow Street					
Signal Visibility	Trim vegetation, specifically on the westbound approach, to improve signal head visibility.	Medium	Short-Term	Low	City of Cambridge
	Install 12-inch signal heads and backplates to increase signal head visibility and comply with current standards.	Medium	Short-Term	Low	City of Cambridge
	Consider adding additional mast-arm signal heads to reduce driver confusion and increase signal head visibility.	Medium	Mid-Term	Medium	City of Cambridge
Cambridge Street at Hunting Street					
Sight Distance	Ensure acceptable sight distance is maintained when 851 Cambridge Street is rebuilt.	Medium	Mid-Term	Low	City of Cambridge
Drainage	Evaluate drainage and grading at the intersection. Ensure catch basins are well maintained and move drainage infrastructure locations if necessary.	Medium	Short-Term	Medium	City of Cambridge
Cambridge Street at Harding Street					
Drainage	Evaluate drainage and grading at the intersection. Ensure catch basins are well maintained and move drainage infrastructure locations if necessary.	Medium	Short-Term	Medium	City of Cambridge

Appendix A. RSA Meeting Agenda

Agenda

Road Safety Audit

Cambridge, MA

Cambridge Street (4 Locations)

Meeting Location: Virtual (Zoom link will be sent to participants)

Thursday, September 17th, 2020

9:00 AM – 1:00 PM

Type of meeting:	High crash location – Road Safety Audit
Attendees:	Invited participants to comprise a multidisciplinary team
Please bring:	Thoughts and enthusiasm!

9:00 AM	Welcome and Introductions <ul style="list-style-type: none">• Overview of virtual RSA format
9:20 AM	Discussion of Safety Issues <ul style="list-style-type: none">• Crash history, speed regulations– all provided in advance• Existing geometries and conditions
10:00 AM	Virtual Site Visit <ul style="list-style-type: none">• Virtually drive through the four intersections• As a group, identify areas for improvement
11:30 PM	Discussion of Potential Improvements <ul style="list-style-type: none">• 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 September 17, 2020, participants are encouraged to drive through the intersection virtually 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.

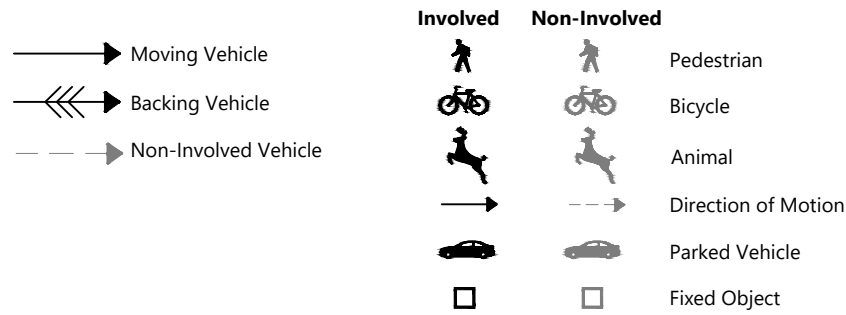
Appendix B. RSA Audit Team Contact List

Participating Audit Team Members

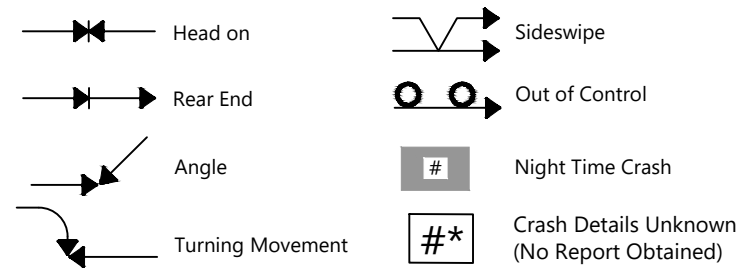
Audit Team Member	Agency/Affiliation	E-mail
Tess Benson	VHB, Inc.	tbenson@vhb.com
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Ashley Domogala	VHB, Inc.	adomogala@vhb.com
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Andy Reker	City of Cambridge – Transportation Planning	areker@cambridgema.gov
Jerry Friedman	City of Cambridge – Department of Public Works	jfriedman@cambridgema.gov
Rick Riley	City of Cambridge – Police Department	rriley@cambridgepolice.org
Paul Sheehan	City of Cambridge – Fire Department	psheehan@cambridgefire.org

Appendix C. Detailed Crash Data

SYMBOLS



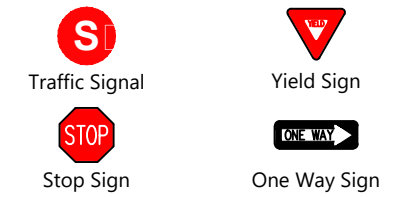
TYPES OF CRASH



SEVERITY



TRAFFIC CONTROL



Source of Crash Reports: Massachusetts Department of Transportation and Cambridge Police Department

Note: See Vehicle-Only Crash Diagram for crashes that do not involve pedestrians or bicyclists.



Not to Scale



Ped & Bike Crash Diagram (2010-2019 Crash Data)
Cambridge Street from Windsor Street to Harding Street
Cambridge, Massachusetts

Pedestrian & Bicycle Crash Data Summary Table

Cambridge Street from Windsor Street to Harding Street, Cambridge, MA
2010 - 2019

