ROAD SAFETY AUDIT

Arborway - West of South Street to West of Eliot Street

City of Boston

September 9, 2019

Prepared For:
DCR

dcr
Massachusetts

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Background

Howard Stein Hudson (HSH) has prepared this Road Safety Audit (RSA) as a formal safety examination of a roadway or intersection by an independent, multidisciplinary team for the Department of Conservation and Recreation (DCR). The intersection of the Arborway at Centre Street, east of Murray Circle was identified as a Highway Safety Improvement Program (HSIP), 2012-2014 High Crash Cluster. An HSIP-eligible location is a crash cluster that ranks within the top 5% of the Boston Region Metropolitan Area Planning Council (MAPC) based on crash incidence and severity.

The most recent data available for HSIP crash clusters (2014-2016) do not indicate any crash clusters along the Arborway corridor. It is noted that construction on the Casey Arborway began in 2015, which may have reduced the volume traveling through the study area.

In general, the RSA is intended to identify potential short and long-term safety improvements that could be evaluated for inclusion as part of a future design and reconstruction. The short-term, low-cost improvements could be considered for implementation prior to a more significant longer-term, more costly construction project.

The RSA was conducted on Monday, April 22, 2019, from 9:00 a.m. to 1:00 p.m. at the Arnold Arboretum in the Jamaica Plain neighborhood of Boston. **Table 1** shows the individuals that participated in the audit. The agenda for that day is included in **Appendix A**, and contact information for attendees can be found in **Appendix B**.

Table 1: Participating Audit Team Members

Audit Team Member	Agency/Affiliation
Sarah Freeman	Arborway Coalition / Emerald Necklace Conservancy (ENC)
Stephen Schneider	Arnold Arboretum
Eliza Parad	Boston Cyclists Union
James Salvia	Boston EMS
James Fitzgerald	Boston Planning & Development Agency (BPDA)
Chris Comeaux	Boston Transportation Department (BTD)
Nathaniel Fink	BTD Planning
Casey Claude	Central Transportation Planning Staff (CTPS)
Anne Fiesinger	DCR
Patrice Kish	DCR
Jeff Parenti	DCR
Karen Mauney-Brodek	Emerald Necklace Conservancy (ENC)
Michael Pezzullo	FHWA
Amy Ingles	Howard Stein Hudson – Active Transportation Leader
Michaela Savran	Howard Stein Hudson – Traffic Engineer
Bob Stathopoulos	Howard Stein Hudson – Traffic Engineer
Tony Lechuga	Livable Streets
Hameed Pervez	MassDOT District 6
Zach Veaner	MassDOT District 6
Michelle Deng	MassDOT Traffic Safety
Ana Fill	MassDOT Traffic Safety
Lt. James Bassinotti	Massachusetts State Police
Sarah Kurpiel Lee	Metropolitan Area Planning Council (MAPC)
Wendy Landman	WalkBoston

Project Location and Description

The study area is shown in **Figure 1**, and a map showing the jurisdiction of the area is shown in **Figure 2**. A description of the study area roadways and intersections is provided below.

The Arborway (Route 203) is a parkway that is classified as an urban principal arterial and is under the jurisdiction of the DCR within the study area. The Arborway is a historic parkway listed on the National Register of Historic Places. It runs north-south and stretches from Pond Street/Jamaicaway at Kelley Circle from the north to Circuit Drive to the south, where the Arborway becomes Morton Street. Within the study area, the Arborway typically consists of two travel lanes in each direction and is separated by a raised median south of Murray Circle. Within the study area, informal on-street parking is provided on the Arborway southbound, south of Murray Circle, until approximately 350 feet south of the Arnold Arboretum. No bicycle accommodations are provided along the Arborway within the study area. Speed limit signs for 25 miles per hour (mph) are present. Sidewalks are typically provided on both sides of the roadway, with crosswalks across the Arborway at Kelley Circle, Murray Circle, and approximately 100 feet south of the Arnold Arboretum.

Within the study area, the Upper Arborway runs parallel to the mainline Arborway, south of Murray Circle. The carriage roads run parallel to the main Arborway on both sides in between Kelley and Murray Circles. These "carriage roads" are intended for local traffic to gain access to local neighborhood roads and the Arborway. The carriage roads between Kelley Circle and Murray Circle provide two lanes in each direction; south of Murray Circle, the Upper Arborway road is located east of the Arborway and south of Murray Circle, with one lane in each direction and parking on one side of the road.

Centre Street is classified as an urban principal arterial west of Murray Circle, under the jurisdiction of DCR, and a minor arterial east of Murray Circle, under the jurisdiction of the City of Boston. Centre Street generally runs northeast-southwest from Columbus Avenue to the Dedham Town Line. Centre Street typically consists of two lanes in each direction with a raised median west of Murray Circle and bicycle lanes in both directions. One lane is provided in either direction on Centre Street, east of Murray Circle, with parking on both sides of the street. Within the study area, sidewalks are typically provided on both sides of Centre Street. A signalized crosswalk is provided just west of Murray Circle across Centre Street; however, there are no crosswalks east of Murray Circle across Centre Street.

Pond Street/Jamaicaway is classified as an urban principal arterial, under DCR jurisdiction east of Kelley Circle, and an urban collector under City of Boston jurisdiction, west of Kelley Circle. Pond Street splits within Kelley Circle to a local one-way roadway, heading toward the segment of Pond Street/Jamaicaway, east of Kelley Circle. Pond Street runs northeast-southwest between Jamaicaway and the Brookline Town Line. Pond Street generally provides one lane in each direction, west of Kelley Circle, and two lanes in each direction, east of Kelley Circle. On-street parking is provided on both sides of the street west of Kelley Circle. Sidewalks are provided along both sides of the roadway, and the Emerald Necklace runs parallel to Pond Street, east of Kelley Circle.

Cataumet Street is a local roadway and is under the jurisdiction of the City of Boston. Cataumet Street runs south-north starting at the intersection of Pond Street and the Arborway, ending in a cul-de-sac. Sidewalks are provided on both sides of the street, and parking is allowed on both sides of the street.

Prince Street is classified as an urban minor arterial, west of Kelley Circle, and a local roadway southeast of Kelley Circle, under the jurisdiction of the City of Boston. Prince Street runs northwest-southeast, from Perkins Street to the Arborway at Murray Circle. Prince Street is a one-way street, southbound. Parking is allowed on both sides of the street, and there is a sidewalk on the west side of the street in the northern segment and on both sides in the southern segment.

Francis Parkman Drive is classified as an urban minor arterial under the jurisdiction of DCR. Francis Parkman Drive runs north-south, from Perkins Street to the Arborway at Kelley Circle. The road provides one lane in each direction. There are no sidewalks along the road, but a paved path along Jamaica Pond runs parallel to the roadway and parking is prohibited along the roadway.

Murray Circle is a rotary with four approaches; Centre Street to the east and west, and the Arborway and the Carriage Road approaches to the north. No pavement markings are provided within the rotary other than inside and outside shoulders. The circulating roadway width varies from approximately 35-60 feet wide, and the inner diameter is approximately 200 feet. All entering vehicles are required to yield to vehicles in the rotary. The Centre Street/Arborway intersection is located at the east exit of the rotary. **Figure 3** shows the layout of Murray Circle.

The Centre Street eastbound approach consists of two travel lanes entering the rotary and two lanes westbound exiting the rotary. A bike lane ends at this approach, with no signage indicating the end of the bike lane. The Centre Street westbound approach provides an unmarked 24-foot lane, which is utilized as one, or, at times, two lanes. The exit is a two-lane signalized exit to Centre Street and the Arborway. The Arborway and Carriage Road southbound approaches enter the rotary next to each other, each consisting of two travel lanes southbound entering the rotary. Two lanes exit the rotary on the Arborway, while the Carriage Road northbound road does not go through Murray Circle. A median separating the Carriage Road and the Arborway is also present, which provides pedestrian refuge. The Arborway southbound exit consists of two travel lanes. The Arborway northbound does not enter Murray Circle directly. The Arborway northbound traffic enters the rotary through the Centre Street westbound approach at the signalized intersection of Centre Street at the Arborway.

Centre Street eastbound provides a crosswalk set back approximately 20 feet from the rotary, spanning the entrance and exit to the rotary, divided by a triangular splitter island, providing refuge for pedestrians. There are no crossings along the Centre Street westbound approach or exit. Crosswalks across the Arborway and Carriage Road southbound approaches and the Arborway northbound exit are set back approximately 30 feet from the rotary with triangular splitter islands providing refuge for pedestrians, dividing the approaches and exit. The Arborway southbound exit has a crosswalk set back approximately 15 feet from the rotary. Wheelchair ramps are provided at the Centre Street approach and exit to the west, the western side of the Carriage Road crosswalk, and at the southern Arborway exit. The remainder of the crosswalks do not have ramps, and the only ramp that appears to be Americans with Disabilities Act (ADA) compliant is the ramp at the western side of the Carriage Road crossing; however, it does not have a reciprocating ramp across the Carriage Road.