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Injury Severity	D1 Age	Comments
1	02/04/10	Thursday	3:50 PM	Pedestrian	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	No Injury	30	V1, a motor vehicle, was traveling SB on Windsor St. P2, a pedestrian, was traveling EB on Cambridge St via the north crosswalk. V1 struck P2.
2	06/10/10	Thursday	7:51 AM	Pedestrian	Daylight	Rain	Wet	Distracted	Non-fatal injury	55	V1, a motor vehicle, was stopped on Cambridge St WB. V1 started to back up due to a tractor trailer turning left from Windsor St onto Cambridge St EB. P2, a pedestrian, was using the west crosswalk. V1 struck P2.
3	07/09/10	Friday	4:30 PM	Bicycle	Daylight	Clear	Dry	Unknown	Non-fatal injury	27	B2, a bicyclist, was traveling EB on Cambridge St in the bike lane. V1, a motor vehicle, was traveling SB on Windsor St. V1 stopped at the stop sign and then proceeded. B2 struck V1. Vision was obstructed by bumper to bumper traffic on Cambridge St.
4	08/25/10	Wednesday	8:22 PM	Bicycle	Dark - lighted roadway	Rain	Wet	Unknown	Unknown	40	Crash report was not obtained. All details from MassDOT crash portal. V1 was traveling WB. Crash occurred at or near the Harding St intersection. A bicyclist was involved.
5	09/18/10	Saturday	8:25 PM	Bicycle	Dark - lighted roadway	Clear	Dry	Unknown	No Injury	28	Crash report was not obtained. All details from MassDOT crash portal. Crash occurred at or near the Windsor St intersection. A bicyclist was involved.
6	11/02/10	Tuesday	6:43 AM	Bicycle	Dark - lighted roadway	Clear	Unknown	Unknown	No Injury	37	Crash report was not obtained. All details from MassDOT crash portal. Crash occurred at or near the Hunting St intersection. A bicyclist was involved.
7	08/11/11	Thursday	10:00 AM	Bicycle	Daylight	Clear	Dry	Unknown	Non-fatal injury	34	V1, a motor vehicle, was traveling WB on Cambridge St. B2, a bicyclist, was at the intersection with Windsor St. V1 struck B2.
8	08/31/11	Wednesday	10:21 AM	Bicycle	Daylight	Clear	Dry	Failed to yield right of way	Non-fatal injury	61	V1, a motor vehicle, was traveling EB on Cambridge St. B2, a bicyclist, was traveling EB on the sidewalk. V1 turned right onto Windsor St. B2 struck V1.
9	10/11/11	Tuesday	5:49 PM	Bicycle	Daylight	Clear	Dry	Made an improper turn	No Injury	45	V1, a motor vehicle, and B2, a bicyclist, were traveling WB on Cambridge St. V1 attempted to make a right turn onto Harding St from the bicycle lane. B2 attempted to maneuver around V1 but made contact with the vehicle doors.
10	10/20/11	Thursday	7:59 PM	Bicycle	Dark - lighted roadway	Cloudy	Dry	Disregarded traffic signs, signals, road markings	Non-fatal injury	21	B2, a bicyclist, was traveling WB on Cambridge St. V1, a motor vehicle, was turning left from Cambridge St EB into the gas station next to Windsor St. B2 struck V1.
11	01/03/12	Tuesday	9:00 AM	Bicycle	Daylight	Clear	Dry	Unknown	Non-fatal injury	46	B2, a bicyclist, was traveling EB on Cambridge St. V1, a motor vehicle, was stopped at the red light at Willow St and opened the passenger door. B2 struck the door.
12	02/16/12	Thursday	11:15 AM	Pedestrian	Daylight	Cloudy	Dry	Failed to yield right of way	Non-fatal injury	84	V1, a motor vehicle, was turning left from Windsor St SB onto Cambridge St EB. P2, a pedestrian, was crossing Cambridge St in the east crosswalk. V1 struck P2.
13	10/17/12	Wednesday	5:47 PM	Bicycle	Unknown	Unknown	Unknown	Unknown	Non-fatal injury	42	V1, a motor vehicle, was traveling SB on Windsor St. B2, a bicyclist, was traveling EB on Cambridge St. V1 struck B2.
14	03/21/13	Thursday	9:00 AM	Bicycle	Daylight	Clear	Wet	Unknown	Non-fatal injury	Unknown	B2, a bicyclist, was traveling WB on Cambridge St. V1, a motor vehicle, was turning left from Cambridge St EB into the gas station next to Windsor St. B2 struck V1.
15	05/13/13	Monday	6:56 PM	Bicycle	Daylight	Clear	Dry	Failed to yield right of way	No Injury	24	B2, a bicyclist, was traveling WB on Cambridge St. V1, a motor vehicle, was turning left from Cambridge St EB into the gas station next to Windsor St. B2 struck V1.
16	05/14/13	Tuesday	5:00 PM	Bicycle	Daylight	Clear	Dry	Inattention	Non-fatal injury	Unknown	V1, a motor vehicle, was parked in front of 826 Cambridge St. B2, a bicyclist, was traveling EB on Cambridge St. V1 opened the driver door. B2 struck the door.
17	08/07/13	Wednesday	3:45 PM	Pedestrian	Daylight	Clear	Dry	Failed to yield right of way	Non-fatal injury	23	V1, a motor vehicle, was traveling SB on Windsor St. P2, a pedestrian, was traveling WB on Cambridge St via the south crosswalk. V1 struck P2.
18	12/11/13	Wednesday	6:15 PM	Bicycle	Dusk	Clear	Dry	Failed to yield right of way	Non-fatal injury	Unknown	B2, a bicyclist, was traveling WB on Cambridge St before Windsor St. V1, a motor vehicle, was stopped in traffic on Cambridge St EB. V1 opened the passenger door. B2 struck the door.
19	02/06/14	Thursday	9:15 AM	Bicycle	Daylight	Cloudy	Snow	Failed to yield right of way	Non-fatal injury	39	V1, a motor vehicle, was traveling SB on Windsor St. B2, a bicyclist, was traveling WB on Cambridge St. V1 struck B2. B2 had observed V1 looking the opposite way, but was unable to stop due to the snowy wet street.
20	05/11/14	Sunday	12:21 PM	Bicycle	Daylight	Clear	Unknown	Unknown	Non-fatal injury	31	V1, a motor vehicle, and B2, a bicyclist, were traveling EB on Cambridge St. V1 suddenly turned right onto Windsor St. V1 struck B2.