The intersection of **Centre Street at the Arborway** is located approximately 130 feet east of Murray Circle and has four approaches. The Centre Street eastbound approach consists of two lanes exiting Murray Circle merging to one after the intersection. The Centre Street westbound approach consists of a

lane approximately 20 feet wide, typically used as two lanes. The Arborway northbound approach consists of two lanes, with a short, channelized right-turn lane onto Centre Street eastbound. A crosswalk is provided across the Arborway approach; however, there are no ramps present. The Prince Street southbound approach consists of one lane and is restricted to right turns only. There is a crosswalk across the Prince Street approach. The Upper Arborway ends at Centre Street approximately 100 feet east of the intersection.

Kelley Circle is a rotary with four approaches with a signalized intersection at the southwest corner of the rotary, and an additional U-turn to reenter the rotary just south of the intersection. The approaches include Pond Street/Jamaicaway to the east, Prince Street and Francis Parkman Drive to the west, and the Arborway to the south. The rotary is marked as a three-lane rotary. All entering vehicles are required to yield to vehicles in the rotary. The Arborway/Pond Street and Cataumet Street intersection is located at the south exit of the rotary. **Figure 4** shows the layout of Kelley Circle.

The Francis Parkman Drive eastbound approach consists of one travel lane entering the rotary in a dedicated lane and one lane westbound exiting the rotary. A crosswalk, set back approximately 25 feet from the rotary, spans the entrance and exit to the rotary, and is divided by a triangular splitter island, providing refuge for pedestrians. The one-way Prince Street southeastbound approach provides one travel lane entering the rotary. Ramps are present, but there is no marked crosswalk across the Prince Street approach. The Prince Street southern segment is a one-way street southeastbound, exiting the circle. The Pond Street westbound approach consists of two travel lanes entering the rotary and two exiting. There are no crosswalks at this approach. A Pond Street extension exits the rotary approximately 150 feet south of the Pond Street exit, providing local access to Orchard Street and from Dunster Road. The Arborway northbound approach has a pedestrian signal, consisting of three travel lanes entering the rotary and two lanes southbound exiting the rotary at a signal with Pond Street and Cataumet Street, and one right-turn lane from the Arborway southbound onto Pond Street. A crosswalk spans the entrance and exit to the rotary and is divided by a triangular splitter island, providing refuge for pedestrians.

The intersection of the **Arborway at Pond Street and Cataumet Street** is located at the southwestern leg of Kelley Circle and has three approaches. The Pond Street eastbound approach consists of one lane and is restricted to right turns only. The Cataumet Street southeastbound approach consists of one lane. The Arborway southbound approach consists of three lanes, two through lanes and an exclusive right turn lane. There is also a channelized left-turn/U-turn lane bringing vehicles around Kelley Circle. At this channelized lane, the Arborway splits into the Carriage Road, the main Arborway road and the channelized lane.

Figure 1: Locus Map

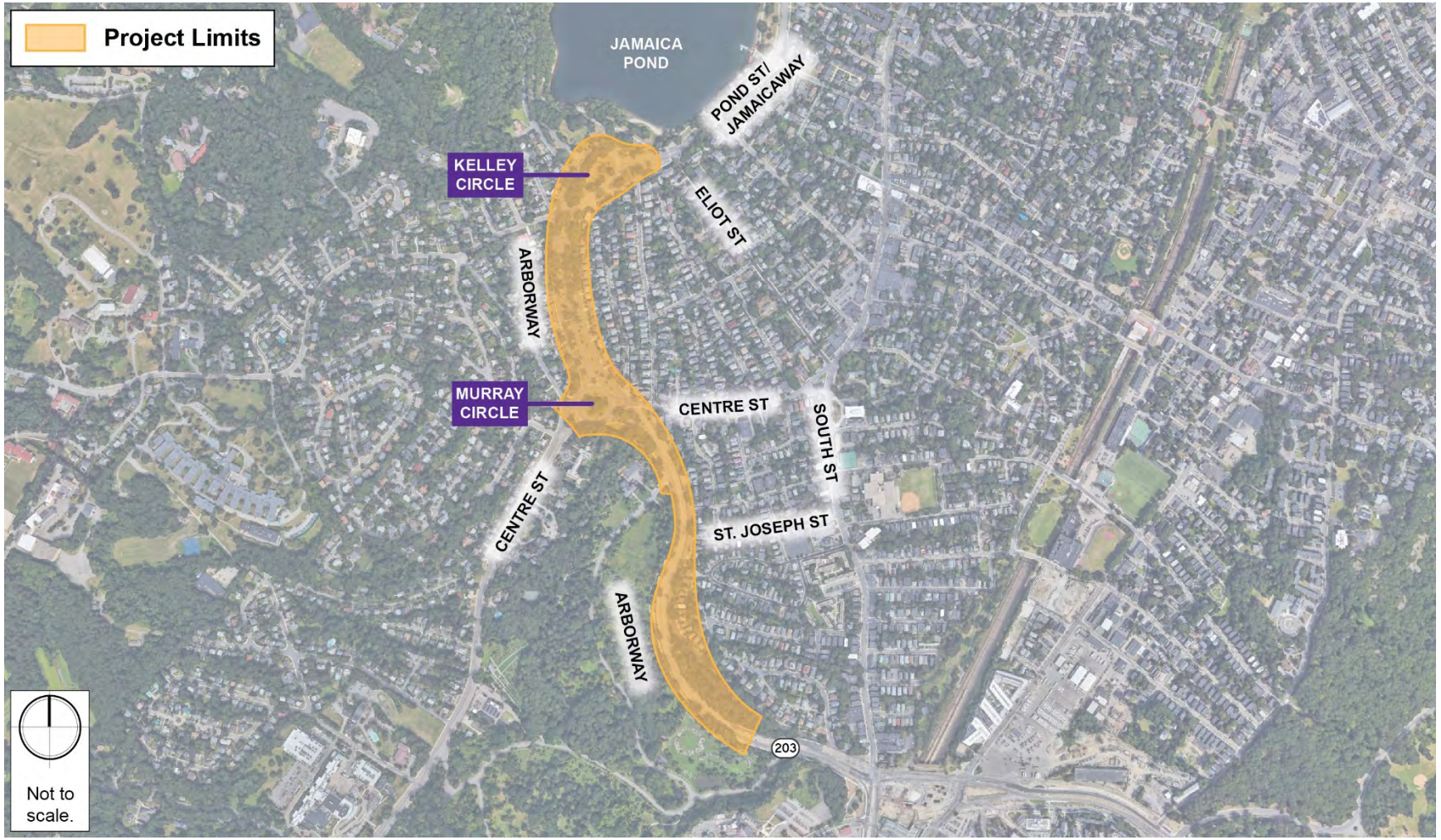


Figure 2: Study Area Jurisdiction

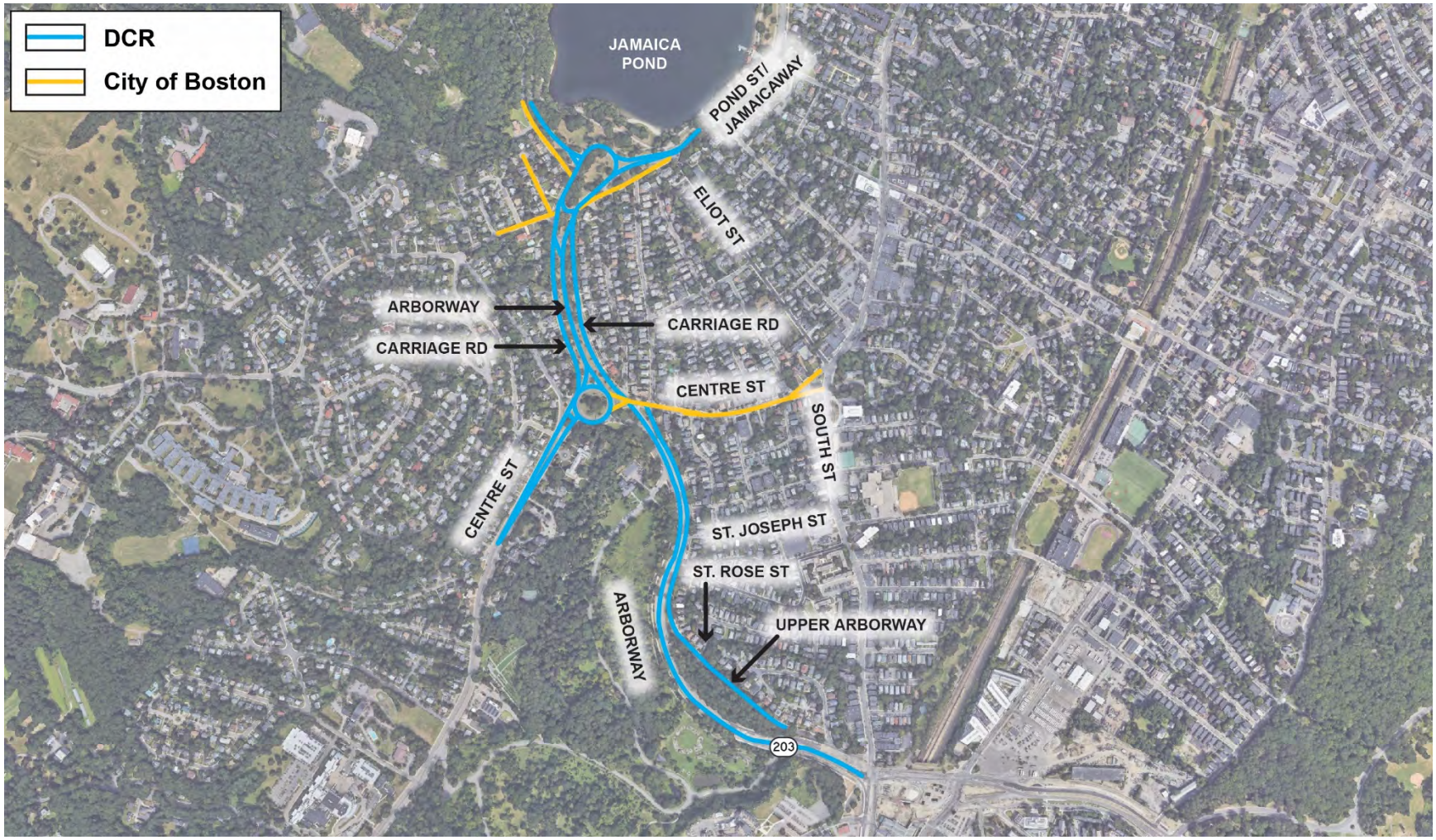


Figure 3: Murray Circle

Figure 4: Kelley Circle

Project Crash Data

Crash data was compiled for the study area, including the Arborway north of South Street to just east of Kelley Circle, as well as, Murray Circle, including the intersection of Centre Street at the Arborway, and Kelley Circle, including the intersection of the Arborway at Pond Street and Cataumet Street for the time period between 2015-2017.

Throughout the study area, 107 crashes were reported between 2015-2017. The segment of the Arborway **between Murray Circle and north of South Street**, 27 crashes were reported, including eight crashes (30%) that resulted in personal injury. Of the 27 crashes, 12 (44%) were single-vehicle crashes; eight (30%) were rear-end crashes, four (15%) were sideswipe crashes, one (4%) were angle crashes, and two (7%) were head-on crashes. Three of the rear-end crashes were due to uninvolved pedestrians within the crosswalk. Two crashes involved parked vehicles, one involved a bicycle, and one involved a pedestrian. Almost half of the crashes (49%) occurred between 8 a.m.-2:00 p.m.

At **Murray Circle and Centre Street at Arborway intersection**, 44 crashes were reported, including 12 crashes (27%) resulting in personal injury. Of the 44 crashes, 20 (45%) were sideswipe crashes, 17 (39%) were rear-end crashes, two (5%) were angle crashes, three (7%) were single-vehicle crashes, one was an unknown crash, and one was a rear-to-rear crash. One of the rear-ends occurred due to an uninvolved pedestrian, and two crashes involved bicycles. Over a quarter of the crashes (28%) occurred between 12:00 p.m.-2:00 p.m.

Between **Murray Circle and Kelley Circle**, five crashes were reported, including one crash (20%) resulting in personal injury. Of the five crashes, three (60%) were single-vehicle crashes, one (20%) was a rear-end crash, and one (20%) was a sideswipe crash.

At **Kelley Circle and Pond Street**, 31 crashes were reported, including five crashes (16%) resulting in personal injury. Of the 31 crashes, seven (23%) were rear-end crashes, nine (29%) were single-vehicle crashes, 13 (42%) were sideswipe crashes, and two were head-on crashes. One single-vehicle crash involved a cyclist, and almost half of the crashes (42%) of the crashes occurred in the dark.

Throughout the study area, four crashes with three injuries were reported involving cyclists, and one was reported involving a pedestrian resulting in an injury.

Audit Observations and Potential Safety Enhancements

The following sections will identify the safety issues observed by the RSA team at the Arborway, between Murray Circle and South Street, Murray Circle and Centre Street, the Arborway in between Murray Circle and Kelley Circle, and Kelley Circle and Eliot Street and will discuss the possible potential safety enhancements identified during the audit.

Overall Arborway Corridor

Speed, pedestrian, bicycle, and ADA accommodations and lighting were safety concerns that were identified along the corridor and are discussed in more detail in the following sections.

Safety Issue #1: Speed

The Arborway serves as part of the Emerald Necklace within the Jamaica Plain neighborhood of Boston. The Emerald Necklace provides a connection from Franklin Park in Roxbury to the Boston Common in downtown Boston. Audit members, including State Police, discussed speed as a critical safety issue in this area. It was mentioned at the RSA that although the Arborway is a parkway, it is designed and driven as a highway; a parkway should be treated as a park with a road running through it, as opposed to a road with a park around it. The speed limit is posted as 25 mph within the study area, which does not correlate with the design of the roadway.

Along the Arborway corridor within the study area, 107 crashes occurred between 2015-2017. Twelve of the 107 crashes were explicitly reported to have been due to motorists exceeding the speed limit or driving too fast for conditions. Nine of the 12 crashes and an additional nine crashes were out-of-control vehicles, which may also have been caused by excessive speed. Four crashes south of Murray Circle were single-vehicle crashes, traveling northbound, and crashing due to excessive speed. Between Kelley and Murray Circles, the Arborway and Carriage Roads consist of two relatively straight lanes with low volume access points, encouraging higher speeds. Five crashes involved out-of-control vehicles within the curve between Pond Street/Jamaicaway and Francis Parkman Drive. Excessive speeds may have contributed to some of the crashes, as no advisory speed signage is present.

Potential Enhancements:

1. Conduct a speed study to determine current speeds along the roadway to determine if speed limit is appropriate for the roadway.

2. Consider reducing the Carriage Roads to one lane in each direction.

3. Provide advisory speed and curve warning signage, where necessary, for roadway and rotary curvature.

4. Consider the implementation of radar speed feedback signs to help reduce vehicle travel speeds.

5. Narrow travel lanes, where possible.

Safety Issue #2: Pedestrian, Bicycle, and ADA Accommodations

There is a need for safe and comfortable pedestrian and bicycle connections to address the desire lines from Forest Hills and the Casey Arborway to the Arboretum and Jamaica Pond, as well as the residential areas in between. No pedestrian or cyclist wayfinding signage is provided through the study area directing pedestrians and cyclists to Jamaica Pond, the Casey Arborway, or the Arboretum.

Crosswalks are missing throughout the corridor, which again becomes an issue of continuity for users through the project area. In addition, compliant ramps are not present at any crosswalks throughout the corridor.

Potential Enhancements:

1. As no bicycle accommodations are provided, consider providing a shared-use path for pedestrians and cyclists connecting the Emerald Necklace at Jamaica Pond to Forest Hills. Shared-use paths should be 10 to 14 feet in width (8-foot minimum at choke points) to be used as a facility for both pedestrians and cyclists, according to the 2012 American Association of State Highway Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities*, 4th Edition.

2. As there have been four bicycle crashes and one pedestrian crash, perform a study to develop solutions to enhance pedestrian and bicycle circulation and ameliorate the dangerous conditions that discourage walkers and cyclists from traveling between Jamaica Pond and the Arboretum.

3. Provide wayfinding signage throughout the corridor to lead pedestrians and cyclists to Jamaica Pond to the north, the Arboretum, and the Casey Arborway to the south.

4. Evaluate placement for additional crosswalks through the corridor to improve continuity through the study area.

5. Review accessibility to ensure that ramps are ADA-compliant and reconstruct ramps that are not in compliance.

6. Evaluate sidewalk conditions and width, and review for obstructions that may impair visibility or access.

Safety Issue #3: Lighting

Along the Arborway, 27 of the 107 crashes reported, or 25%, occurred at night. South of Murray Circle, five of the 27 crashes, or 19%, occurred at night, which may indicate that the lighting is not sufficient along the roadway. Kelley Circle may have insufficient lighting as well, with 13 of the 31 crashes, or 42%, occurring at night.

Potential Enhancements:

1. Evaluate current streetlights to determine if lighting is sufficient. Provide additional lights, if necessary.

2. Provide reflectors on shoulders, retroreflective backplates, and retroreflective pavement markings.

The Arborway – Between Murray Circle and South Street

Existing roadway geometry, unclear pavement marking and signage, and the lack of pedestrian, bicycle, and ADA accommodations were safety issues that were identified for the area and are discussed in more detail in the following sections.

Figure 5: Section Between Murray Circle and South Street

Safety Issue #1: Geometry

Issues

While traveling northbound, the land use surrounding the Arborway shifts from parkland to residential; however, the geometry of the roadway does not change to accommodate the change in land use with two lanes in each direction separated by a median. Although the speed limit within the study area is posted at 25 mph, audit attendees discussed that the traffic flow travels much faster than 25 mph along the roadway. Some attendees were unfamiliar with the low speed limit as it is in conflict with the roadway geometry, which includes a median separating the northbound and southbound traffic. The lanes along this section of the Arborway vary between approximately 11-16 feet.

Vehicles crash into fence dividing the Arborway from the Upper Arborway road.

Four of the 27 crashes were reported as exceeding the authorized speed limit or driving too fast for conditions. All four crashes were single-vehicle crashes, all vehicles involved in these crashes were traveling northbound, and three crashed along the horizontal curve approaching the signalized pedestrian crossing approximately 400 feet south of the Arnold Arboretum driveway. Northbound vehicles may not have adequate sight distance to the midblock pedestrian crossing signal due to roadway geometry. This, combined with the high speeds vehicles travel along the roadway, may have led to the seven crashes involving the midblock pedestrian crossing. All seven crashes either involved pedestrians or vehicles stopping for pedestrians.