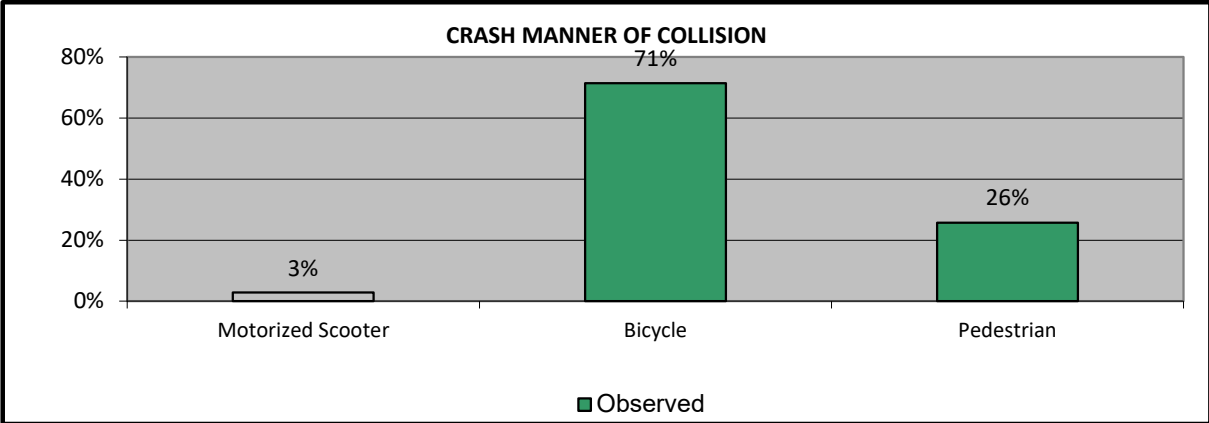
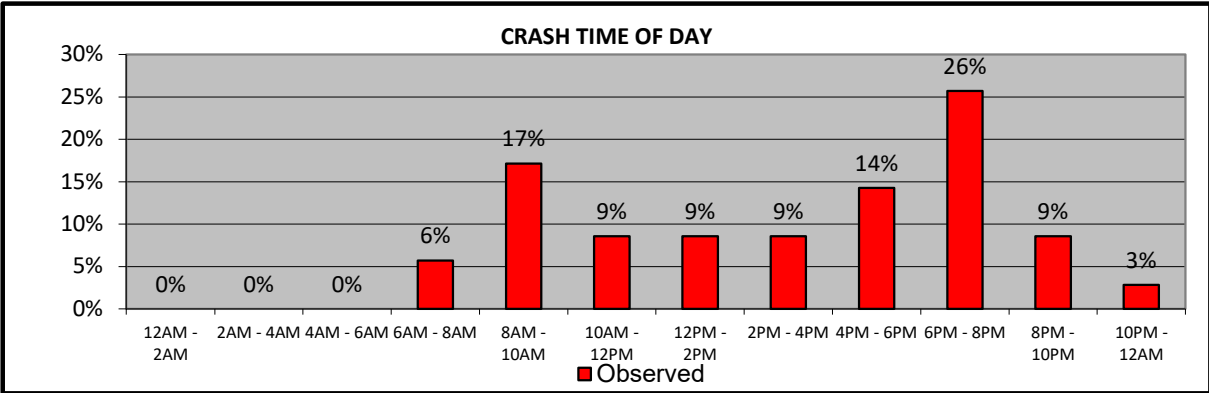
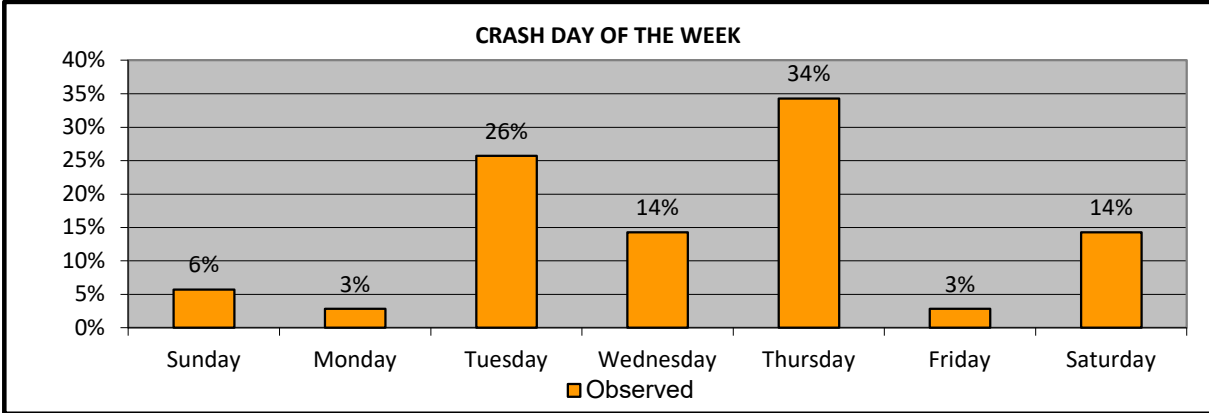
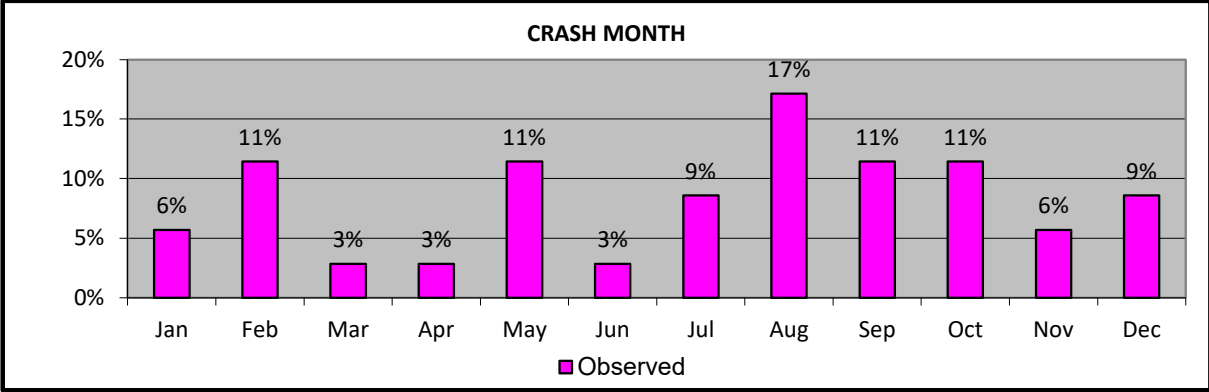
Pedestrian & Bicycle Crash Data Summary Table

Cambridge Street from Windsor Street to Harding Street, Cambridge, MA
2010 - 2019

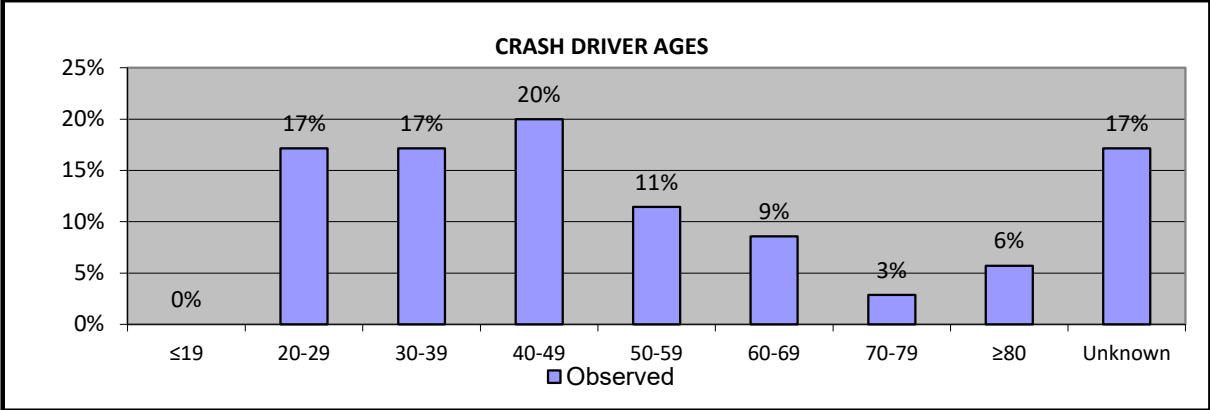
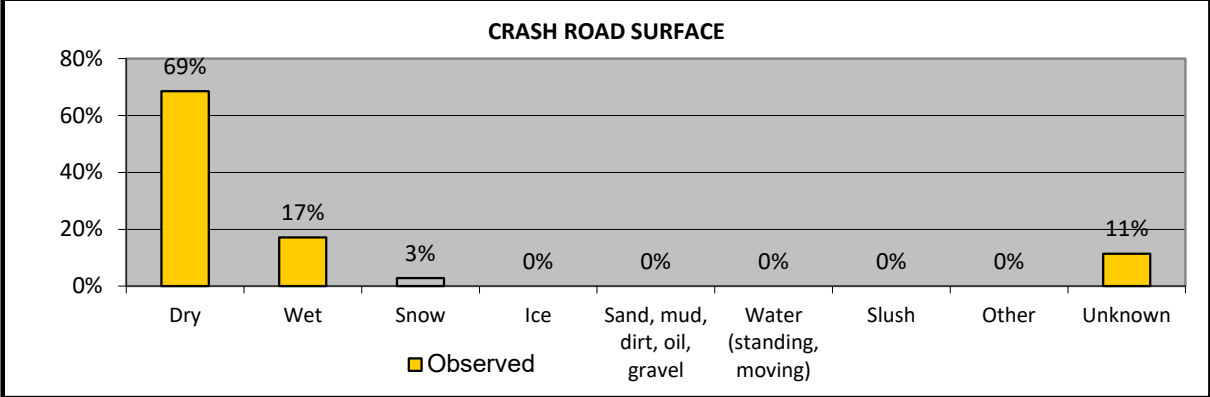
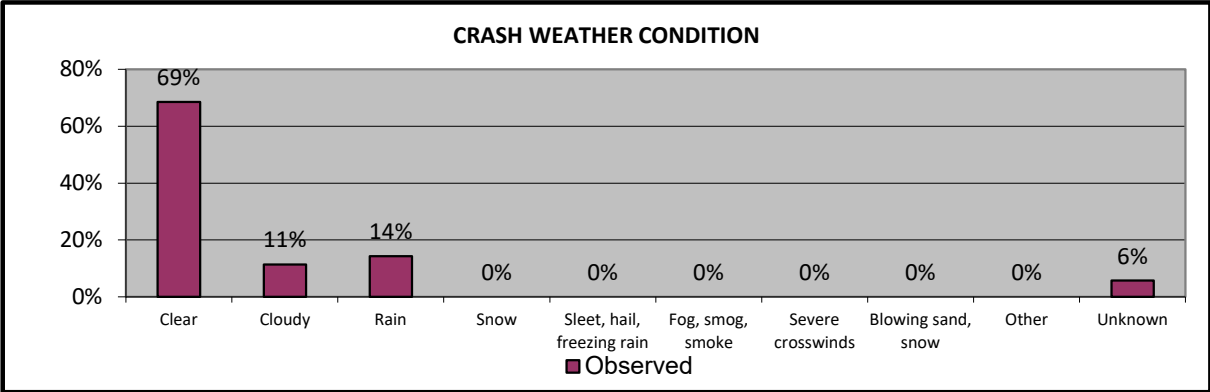
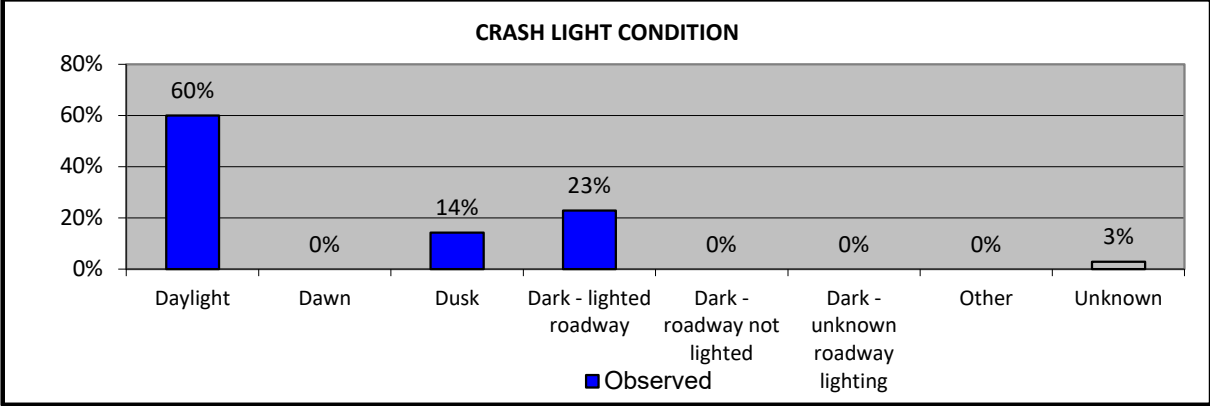
Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Injury Severity	D1 Age	Comments
21	09/18/14	Thursday	9:19 AM	Bicycle	Daylight	Clear	Dry	No improper driving	No Injury	72	V1, a motor vehicle, was traveling SB on Windsor St. B2, a bicyclist, was traveling EB on Cambridge St. V1 struck B2.
22	10/30/14	Thursday	5:28 PM	Motorized Scooter	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	Non-fatal injury	52	V2, a motorized scooter, was traveling WB on Cambridge St in the bike lane. V1, a motor vehicle, was turning left from Cambridge St EB into the gas station next to Windsor St. V1 struck V2.
23	12/09/14	Tuesday	6:04 PM	Pedestrian	Dusk	Rain	Wet	Failed to yield right of way	Non-fatal injury	26	V1, a motor vehicle, was traveling EB on Cambridge St. P2, a pedestrian, was crossing Cambridge St in the east crosswalk at Willow St. V1 struck P2. V1 operator stated she traveled through a yellow light and did not see P2 due to the heavy rain and wind, as well as heavy traffic.
24	07/23/15	Thursday	7:02 PM	Bicycle	Daylight	Clear	Dry	Unknown	Unknown	Unknown	V1, a motor vehicle, was traveling SB on Windsor St. B2, a bicyclist, was traveling EB on Cambridge St. V1 struck B2.
25	01/14/16	Thursday	1:28 PM	Pedestrian	Daylight	Clear	Dry	Unknown	Non-fatal injury	81	V1, a motor vehicle, was turning left from Windsor St SB onto Cambridge St EB. P2, a pedestrian, was crossing Cambridge St in the east crosswalk. V1 struck P2.
26	02/16/16	Tuesday	6:19 PM	Bicycle	Dark - lighted roadway	Rain	Wet	Unknown	Non-fatal injury	60	V1, a motor vehicle, and B2, a bicyclist, were traveling EB on Cambridge St near 803 Cambridge St. B2 was displaying odd behavior due to intoxication, weaving in and out of the travel lane. B2 struck V1 as V1 passed.
27	05/14/16	Saturday	7:02 PM	Bicycle	Dusk	Clear	Dry	Unknown	Unknown	Unknown	A family of four bicyclists were traveling eastbound on Cambridge Street. A motor vehicle turned right onto Willow Street in front of them. Three of the bicyclists stopped, but one child hit the back of her mother's bike.
28	07/16/16	Saturday	2:20 PM	Bicycle	Daylight	Clear	Dry	Unknown	Non-fatal injury	42	B1, a bicycle, was traveling EB on Cambridge Street. V2, a motor vehicle, was parked in the eastbound parking lane before Willow Street. V2 opened the driver door and struck B1.
29	09/17/16	Saturday	9:54 AM	Bicycle	Daylight	Clear	Dry	Failed to yield right of way	Non-fatal injury	55	V1, a motor vehicle, and B2, a bicyclist, were traveling WB on Cambridge St. V1 turned right onto Evereteze Way, believing B2 was far enough behind. B2 struck V1.
30	04/17/18	Tuesday	10:47 PM	Bicycle	Dark - lighted roadway	Clear	Dry	Unknown	Non-fatal injury	Unknown	V1, a motor vehicle, was backing up on Cambridge St WB toward Harding St. B2, a bicyclist, was riding SB on Harding St (against the one-way direction of traffic). V1 struck B2.
31	08/26/18	Sunday	12:45 PM	Pedestrian	Daylight	Clear	Dry	Visibility obstructed	No Injury	45	V1, a motor vehicle, was attempting to back up onto Windsor St from Cambridge St to reverse direction. P2, a pedestrian, was in the crosswalk. V1 struck P2 at low speed.
32	12/13/18	Thursday	6:32 PM	Pedestrian	Dusk	Cloudy	Dry	No improper driving	Non-fatal injury	36	V1, a motor vehicle, was turning left from Cambridge St EB onto Harding St. P2, a pedestrian, was crossing Harding St in the crosswalk looking down at his phone. V1 struck P2.
33	08/13/19	Tuesday	8:00 AM	Bicycle	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	Non-fatal injury	62	V1, a motor vehicle, and B2, a bicyclist, were traveling EB on Cambridge St. V1 turned right onto Windsor St, not seeing any lights on B2. V1 struck B2.
34	09/28/19	Saturday	9:54 PM	Bicycle	Dark - lighted roadway	Unknown	Unknown	Unknown	No Injury	51	B2, a bicyclist, was traveling WB on Cambridge St. V1, a motor vehicle, was turning left from Cambridge St EB onto Windsor St. V1 struck B2.
35	11/12/19	Tuesday	6:34 PM	Pedestrian	Dusk	Rain	Wet	Failed to yield right of way	Non-fatal injury	40	V1, a motor vehicle, was turning right from Windsor St SB onto Cambridge St WB. P2, a pedestrian, was crossing Cambridge St in the west crosswalk. V1 struck P2.