One of the seven crashes occurred at the unsignalized crossing along the Upper Arborway adjacent to the signalized crossing. It should be noted that this crash occurred in 2016. In 2018, a raised crossing was implemented across the Upper Arborway, replacing a painted crosswalk that was in its place.

During the site walk, attendees observed that the grade and curvature on the Upper Arborway northbound at St. Rose Street may reduce the available sight distance. Two crashes, or 7%, occurred at the intersection, and one of the two involved a cyclist.

Vehicles are shown parked over the edge line of the shoulder, and doors extend into the lane when opened.

Audit members also discussed the unclear parking regulations along the shoulders along the Arborway. There is nowhere to patrol or pull over vehicles along the roadway except in the wide shoulder used as a parking lane. The shoulder provides signage implying the shoulder is a parking lane but the lane appears to be of inadequate width, also negatively affects the sight distance of vehicles traveling southbound toward the signalized pedestrian crossing. Three crashes, or 11%, involved a parked car or vehicle exiting the shoulder.

Potential Enhancements:

1. Evaluate traffic calming measures along the Arborway to encourage motorists to travel at or below the speed limit, including reduced lane widths to an 11’ maximum width, reducing to a single lane in each direction, and rumble strips approaching crossings.

2. Evaluate shoulder width to formalize a parking lane and restrict parking where width is inadequate and additional width cannot be taken from travel lanes.

3. Consider restricting parking in close proximity to pedestrian crossings to improve sight distance for approaching vehicles.

4. Consider providing additional off-street parking for the Arboretum.

5. Evaluate approach sight distance to the signalized midblock crossing to ensure adequate sight distance is provided for motorists to safely stop, and add warnings for drivers, if necessary.

6. Check crashes at the unsignalized crossing along the Upper Arborway for the year following the implementation of the raised crossing to determine the influence on crashes.

7. Consider installation of a raised device on the Upper Arborway before St. Rose Street to reduce speed.

8. Provide advanced intersection warning signage on the Upper Arborway approaching St. Rose Street.

9. Consider restricting parking along the Upper Arborway adjacent to the intersection with St. Rose Street to improve sight distance for vehicles turning onto the Upper Arborway.

Safety Issue #2: Signage

Issues

Approximately 1,000 feet west of South Street, the Arborway has an approximately 1,500 feet long horizontal curve. There is signage to warn drivers of the upcoming curve traveling on the Arborway northbound, but the signage is not present at the point where vehicles were noted to crash into the fence and median separating the Arborway from the Upper Arborway and the opposing Arborway direction, respectively. Four of the 27 crashes involved a vehicle crashing into the fence. In addition, there is no warning or object marker signage along the median with the fence facing the Arborway, which may impair visibility along the median, especially at night.

No signage is present along the Arborway curve northbound approaching the signalized crossing.

Guide and lane usage signage are not provided at the Arborway northbound approach to Murray Circle, which may have led to one crash, where a vehicle switched lanes abruptly approaching the Circle.

It was discussed during the RSA that the crashes involving pedestrians at the signalized midblock crossing occurred before the installation of the advanced warning signage that was present during the site visit, installed within the past year. The crashes may have been due to the lack of advanced warning and may have improved since the installation.

Potential Enhancements:

1. Provide reflective markings, signage, etc. along roadway to improve nighttime visibility, especially with the curvature of the roadway.

2. Evaluate horizontal alignment signage and implement additional warning signage, if necessary.

3. Provide advanced signage to inform drivers no parking is allowed within the Arnold Arboretum to reduce the confusion RSA members discussed.

4. Evaluate if the newly installed advanced pedestrian crossing signage at the signalized pedestrian crossing reduced crashes along the roadway.

5. Provide wayfinding and pedestrian and cyclist signage.

Safety Issue #3: Pedestrian, Bicycle, and ADA Accommodations

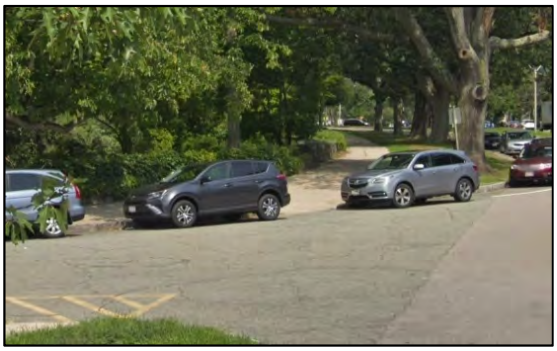
Issues

As mentioned previously, seven of the 27 crashes occurred at the crosswalk across the Arborway and Upper Arborway roads, south of the Arboretum driveway. The crossing across the Arborway is signalized with two post-mounted signals in each direction whereas, across the Upper Arborway segment, the crossing is unsignalized. With each direction of traffic traveling around a curve shortly before the crossing, sight distance may be an issue at the crossing as the signals are post-mounted without backplates. The pedestrian signal also does not have APS pushbuttons. In addition, since the crossing is midblock, drivers may not be expecting the signal. Audit members also discussed insufficient timings for the pedestrian signal. The clearances for pedestrians appeared to be too short for the length of the total crossing. Although there is a pedestrian pushbutton within the median, which may indicate the intention of a two-stage crossing, the pedestrian refuge is only approximately five feet wide, which is not compliant. The yellow and red clearance intervals also appeared short during our site visit, considering the speeds vehicles travel along the Arborway, which may lead to drivers stopping short at the crosswalk. Six of the 27 crashes were rear-end crashes occurring at the crosswalk.

Advanced bicycle and pedestrian warning signage are provided warning about both pedestrians and cyclists crossing; however, no guidance is given to the cyclists directing them to use the road or sidewalk through the study area.

Furthermore, during the RSA walk, concerns were raised about possible confusion by pedestrians utilizing the signalized and unsignalized crossings across the Arborway and Upper Arborway, respectively. The transition from signalized crossing to unsignalized crossing may create a false sense of security because, if pedestrians are crossing the signalized crossing first, they may think they can cross protected all the way through the Upper Arborway. Similarly, a pedestrian coming from the unsignalized crossing first, may think they can cross the signalized crossing across the Arborway without having to wait for the walk indication. The raised crosswalk and warning signage that were provided in 2018 aim to mitigate this issue. One crash occurred due to a pedestrian not using the signal to safely cross the Arborway.

No clear bicycle accommodations are provided along the Arborway. The warning signage for motorists at the signalized crossing indicate the crossing is provided for both pedestrians and cyclists, but the sidewalks on either side are not signed as shared-use paths. There are also no bike lanes or shoulders cyclists can use due to parking along the Arborway and Upper Arborway. This section is part of a gap in bicycle accommodations between Jamaica Pond and the Casey Arborway.



Cars park in front of the pedestrian ramp, which obstructs the path for pedestrians.

The west ramp and the refuge island ramps at the signalized midblock crosswalk across the Arborway do not appear to be ADA-compliant. Ramps are provided on both sides of the Arboretum driveway that also do not appear to be ADA-compliant; there is no painted crosswalk, and vehicles tend to park blocking the southern ramp.

Potential Enhancements:

1. Determine if red and yellow clearance intervals for vehicles and the "flashing don't walk" interval for pedestrians are adequate to reduce rear-end crashes.

2. Evaluate the 85th percentile speed and adjust signal clearances as appropriate to reduce rear-end crashes.

3. Consider upgrading the pedestrian signal with mast arms to improve vehicular visibility or upgrading the signal to a High-Intensity Activated crosswalk (HAWK) signal.

4. Provide signage if pedestrian signal is two-stage.

5. Evaluate the possibility of providing a shared-use path for pedestrians and cyclists connecting the Emerald Necklace at Jamaica Pond to Forest Hills.

6. Consider connecting the Casey Arborway paths into the Upper Arborway.

7. Review accessibility to ensure that ramps are ADA-compliant and reconstruct ramps that are not in compliance. Upgrade and relocate pedestrian signals and pushbuttons as necessary to meet accessibility requirements.

8. Consider widening the pedestrian refuge island for pedestrians and cyclists crossing the Arborway due to the heavy use by cyclists and pedestrians with strollers.

9. Evaluate the potential for a raised crossing across the Arboretum driveway to prevent parking across the crosswalk and provide a safer crossing across a wide driveway.

Murray Circle and the Centre Street at Arborway Intersection

Signalized intersection operations, pedestrian, bicycle, and ADA accommodations, and geometry were safety concerns that were identified for the circle and adjacent intersection with Centre Street, and are discussed in more detail in the following sections.

Figure 6: Section at Murray Circle and the Centre Street at Arborway Intersection

Safety Issue #1: Signalized Intersection Operations

Issues

The signalized intersection of Centre Street at the Arborway is located east of Murray Circle. The Centre Street eastbound approach, the eastern exit leg of Murray Circle, consists of two lanes; however, it was observed that the majority of vehicles queue in the right lane because Centre Street eastbound merges to

one lane after the intersection. This causes vehicles to back up into Murray Circle, which was observed to cause congestion within the circle.