Summaries based on crash reports obtained from the Massachusetts Department of Transportation and Cambridge Police Department

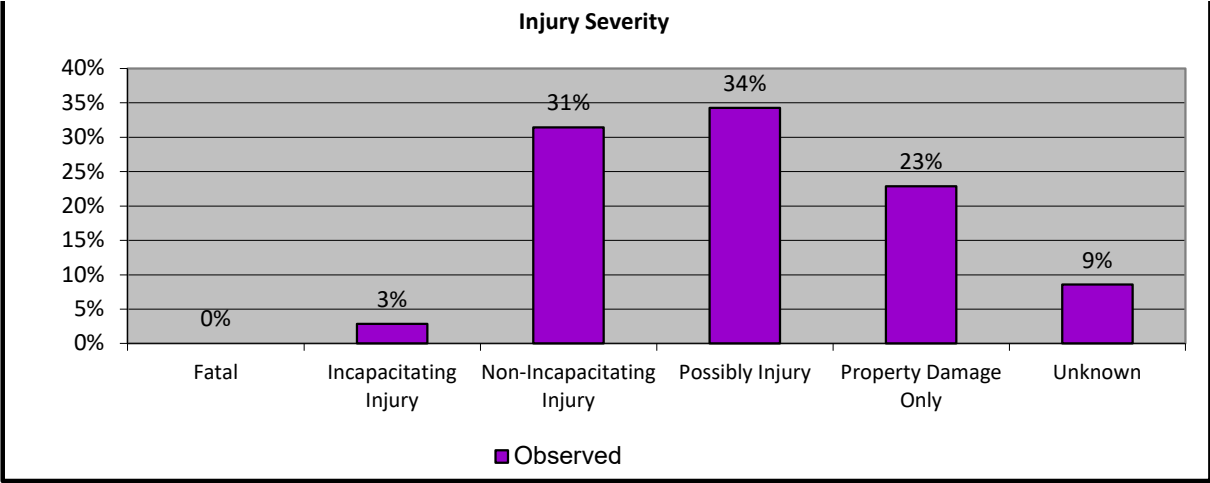
Pedestrian & Bicycle Crash Data Summary Charts
Cambridge Street from Windsor Street to Harding Street, Cambridge, MA



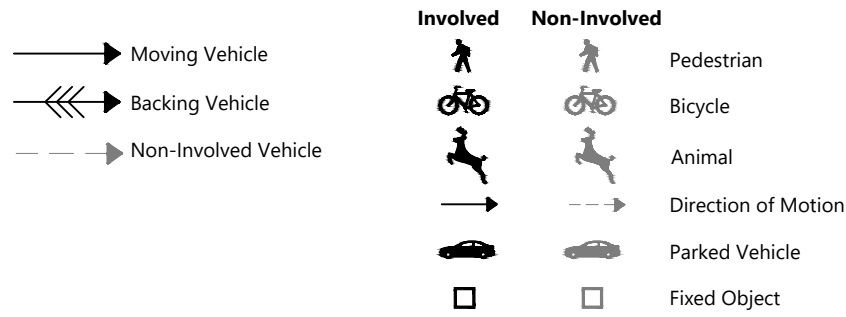
Pedestrian & Bicycle Crash Data Summary Charts
Cambridge Street from Windsor Street to Harding Street, Cambridge, MA



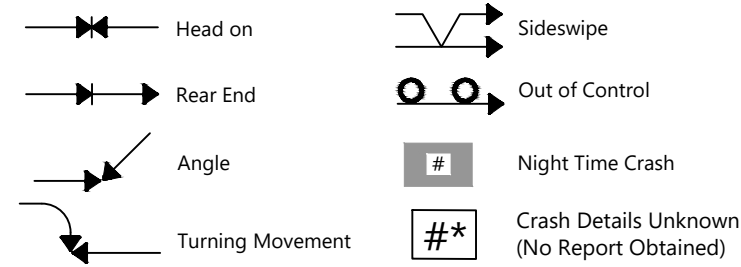
Pedestrian & Bicycle Crash Data Summary Charts
Cambridge Street from Windsor Street to Harding Street, Cambridge, MA



SYMBOLS



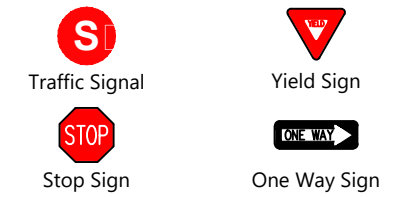
TYPES OF CRASH



SEVERITY



TRAFFIC CONTROL



Source of Crash Reports: Massachusetts Department of Transportation and Cambridge Police Department

Note: See Ped & Bike Crash Diagram for crashes involving pedestrians and bicyclists.



Not to Scale



Vehicle-Only Crash Diagram (2016-2018 Crash Data)
Cambridge Street from Windsor Street to Harding Street
Cambridge, Massachusetts

Vehicle-Only Crash Data Summary Table
Cambridge Street from Windsor Street to Harding Street, Cambridge, MA
2016 - 2018

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Injury Severity	D1 Age	D2 Age	D3 Age	Comments
1	01/06/16	Wednesday	8:08 PM	Sideswipe, opposite direction	Dark - lighted roadway	Clear	Dry	Unknown	No Injury	24	Unknown		V1 was turning right from Windsor St SB onto Cambridge St WB. V2 was turning left from Cambridge St EB onto Windsor St NB. V2 sideswiped V1.
2	02/19/16	Friday	2:39 PM	Rear-end	Daylight	Clear	Dry	No improper driving	No Injury	34	44		Road rage incident. V1 was cut off by V2 traveling from Somerville to Cambridge so she honked. V2 and V1 proceeded SB on Hunting St. V2 pulled over, yelled at V1, and then purposely rear-ended V1.
3	05/06/16	Friday	12:26 PM	Angle	Daylight	Clear	Dry	Unknown	Non-fatal injury	39	Unknown		V1 was traveling EB on Cambridge St. V2 was travelling SB on Windsor St. V2 entered the intersection at a high rate of speed. V1 struck V2.
4	05/19/16	Thursday	6:55 PM	Sideswipe, same direction	Daylight	Clear	Unknown	Unknown	No Injury	33	Unknown		V1 was traveling SB on Windsor St. V2 sideswiped V1.
5	10/05/16	Wednesday	5:38 PM	Angle	Daylight	Clear	Dry	Unknown	No Injury	37	19		V1 was traveling SB on Windsor St. V1 stopped at the stop sign at Cambridge St. Both EB and WB traffic stopped, allowing V1 to enter the intersection. V2 passed the stopped vehicle on Cambridge St EB and struck V1.
6	12/06/16	Tuesday	4:45 PM	Angle	Dusk	Clear	Dry	Unknown	No Injury	21	26		V1 was traveling SB on Windsor St. V2 was turning right from Cambridge St EB onto Windsor St. V1 struck V2.
7	12/18/16	Sunday	4:55 PM	Rear-end	Dark - lighted roadway	Cloudy	Dry	No improper driving	No Injury	63	61	22	V1, V2 (a motorcycle), and V3 were traveling EB on Cambridge St near Evereteze Way. V2 and V3 were stopped in traffic for the red light at Willow St. V1 rear-ended V2, which then struck V3.
8	05/03/17	Wednesday	6:21 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	No Injury	23	21		V1 was traveling WB on Cambridge St. V2 was turning left from Cambridge St EB into the gas station next to Windsor St. V2 struck V1.
9	09/15/17	Friday	10:27 PM	Rear-end	Dark - lighted roadway	Cloudy	Wet	No improper driving	No Injury	34	31	44	V1, V2, and V3 were traveling on Cambridge St WB. V1 and V2 were stopped at the red light at Willow St. V3 rear-ended V2, which then struck V1.
10	11/14/17	Tuesday	8:49 PM	Rear-end	Dark - lighted roadway	Clear	Dry	Followed too closely	No Injury	44	24		V2 was traveling WB on Cambridge St. V2 stopped abruptly to allow the vehicle ahead of it to park in front of 877 Cambridge St. V1 rear-ended V2.
11	12/23/17	Saturday	11:30 PM	Single vehicle crash	Dark - lighted roadway	Clear	Ice	Physical impairment	No Injury	19			V1 was traveling WB on Cambridge St. V1 operator stated his emergency brakes turned on, causing him to swerve and collide with the house at 918 Cambridge St at the corner of the Willow St intersection. Police observed a slight odor of marijuana on V1 operator.
12	02/07/18	Wednesday	9:01 AM	Rear-end	Daylight	Cloudy	Dry	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	No Injury	53	Unknown		V1 and V2 were traveling EB on Cambridge St. V1 slowly turned right onto Windsor St. V2 was impatient and honked, then attempted to pass V1 on the right. V2 struck V1.
13	03/08/18	Thursday	10:06 AM	Angle	Daylight	Snow	Snow	History heart/epilepsy/fainting	Non-fatal injury	42	Unknown		V1 was traveling WB on Cambridge St. V1 operator suffered a seizure. V1 turned onto the sidewalk and knocked over a light post after Evertze Way. V1 then struck the rear passenger side of parked V2 before striking a tree, where V1 stopped.
14	04/07/18	Saturday	5:53 PM	Angle	Daylight	Clear	Dry	Other improper action	No Injury	24	55		V1 was traveling SB on Windsor St, stopped at the stop sign. V2 was traveling EB on Cambridge St behind a large truck. V1 thought there was a gap after the large truck and entered the intersection, striking V2.
15	04/08/18	Sunday	12:26 AM	Rear-end	Dark - lighted roadway	Clear	Dry	Unknown	No Injury	24	Unknown		V1 and V2 were stopped on Cambridge St WB at the red light at Hunting St. V2 reversed, attempting to parallel park, and struck V1.
16	08/23/18	Thursday	1:56 PM	Sideswipe, same direction	Daylight	Clear	Dry	Failure to keep in proper lane or running off road	No Injury	36	Unknown		V2, a tractor trailer, was turning left from Windsor St SB onto Cambridge St EB. V1 was traveling SB on Windsor St. V2 was taking a wide turn, so V1 thought V2 was turning right. V1 crossed the double yellow line on Windsor St to pass V2. V1 struck V2.
17	11/13/18	Tuesday	5:23 PM	Angle	Dusk	Cloudy	Wet	Failed to yield right of way	Non-fatal injury	29	25		V1 was traveling EB on Cambridge St. V2 was travelling SB on Windsor St. V2 entered the intersection after stopping at the stop sign. V1 struck V2. It was noted traffic was heavy on both streets.

Summaries based on crash reports obtained from the Massachusetts Department of Transportation and Cambridge Police Department.

Pedestrian & Bicycle Crash Data Summary Table

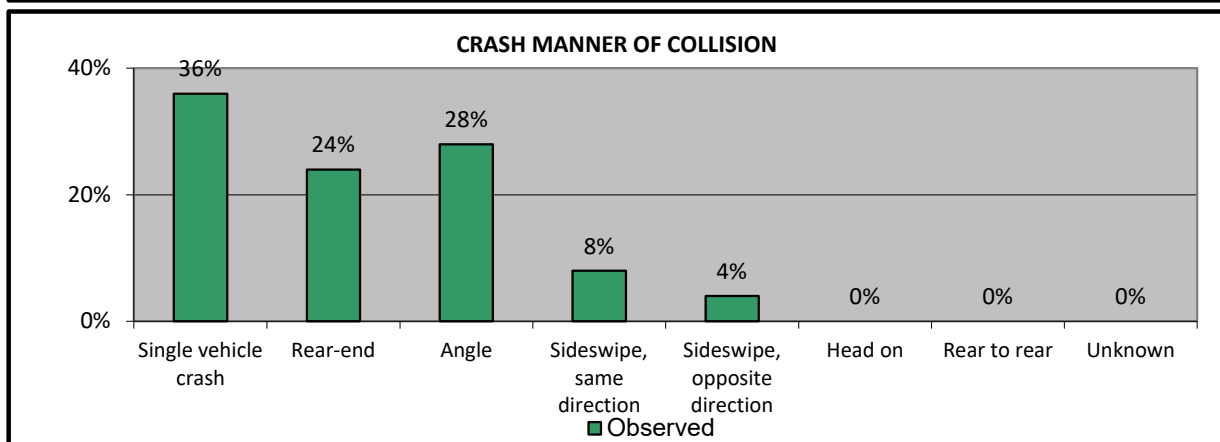
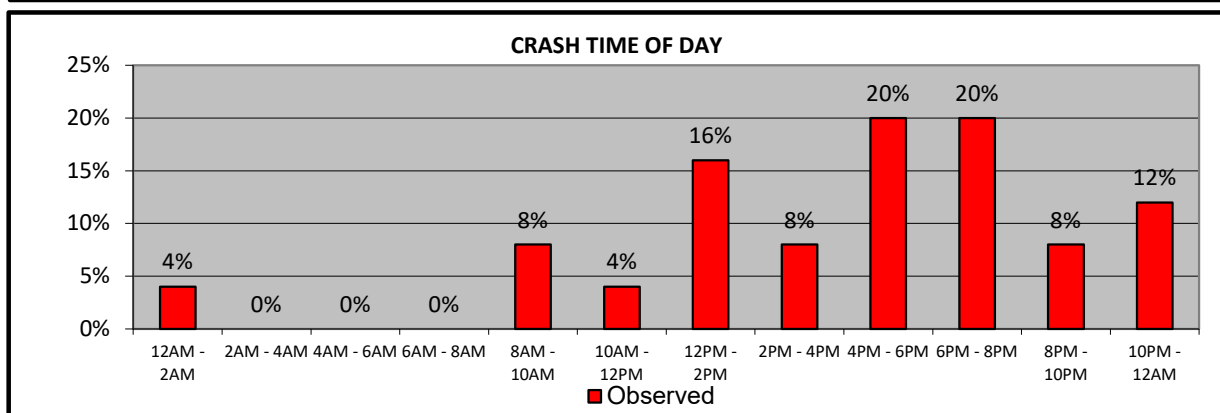
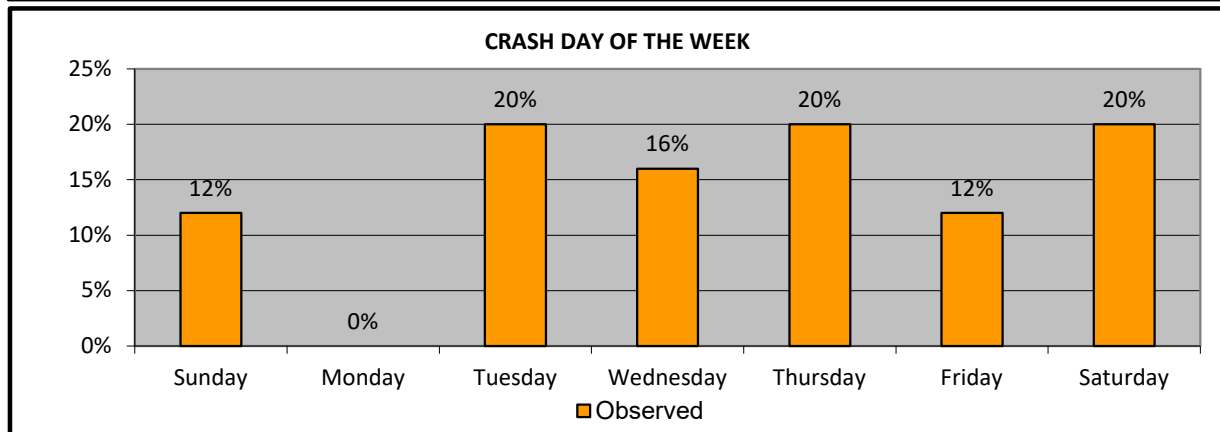
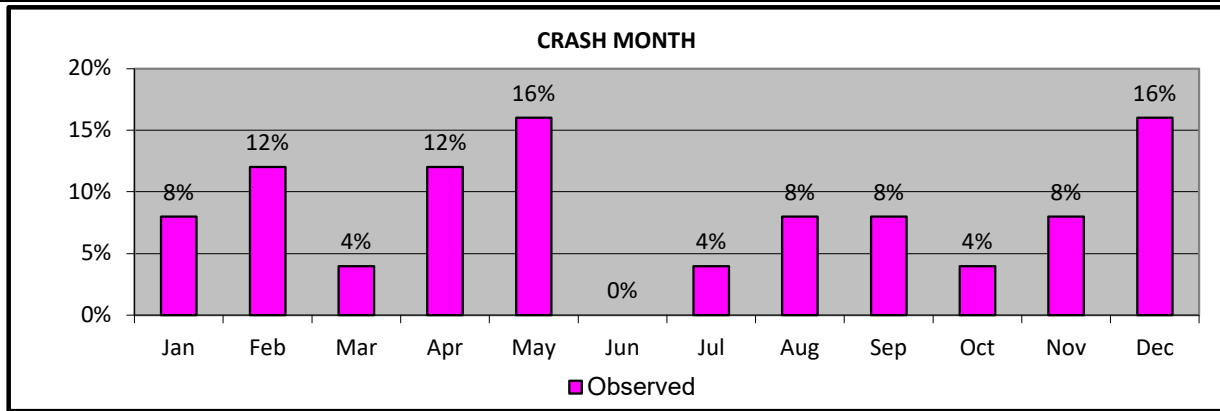
Cambridge Street from Windsor Street to Harding Street, Cambridge, MA
2016 - 2018