The signals are all post-mounted, which may affect motorists' sight distance of the signal indications. Although the signals are equipped with visors, a signal head facing Centre Street westbound on the Centre Street east/westbound splitter island is present and is visible as drivers approach the rotary from the Arborway northbound approach. Most of the signals are outside of the motorists' direct line of sight, which may lead to confusion. Two of the five crashes at the intersection were caused by vehicles making opposing movements believing they had the right of way, and one involved an emergency vehicle was hit trying to travel through the intersection, as there is no Opticom for emergency vehicles to travel through the intersection.

The signal facing the Centre Street eastbound approach is visible to the Arborway northbound traffic.

In addition, there is only one signalized pedestrian crossing across the Arborway approach. There is no crosswalk across Centre Street, which may cause eastbound delay if vehicles have to stop for crossing pedestrians, and it creates additional conflicts for pedestrians who are forced to cross without a protected phase.

Although no crashes were reported, the "near side" signal head for Prince Street may be blocked for approaching vehicles by the tree on the corner, and the overall design of the intersection does not provide clear direction for users.

Potential Enhancements:

1. Clarify lane use at the approaches to the signal by providing advanced lane use signage and pavement markings.

2. Update old signal equipment, providing 12" LED signal heads with backplates and retro-reflective borders and 16" LED countdown pedestrian signals to provide greater visibility for motorists and pedestrians.

3. Evaluate if mast arms should be implemented at the intersection to provide adequate sight distances.

4. Evaluate the pedestrian phasing and/or pedestrian recall. Pedestrian timings and clearance intervals should also be checked to ensure adequate time is provided to cross the intersection.

5. Evaluate the traffic signal cycle length for opportunities to reduce delay across all modes.

6. Consider adding or updating detection to further reduce delay across all modes.

7. Install Opticom for emergency vehicles.

8. Evaluate right-turn radius for Prince Street onto the Carriage Road.

Safety Issue #2: Geometry

Issues

Lane usage is not clear in Murray Circle causing many motorists to drive in the middle of one wide travel lane.

Murray Circle has a varied circulating width between approximately 30-60 feet. Without pavement markings, the circulating traffic lane usage varies from one to three or four lanes. There was queuing observed at the Centre Street eastbound approach during the RSA due to the circulating traffic using the rotary as one lane, even though the circulating width is approximately 40 feet near the approach. Although the circle did not appear to be congested, the entering traffic did not have an adequate gap due to the lack of lane usage signage and markings. There were 18 of the 44 crashes involving switching lanes sideswipes within the rotary or while entering or exiting the rotary.

The wide layout of the circle and lack of deflection also encourages high speeds through the rotary. Two crashes were caused due to vehicles driving too fast for conditions, and RSA attendees noted that speeds were a major concern traveling through the circle. The high entry and exit speeds also pose a safety risk for pedestrians and cyclists attempting to cross the rotary legs. The southbound Arborway exit is only 200 feet south of the Centre Street eastbound approach of Murray Circle. The close proximity between the entrance and exit corresponds with the crash cluster present, with 14 of 44 crashes occurring at this part of the rotary, with the majority being sideswipes. Ten of these 14 crashes involved vehicles attempting to exit the rotary onto the Arborway southbound.

In addition to the lack of markings and wide circulating width, no lane-use or guide signage is provided at approaches to inform motorists which lane they should be in to reach their desired exit leg of the rotary. Yield signs are present at all approaches, but most only have one yield sign and there are no yield lines. Ten of the 44 crashes occurred because a motorist failed to yield the right of way at the entry points to the rotary and while within the rotary. Five of 44 crashes occurred because a motorist, while attempting to enter Murray Circle, followed too closely and rear-ended the lead motorist. This may be due to the second vehicle seeing a gap in circulating traffic with the first vehicle not entering the rotary.

Murray Circle is laid out such that the northbound Arborway traffic is directed toward the Carriage Roads, as opposed to the mainline Arborway road. The geometry allows the vehicles to bypass Murray Circle completely, and proceed to the north toward Kelley Circle. The southbound Arborway and Carriage Roads enter the rotary within approximately 20 feet of each other, creating additional conflict points.

May Street runs adjacent to the northwest corner of the rotary. It has been closed off to the rotary with a mountable curb, but the street sign is still present facing the rotary. During the RSA, a garbage truck was witnessed exiting the rotary through the mountable curb onto May Street. Though the garbage truck may have permission to do so, it was noted to be a confusing area by RSA attendees.

Potential Enhancements:

1. Consider reconstructing all legs of the rotary to provide more deflection and help reduce vehicle speeds, improve sight lines, and provide a safer crossing for pedestrians and cyclists.

2. Consider providing pavement markings designating two lanes and narrowing roadway width within the rotary or consistent width for circulating traffic.

3. Consider placing lane use and wayfinding signage in advance of the rotary on approaches to instruct motorists which travel lanes may be used to exit versus for continuing through the rotary.

4. Consider adding advanced warning signage exiting the rotary onto Centre Street westbound for the signalized crossing approximately 200 feet west of the rotary.

5. Consider providing yield pavement markings on all lanes entering the rotary and providing yield signs on both sides of each entrance.

6. Conduct an origin-destination study to determine heavily traveled paths through the rotary to help determine necessary number of lanes and the potential for bypass lanes.

7. Explore options to consolidate rotary entrances, including considering the potential to merge the southbound Carriage Road prior to the rotary or if the Carriage Road is necessary for the current traffic.

8. Evaluate alternatives for full intersection reconstruction including, but not limited to, decreasing the width of the rotary, converting the rotary into a modern roundabout, or converting into a signalized intersection.

9. Evaluate the May Street configuration and determine if additional clarity can be provided to reduce confusion. Consider additional physical obstruction to block off May Street.

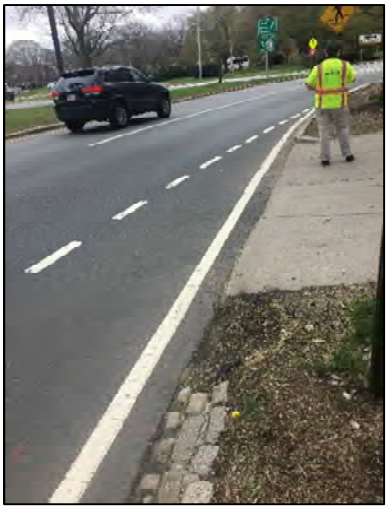
Safety Issue #3: Pedestrian, Bicycle, and ADA Accommodations

Issues

The signalized crossing across Arborway at Centre Street does not have ramps or pedestrian head with countdowns.

Through Murray Circle, many approaches are missing crossings or pedestrian ramps. There is no crossing along the eastern leg of the rotary. In addition, there is currently no crossing across the eastern segment of Centre Street until over 800 feet east of the rotary. Pedestrians have no safe way to cross Centre Street. MBTA routes 35 and 37/38 are present on this leg of Centre Street, creating demand to cross Centre Street. In addition, it was noted that at the Upper Arborway at Centre Street, a crosswalk was present across the Upper Arborway road; however, after the road was repaved, the crosswalk was not repainted. Around the rotary, the crossings force pedestrians to cross two lanes of traffic at a time with no RRFB or HAWK signal assisting in the crossing. Pedestrian crossing warning signs are provided for some but not all pedestrian crossings around the rotary. One crash of the 44 reported crashes was a rear-end involving a vehicle stopping for pedestrians while exiting the rotary northbound onto the Arborway. The existing pedestrian signals do not have APS pushbuttons, nor do they have a countdown. The crosswalks are also not all marked the same way; for instance, the Prince Street crosswalk does not have ladder markings.

Drivers' attention when entering the rotary is often focused on finding a gap in oncoming traffic within the rotary and often are not expecting or looking for crossing pedestrians. While only one crash involved a pedestrian and few were witnessed during the RSA, crossing the rotary at every leg was notably difficult during the RSA, and can often lead to a double-threat crash where one lane stops, and the other lane does not. The RSA participants felt that the relatively low number of walkers and cyclists observed in this location was due to their deliberate avoidance of the area.



Bicycle lanes taper at the Carriage Road southbound approach to the rotary.

A signalized pedestrian crossing is present approximately 200 feet southwest of Murray Circle on Centre Street. It is pre-timed to meter the traffic entering the rotary and is also pushbutton activated to allow pedestrians to safely cross the road. This signal has 6" red signal heads and signage that are both not MUTCD compliant.

A bicycle lane is provided approaching Murray Circle from the western leg of Centre Street. The end of the bicycle lane happens with a "bike lane ends" sign approximately 450 feet away from the rotary and a dotted taper. There is no direction given to cyclists entering the rotary through signage or pavement markings, leaving them to navigate the rotary. The lack of protected infrastructure leaves cyclists vulnerable to entering and exiting rotary traffic, as well as the circulating traffic. Two of 44 crashes involved cyclists; one

cyclist was hit within the rotary, and one cyclist was hit on the eastern leg of Centre Street crossing the northbound Arborway approach. During the RSA, a cyclist was observed on the roadway circulating the rotary.

No pedestrian or cyclist wayfinding signage is provided through the study area for Jamaica Pond and the Casey Arborway for pedestrian and cyclist connections, as well as the Arboretum for pedestrians. The only signage provided is a bike route sign at the Arborway southbound exit. In addition, the bus stops along the eastern leg of Centre Street are signed but may be blocked by trees. During a site visit, a pedestrian asked for directions toward the bus stop.

Potential Enhancements:

1. Review all wheelchair ramps to ensure that they are ADA-compliant and reconstruct ramps that are not in compliance.

2. Upgrade and relocate pedestrian signals and pushbuttons as necessary to meet accessibility requirements.

3. Reinstall crosswalk across the Upper Arborway that was removed after recent repaving.

4. Determine optimal location and jurisdiction for a crosswalk across Centre Street by #891 Centre Street.

5. Provide wayfinding signage for cyclists and pedestrians, as well as pedestrian warning signage at the approaches and exits to the circle.

6. Consider providing a shared-use path or separated bike lane and sidewalk for pedestrians and cyclists around the rotary.

7. Evaluate crosswalks around the rotary and signalize crossings where necessary.

8. Consider traffic calming measures at the signalized crossing on Centre Street to allow for vehicles to stop safely when approaching and exiting the rotary.

The Arborway – Between Kelley Circle and Murray Circle

Roadway geometry, and pedestrian, bicycle, and ADA accommodations were safety concerns that were identified in this segment of the roadway and are discussed in more detail in the following sections.

Figure 7: Section Between Kelley Circle and Murray Circle

Safety Issue #1: Geometry

Issues

Although there were only five crashes reported along this corridor, issues were noted through the RSA site walk observations. Vehicles are guided from both the north and south into the Carriage Roads, meant for local access, as opposed to the main Arborway roads. The main Arborway roadways between Kelley

and Murray Circles are underutilized due to the use of the Carriage Roads, which in turn impacts the operations of the rotaries; the Carriage Roads were not designed to carry the volume that currently use the roads. The roadway itself is wider along the Carriage Roads when compared to the main Arborway roadways, which again encourages travel on the Carriage Roads.

All five of the reported crashes occurred on the Carriage Roads. The northbound Carriage Road merges from two lanes to one lane approaching Kelley Circle. The lane markings end, but no signage indicates the need for motorists to merge. One of the five crashes involved vehicles switching lanes approaching the merge on the Carriage Road.

The Carriage Road merges from two lanes to one lane with no warning for motorists.

The geometry of the road direct motorists straight onto the Carriage Roads, as opposed to the main Arborway roadway.

In addition, signage is unclear when exiting Kelley Circle southbound. For vehicles to remain on the main Arborway roadway they need to stay to the left, versus staying straight, which leads to the Carriage Road. Traveling northbound, the natural trajectory of the roadway places them on the Carriage Road, as they need to perform the uncomfortable maneuver of bearing left, enter Murray Circle, then immediately exit to access the Arborway.

Potential Enhancements:

1. Consider modifying the curb alignments to direct southbound traffic exiting Kelley Circle onto the main Arborway and away from the Carriage Road.

2. Consider reducing lane widths on the Carriage Roads or reducing the roads to one lane to reduce desire to bypass the main Arborway.

3. Consider closing off the Carriage Roads to the mainline, providing a connection at the south end of the Arborway and converting the Carriage Roads to two-way roadways.

4. Provide guide signage at entrances to the Carriage Roads to clarify intended usage and potentially prevent overuse of the Carriage Roads or provide guidance directing through traffic to use the main Arborway.

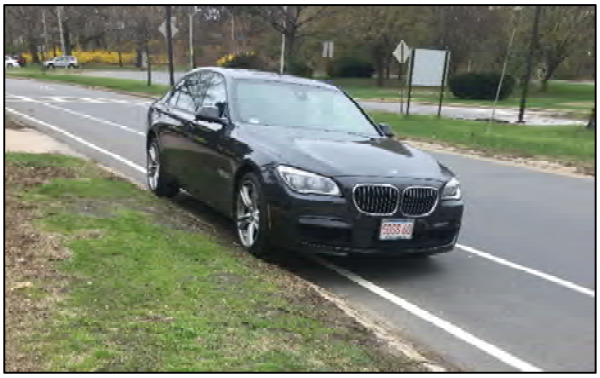
5. Provide clear signage and markings at the lane merge along the northbound Carriage Road to inform drivers.

6. Evaluate traffic calming methods along the Carriage Roads to reduce speed adjacent to residents, as well as along the main Arborway.

Safety Issue #2: Pedestrian, Bicycle, and ADA Accommodations

Issues

Along the Carriage Roads, an approximately five-foot shoulder is provided on the right. According to RSA members, the shoulder was originally marked as a bicycle lane, but due to the lack of connection at Kelley and Murray Circles, the markings were removed. This shoulder is now used at times for illegal parking. No bicycle accommodations are provided at either Kelley or Murray Circles; the shoulder ends with no warning signage, so cyclists using this shoulder are forced onto the roadway or sidewalk with no warning.



Vehicle is parked on the shoulder along the Carriage Road.

No pedestrian or cyclist wayfinding signage is provided through the study area for Jamaica Pond, the Casey Arborway, or the Arboretum for pedestrian and cyclist connections.

Potential Enhancements:

1. If a road diet is feasible, consider formalizing buffered or protected bicycle lanes along the shoulders with connections to bicycle accommodations beyond the Carriage Roads.

2. Turn the existing "No Parking" signs at a 45-degree angle to improve readability for motorists and reduce the illegal parking within the shoulders.

3. Consider providing a shared-use path for pedestrians and cyclists along the Carriage Roads, connecting the Emerald Necklace at Jamaica Pond to Forest Hills.

4. Check all wheelchair ramps and pedestrian crossings for ADA compliancy and perform any upgrades necessary.

Kelley Circle and Pond Street/Jamaicaway

Geometry and pedestrian, bicycle, and ADA accommodations were safety concerns that were identified and are discussed in more detail in the following sections.

Figure 8: Section at Kelley Circle and Pond Street/Jamaicaway

Safety Issue #1: Geometry

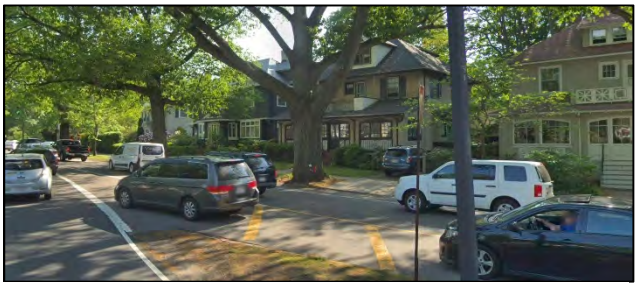
Issues

Kelley Circle connects Pond Street to the Arborway, as well as the residential roadways around the circle. Entering the circle from Pond Street westbound, the outside lane is a right-turn only lane onto Francis Parkman Drive, which can lead to vehicles getting trapped in the lane. As vehicles enter the rotary from Pond Street/Jamaicaway, they tend to traverse the pavement markings to access the rotary due to the short entrance. At least one of the crashes occurred in conflict with the right-turn only lane.

Francis Parkman Drive enters the rotary in a right-turn only lane towards the western leg of Pond Street. This requires motorists heading east toward the eastern leg of Pond Street to enter and cross three lanes of traffic to travel around Kelley Circle. During the RSA, finding gaps in circulating traffic to enter and cross lanes was noted to be an issue, especially during the afternoon peak. Two rear-end crashes occurred at the entrance to the rotary, possibly due to the first vehicle struggling to find a gap in the traffic. Vehicles tend to look left to find a gap in traffic and fail to look right towards the crossing, which may have led to one of the crashes with a cyclist in the crossing.

The pavement markings indicating lane use is provided after the motorist's decision point.

The Carriage Road merges from two to one lane, approximately 400 feet before the pedestrian signal at the rotary. Many motorists were witnessed changing lanes over the gore, which was the cause of one of the 31 reported crashes to avoid the exit only lane 300 feet north of the signalized crossing. In addition, approaching the exit onto Pond Street/Jamaicaway, pavement markings indicating lane use are placed near the split, leaving motorists without enough distance to safely switch lanes. This may have contributed to four of the 31 crashes. The traffic control at the pedestrian signal is unclear. In a typical rotary, traffic entering the rotary would yield to circulating traffic. However, the pedestrian signal gives the Arborway northbound traffic a green signal when the pedestrian signal is not activated. Although no crashes were reported involving a conflict with the U-turn and northbound traffic, the green signal for the Arborway approach and lack of yield control at the U-turn makes the vehicular right of way unclear.



Vehicles entering the rotary from the Carriage Road switch lanes onto the Arborway through the gore to avoid the Pond Street/Jamaicaway exit only lane.

Kelley Circle provides a U-turn before the signal at Arborway and Pond Street/Cataumet Street, and a U-turn after the signal to proceed towards Pond Street and Jamaicaway. The U-turn after the intersection at Pond Street requires motorists to merge with the Arborway just south of the intersection with the Carriage Road on the other side. No crashes were reported at these U-turns, but the curvature suggests the need for curve warnings and advisory speed signage. In addition, the redundancy of the U-turns adds more conflict points at an already confusing location.

The large footprint of the rotary, confusing geometry, and lack of guide signage may have contributed to the sideswipes, both within the rotary, as well as entering and exiting the rotary. There were 13 crashes involving vehicles switching lanes. In addition, on Google Maps there is a vehicle going the wrong way on the southern end of the rotary.

The high number of secondary entrance and exit roadways within the rotary (such as the Pond Street extension road and Prince Street) add to motorist confusion. An RSA attendee mentioned the difficulty of entering the southern portion of Prince Street from the rotary due to the proximity to the Arborway entrance, coupled with high circulating speeds.