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Injury Severity	D1 Age	D2 Age	D3 Age	Comments
25	01/14/16	Thursday	1:28 PM	Pedestrian	Daylight	Clear	Dry	Unknown	Non-fatal injury	81			V1, a motor vehicle, was turning left from Windsor St SB onto Cambridge St EB. P2, a pedestrian, was crossing Cambridge St in the east crosswalk. V1 struck P2.
26	02/16/16	Tuesday	6:19 PM	Bicycle	Dark - lighted roadway	Rain	Wet	Unknown	Non-fatal injury	60			V1, a motor vehicle, and B2, a bicyclist, were traveling EB on Cambridge St near 803 Cambridge St. B2 was displaying odd behavior due to intoxication, weaving in and out of the travel lane. B2 struck V1 as V1 passed.
27	05/14/16	Saturday	7:02 PM	Bicycle	Dusk	Clear	Dry	Unknown	Unknown	Unknown			A family of four bicyclists were traveling eastbound on Cambridge Street. A motor vehicle turned right onto Willow Street in front of them. Three of the bicyclists stopped, but one child hit the back of her mother's bike.
28	07/16/16	Saturday	2:20 PM	Bicycle	Daylight	Clear	Dry	Unknown	Non-fatal injury	42			B1, a bicycle, was traveling EB on Cambridge Street. V2, a motor vehicle, was parked in the eastbound parking lane before Willow Street. V2 opened the driver door and struck B1.
29	09/17/16	Saturday	9:54 AM	Bicycle	Daylight	Clear	Dry	Failed to yield right of way	Non-fatal injury	55			V1, a motor vehicle, and B2, a bicyclist, were traveling WB on Cambridge St. V1 turned right onto Evereteze Way, believing B2 was far enough behind. B2 struck V1.
30	04/17/18	Tuesday	10:47 PM	Bicycle	Dark - lighted roadway	Clear	Dry	Unknown	Non-fatal injury	Unknown			V1, a motor vehicle, was backing up on Cambridge St WB toward Harding St. B2, a bicyclist, was riding SB on Harding St (against the one-way direction of traffic). V1 struck B2.
31	08/26/18	Sunday	12:45 PM	Pedestrian	Daylight	Clear	Dry	Visibility obstructed	No Injury	45			V1, a motor vehicle, was attempting to back up onto Windsor St from Cambridge St to reverse direction. P2, a pedestrian, was in the crosswalk. V1 struck P2 at low speed.
32	12/13/18	Thursday	6:32 PM	Pedestrian	Dusk	Cloudy	Dry	No improper driving	Non-fatal injury	36			V1, a motor vehicle, was turning left from Cambridge St EB onto Harding St. P2, a pedestrian, was crossing Harding St in the crosswalk looking down at his phone. V1 struck P2.

Summaries based on crash reports obtained from the Massachusetts Department of Transportation and Cambridge Police Department.
2016 - 2018 Pedestrian and Bicycle crashes not included in Vehicle-Only Crash Diagram. See Pedestrian and Bicycle Crash Diagram.

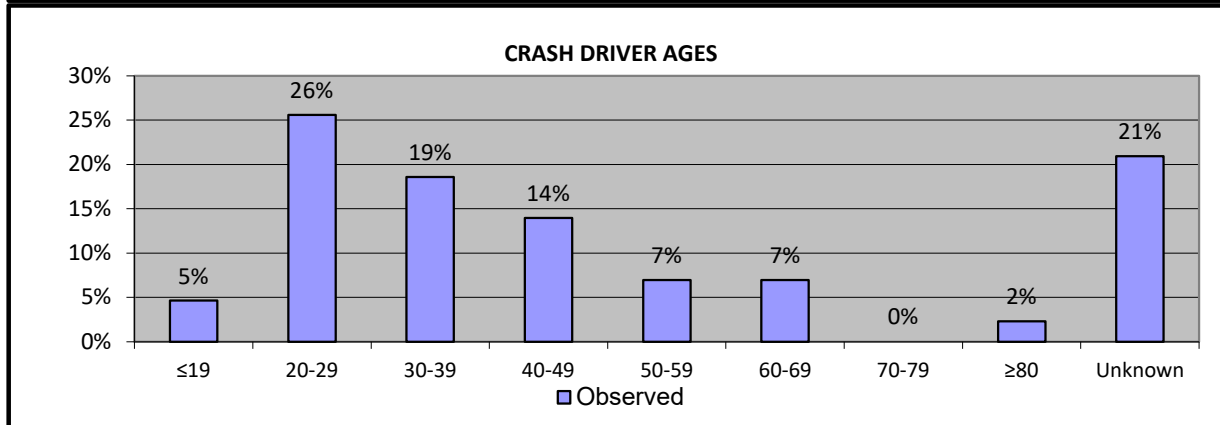
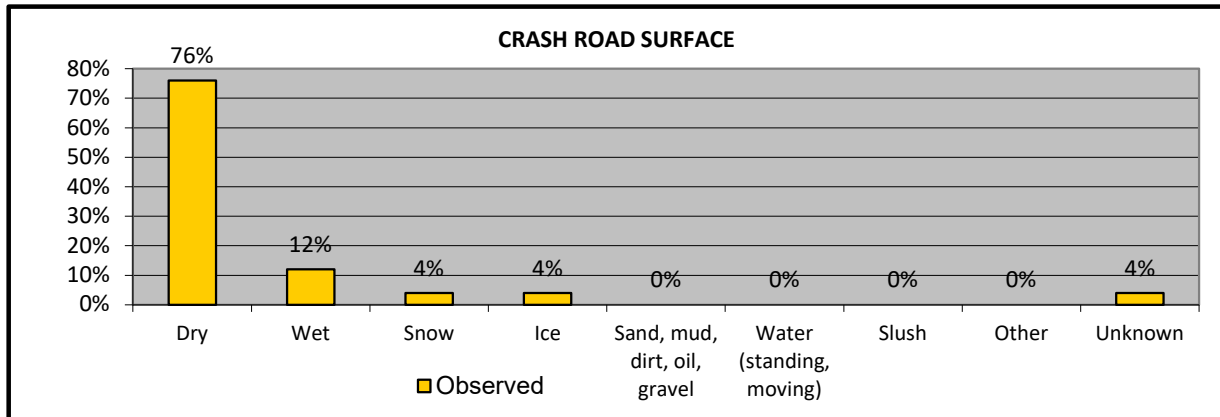
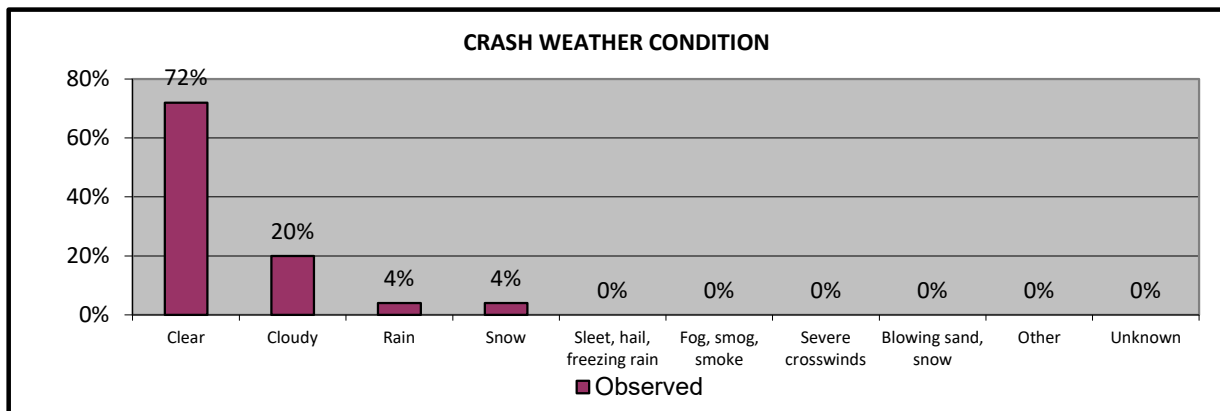
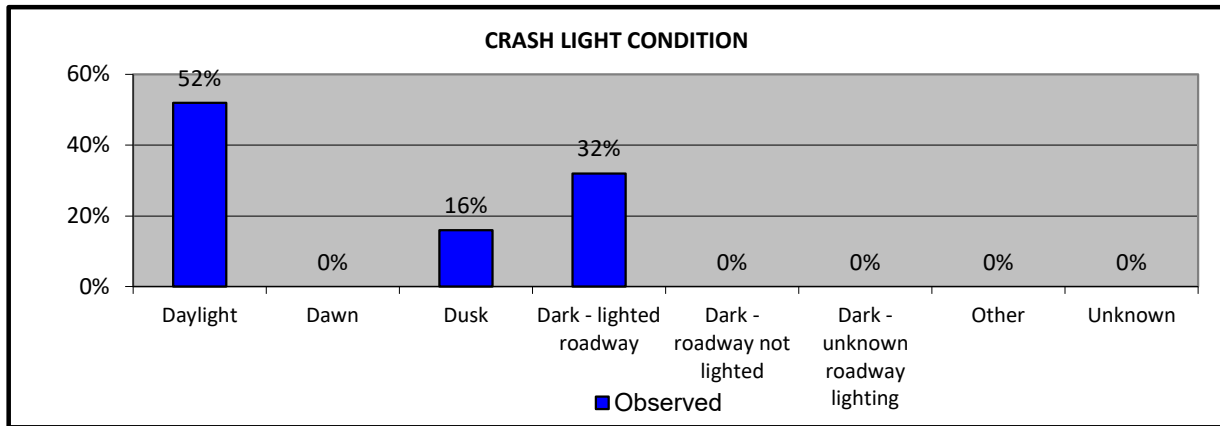
Crash Data Summary Charts - Vehicle and Bicycle and Pedestrian Crashes (2016-2018)

Cambridge Street from Windsor Street to Harding Street, Cambridge, MA

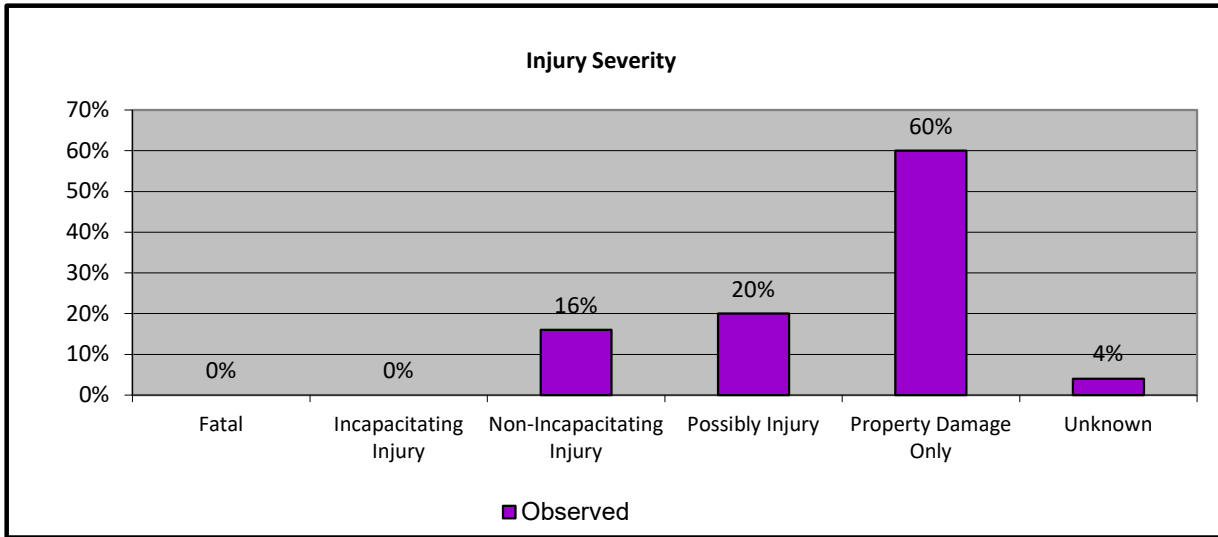


Crash Data Summary Charts - Vehicle and Bicycle and Pedestrian Crashes (2016-2018)

Cambridge Street from Windsor Street to Harding Street, Cambridge, MA



Crash Data Summary Charts - Vehicle and Bicycle and Pedestrian Crashes (2016-2018)
Cambridge Street from Windsor Street to Harding Street, Cambridge, MA



Appendix D. Road Safety Audit References

Road Safety Audit References

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