Potential Enhancements:

1. Evaluate the need for warning signage around the northern curve of the circle.

2. Provide adequate warning signage for merges approaching the circle, yield signage at approaches, and one-way/wrong way signage through the rotary, as well as markings for guidance.

3. Provide reflectors on shoulders, retroreflective backplates on the signals, and retroreflective pavement markings.

4. Consider consolidating the two U-turn segments at the southern end of the circle.

5. Conduct origin-destination counts to determine the need for the right-turn only lane from Pond Street to Francis Parkman Drive and the overall lane usage through the rotary and restripe as necessary.

6. Provide advanced wayfinding and guide signage for entering and circulating vehicles to inform motorists on lane usage and destinations at exits of the rotary.

7. Consider reconstructing the legs to the rotary to provide more deflection, especially at the Arborway northbound approach, and help reduce vehicle speeds, improve sight lines, and provide a safer crossing for pedestrians and cyclists.

8. Provide merge signage for the Carriage Road northbound approach.

9. Evaluate alternatives for full intersection reconstruction including, but not limited to, decreasing the width of the rotary, converting the rotary into a modern roundabout, or converting into one or multiple signalized intersections.

10. Determine Right of Way at the northbound entrance to the rotary. Provide yield signs at the U-turn or a flashing yellow light at the Arborway northbound approach, depending on the resolution.

Safety Issue #2: Pedestrian, Bicycle, and ADA Accommodations

Issues

Signalized crossings are provided around Kelley Circle at the signalized intersection of the Arborway southbound at Pond Street, as well as at the Arborway northbound approach. Unsignalized crosswalks are present at the southern leg of Prince Street and at Francis Parkman Drive. No crossing is provided along the northern leg of Prince Street. There is also no crossing across Orchard Street or Dunster Road, along the sidewalk provided to connect pedestrians from the southern end of the circle to Pond Street/Jamaicaway, where a protected signalized crossing is provided at Eliot Street.

Most existing wheelchair ramps and pedestrian pushbuttons at the crossings do not appear to be ADA-compliant. The signals at the southern section of the rotary, at Pond Street and the northbound entrance to the rotary, do not have Accessible Pedestrian Signals (APS), nor do they have countdown signal heads.

The pedestrian signals at the Arborway northbound entrance to the rotary are outdated, and the wheelchair ramps are in poor condition.

The Emerald Necklace continues through the corridor, but the biking path along the Emerald Necklace borders the northern section of the rotary and ends at Francis Parkman Drive. At this point, sidewalks continue, but there are no bicycle accommodations through the rotary. Drivers are focused on finding a gap in traffic and are not looking for crossing pedestrians. One crash occurred at Francis Parkman Drive, with a cyclist struck within the crosswalk.

Potential Enhancements:

1. Evaluate the pedestrian phasing and/or pedestrian recall to help reduce delay at both the signal at Pond Street/Cataumet Street and at the pedestrian signal across the Arborway northbound entrance to the rotary. Pedestrian timings and clearance intervals should also be checked to ensure adequate time is provided to cross the intersection. Signal equipment should be updated, as necessary.

2. Provide crosswalk and reciprocal ramp across the northern Prince Street leg to continue pedestrian accommodations around the circle, as well as across Orchard Street and Dunster Road.

3. Consider providing a shared-use path for pedestrians and cyclists connecting the Emerald Necklace at Jamaica Pond to Forest Hills.

4. Check all wheelchair ramps and pedestrian crossings for ADA compliancy and perform any upgrades necessary.

5. Improve signage to provide adequate warning signage at all crossings and consider providing wayfinding signage for pedestrians and cyclists for major destinations.

6. Evaluate the potential for a contra-flow bicycle lane on the Pond Street one-way extension from Pond Street/Jamaicaway to Orchard Street.

7. Consider an off-road bicycle connection between the shoulder at the Carriage Road northbound, where the road begins to narrow to the Pond Street extension road to direct cyclists to the local roads, as well as to the signal across Pond Street/Jamaicaway.

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 estimated cost ranges of low-cost, medium-cost, and high-cost projects. On the following pages, **Tables 3-7** provide estimates of the time frame and cost of each potential safety issue that may address each of the identified safety issues.

Table 2: Estimated Time Frame and Costs Breakdown

Time Frame	
Short-Term	<1 Year
Mid-Term	1-3 Years
Long-Term	>3 Years

Costs	
Low	<$10,000
Medium	$10,001-$50,000
High	>$50,000

Table 3: Potential Safety Enhancement Summary – Overall Arborway Corridor

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Speed	Conduct a speed study to determine current speeds along the roadway to determine if speed limit is appropriate for the roadway.	Medium	Mid-Term	Medium	DCR
Speed	Consider reducing the Carriage Roads to one lane in each direction.	High	Mid-Term	Medium	DCR
Speed	Provide advisory speed signage, where necessary, for roadway and rotary curvature.	Medium	Mid-Term	Medium	DCR
Speed	Consider the implementation of radar speed feedback signs to help reduce vehicle travel speeds.	Low	Short-Term	Low	DCR
Speed	Narrow travel lanes, where possible.	Medium	Mid-Term	Medium	DCR
Pedestrian, Bicycle, and ADA Accommodations	As the study area doesn't provide any bicycle accommodations, consider providing a shared-use path for pedestrians and cyclists connecting the Emerald Necklace at Jamaica Pond to Forest Hills. Shared-use paths should be 10 to 14 feet in width (8-foot minimum at choke points) to be used as a facility for both pedestrians and cyclists, according to the 2012 American Association of State Highway Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities,* 4th Edition.	Medium	Long-Term	High	DCR
Pedestrian, Bicycle, and ADA Accommodations	As there have been four bicycle crashes and one pedestrian crashes within the study area, perform a study to develop solutions to enhance pedestrian and bicycle circulation and ameliorate the dangerous conditions that discourage walkers and cyclists from traveling between Jamaica Pond and the Arboretum.	Medium	Mid-Term	Medium	DCR
Pedestrian, Bicycle, and ADA Accommodations	Provide wayfinding signage throughout the corridor to lead pedestrians and cyclists to Jamaica Pond to the north, the Arboretum, and the Casey Arborway to the south.	Low	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Evaluate placement for additional crosswalks through the corridor to improve continuity through the study area.	Medium	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Review accessibility to ensure that ramps are ADA-compliant and reconstruct ramps that are not in compliance.	Low	Short-Term	Medium	DCR

Table 3: Potential Safety Enhancement Summary – Overall Arborway Corridor (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Pedestrian, Bicycle, and ADA Accommodations	Evaluate sidewalk conditions and width, and review for obstructions that may impair visibility or access.	Low	Short-Term	Medium	DCR
Lighting	Evaluate current streetlights to determine if lighting is sufficient. Provide additional lights, if necessary.	Medium	Short-Term	Medium	DCR
Lighting	Provide reflectors on shoulders, retroreflective backplates, and retroreflective pavement markings.	Medium	Short-Term	Low	DCR

Table 4: Potential Safety Enhancement Summary – The Arborway – Between Murray Circle and South Street

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Geometry	Evaluate traffic calming measures along the Arborway to encourage motorists to travel at or below the speed limit, including reduced lane widths to an 11' maximum width, reducing to a single lane in each direction, and rumble strips approaching crossings.	High	Mid-Term	Medium	DCR
Geometry	Evaluate shoulder width to formalize a parking lane and restrict parking where width is inadequate and additional width cannot be taken from travel lanes.	Medium	Short-Term	Low	DCR
Geometry	Consider restricting parking within 40 feet of the pedestrian crossings to improve sight distance for approaching vehicles.	Medium	Short-Term	Low	DCR
Geometry	Consider providing additional off-street parking for the Arboretum	Low	Short-Term	Low	Arboretum
Geometry	Evaluate approach sight distance to the signalized midblock crossing to ensure adequate sight distance is provided for motorists to safely stop, and add warnings for drivers, if necessary.	Low	Short-Term	Low	DCR
Geometry	Check crashes at the unsignalized crossing along the Upper Arborway for the year following the implementation of the raised crossing to determine the influence on crashes.	Low	Short-Term	Low	DCR
Geometry	Consider installation of a raised device on the Upper Arborway before St. Rose Street to reduce speed.	Medium	Mid-Term	Low	DCR
Geometry	Provide advanced intersection warning signage on the Upper Arborway approaching St. Rose Street.	Low	Short-Term	Low	DCR
Geometry	Consider restricting parking along the Upper Arborway adjacent to the intersection with St. Rose Street to improve sight distance for vehicles turning onto the Upper Arborway.	Low	Short-Term	Low	DCR
Pavement Marking and Signage	Provide reflective markings, signage, etc. along roadway to improve nighttime visibility, especially with the curvature of the roadway.	Medium	Short-Term	Low	DCR

Table 4: Potential Safety Enhancement Summary – The Arborway – Between Murray Circle and South Street (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Pavement Marking and Signage	Evaluate horizontal alignment signage, and implement additional warning signage, if necessary.	Medium	Short-Term	Low	DCR
Pavement Marking and Signage	Provide advanced signage to inform drivers no parking is allowed within the Arnold Arboretum to reduce the confusion RSA members discussed.	Low	Short-Term	Low	DCR
Pavement Marking and Signage	Evaluate if the newly installed advanced pedestrian crossing signage at the signalized crossing reduced crashes along the roadway.	Low	Short-Term	Low	DCR
Pavement Marking and Signage	Provide wayfinding and pedestrian and cyclist signage.	Low	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Determine if red and yellow clearance intervals for vehicles and the "flashing don't walk" interval for pedestrians are adequate to reduce rear-end crashes.	Medium	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Evaluate the 85th percentile speed and adjust signal clearances, as appropriate to reduce rear-end crashes.	Medium	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Consider upgrading the pedestrian signal with mast arms to improve vehicular visibility or upgrading the signal to a High-Intensity Activated crosswalk (HAWK) signal.	High	Medium-Term	Medium	DCR
Pedestrian, Bicycle, and ADA Accommodations	Provide signage if pedestrian signal is two-stage	Low	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Evaluate the possibility of providing a shared-use path for pedestrians and cyclists connecting the Emerald Necklace at Jamaica Pond to Forest Hills.	Medium	Long-Term	High	DCR
Pedestrian, Bicycle, and ADA Accommodations	Consider connecting the Casey Arborway paths into the Upper Arborway.	Medium	Long-Term	High	DCR

Table 4: Potential Safety Enhancement Summary – The Arborway – Between Murray Circle and South Street (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Pedestrian, Bicycle, and ADA Accommodations	Review all accessibility to ensure that ramps are ADA compliant and reconstruct ramps that are not in compliance. Upgrade and relocate pedestrian signals and pushbuttons as necessary to meet accessibility requirements.	Low	Mid-Term	Medium	DCR
Pedestrian, Bicycle, and ADA Accommodations	Consider widening the pedestrian refuge island for pedestrians and cyclists crossing the Arborway, due to the heavy use by cyclists and pedestrians with strollers.	Medium	Mid-Term	Medium	DCR
Pedestrian, Bicycle, and ADA Accommodations	Evaluate the potential for a raised crossing across the Arboretum driveway to prevent parking across the crosswalk and provide a safer crossing across a wide driveway.	Medium	Mid-Term	Low	Arboretum

Table 5: Potential Safety Enhancement Summary – Murray Circle and Centre Street

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Signalized Intersection Operations	Clarify lane use at the approaches to the signal by providing advanced lane use signage and pavement markings.	Medium	Short-Term	Low	DCR
Signalized Intersection Operations	Update old signal equipment, providing 12” LED signal heads with backplates and retro-reflective borders and 16” LED countdown pedestrian signals to provide greater visibility for motorists and pedestrians.	Medium	Mid-Term	High	DCR
Signalized Intersection Operations	Evaluate if mast arms should be implemented at the intersection to provide adequate sight distances.	Medium	Long-Term	High	DCR
Signalized Intersection Operations	Evaluate the pedestrian phasing and/or pedestrian recall. Pedestrian timings and clearance intervals should also be checked to ensure adequate time is provided to cross the intersection.	Low	Short-Term	Low	DCR
Signalized Intersection Operations	Evaluate the traffic signal cycle length for opportunities to reduce delay across all modes.	Low	Short-Term	Low	DCR
Signalized Intersection Operations	Consider adding or updating detection to further reduce delay across all modes.	Low	Short-Term	Low	DCR
Signalized Intersection Operations	Install Opticom for emergency vehicles.	Medium	Mid-Term	Medium	DCR
Signalized Intersection Operations	Evaluate right-turn radius for Prince Street onto the Carriage Road.	Low	Short-Term	Low	DCR

Table 5: Potential Safety Enhancement Summary – Murray Circle and Centre Street (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Geometry	Consider reconstructing all legs of the rotary to provide more deflection and help reduce vehicle speeds, improve sight lines, and provide a safer crossing for pedestrians and cyclists.	High	Long-Term	High	DCR
Geometry	Consider providing pavement markings designating two lanes and narrowing roadway width within the rotary or consistent width for circulating traffic.	High	Short-Term	Low	DCR
Geometry	Consider placing lane use and wayfinding signage in advance of the rotary on approaches to instruct motorists which travel lanes may be used to exit versus for continuing through the rotary.	Medium	Mid-Term	Low	DCR
Geometry	Consider adding advanced warning signage exiting the rotary onto Centre Street westbound for the signalized crossing approximately 200 feet west of the rotary.	Medium	Short-Term	Low	DCR
Geometry	Consider providing yield pavement markings on all lanes entering the rotary and providing yield signs on both sides of each entrance.	Low	Short-Term	Low	DCR
Geometry	Conduct an origin-destination study to determine heavily traveled paths through the rotary to help determine necessary number of lanes and the potential for bypass lanes.	Low	Mid-Term	Low	DCR
Geometry	Explore options to consolidate rotary entrances, including considering the potential to merge the southbound Carriage Road prior to the rotary or if the Carriage Road is necessary for the current traffic.	High	Long-Term	High	DCR
Geometry	Evaluate alternatives for full intersection reconstruction including, but not limited to, decreasing the width of the rotary, converting the rotary into a modern roundabout, or converting into a signalized intersection.	High	Long-Term	High	DCR
Geometry	Evaluate the May Street configuration and determine if additional clarity can be provided to reduce confusion. Consider additional physical obstruction to block off May Street.	Low	Short-Term	Low	DCR

Table 5: Potential Safety Enhancement Summary – Murray Circle and Centre Street (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Pedestrian, Bicycle, and ADA Accommodations	Review all wheelchair ramps to ensure that they are ADA compliant and reconstruct ramps that are not in compliance.	Low	Mid-Term	Medium	DCR
Pedestrian, Bicycle, and ADA Accommodations	Upgrade and relocate pedestrian signals and pushbuttons as necessary to meet accessibility requirements.	Low	Mid-Term	Medium	DCR
Pedestrian, Bicycle, and ADA Accommodations	Reinstall crosswalk across the Upper Arborway that was removed after recent repaving.	Low	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Determine optimal location and jurisdiction for a crosswalk across Centre Street by #891 Centre Street.	Low	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Provide wayfinding signage for cyclists and pedestrians as well as pedestrian warning signage at the approaches and exits to the circle.	Low	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Consider providing a shared-use path or separated bike lane and sidewalk for pedestrians and cyclists around the rotary.	Medium	Long-Term	High	DCR
Pedestrian, Bicycle, and ADA Accommodations	Evaluate crosswalks around the rotary and signalize crossings where necessary.	Medium	Mid-Term	Medium	DCR
Pedestrian, Bicycle, and ADA Accommodations	Consider traffic calming measures at the signalized crossing on Centre Street to allow for vehicles to stop safely when approaching and exiting the rotary.	Medium	Mid-Term	Medium	DCR

Table 6: Potential Safety Enhancement Summary – The Arborway – Between Kelley Circle and Murray Circle

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Geometry	Consider modifying the curb alignments to direct southbound traffic exiting Kelley Circle onto the main Arborway and away from the Carriage Road.	Medium	Long-Term	High	DCR
Geometry	Consider reducing lane widths on the Carriage Roads or reducing the roads to one lane to reduce desire to bypass the main Arborway.	Medium	Long-Term	High	DCR
Geometry	Consider closing off the Carriage Roads to the mainline, providing a connection at the south end of the Arborway and converting the Carriage Roads to two-way roadways.	High	Long-Term	High	DCR
Geometry	Provide guide signage at entrances to the Carriage Roads to clarify intended usage and potentially prevent overuse of the Carriage Roads or provide guidance directing through traffic to use the main Arborway.	Medium	Short-Term	Low	DCR
Geometry	Provide clear signage and markings at the lane merge along the northbound Carriage Road to inform drivers.	Medium	Short-Term	Low	DCR
Geometry	Evaluate traffic calming methods along the Carriage Roads to reduce speed adjacent to residents, as well as along the main Arborway.	Medium	Mid-Term	Medium	DCR
Pedestrian, Bicycle, and ADA Accommodations	If a road diet is feasible, consider formalizing buffered or protected bicycle lanes along the shoulders with connections to bicycle accommodations beyond the Carriage Roads.	Medium	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Turn the existing “No Parking” signs at a 45-degree angle to improve readability for motorists and reduce the illegal parking within the shoulders.	Low	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Consider providing a shared-use path for pedestrians and cyclists along the Carriage Roads, connecting the Emerald Necklace at Jamaica Pond to Forest Hills.	Medium	Long-Term	High	DCR

Table 6: Potential Safety Enhancement Summary – The Arborway – Between Kelley Circle and Murray Circle (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Pedestrian, Bicycle, and ADA Accommodations	Check all wheelchair ramps and pedestrian crossings for ADA compliancy and perform any upgrades necessary.	Low	Short-Term	Medium	DCR

Table 7: Potential Safety Enhancement Summary – Kelley Circle and Eliot Street

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Geometry	Evaluate the need for warning signage around the northern curve of the circle.	Medium	Short-Term	Low	DCR
Geometry	Provide adequate warning signage for merges approaching the circle, yield signage at approaches, and one-way/wrong way signage through the rotary, as well as markings for guidance.	Medium	Short-Term	Low	DCR
Geometry	Provide reflectors on shoulders, retroreflective backplates on the signals, and retroreflective pavement markings.	Low	Short-Term	Low	DCR
Geometry	Consider consolidating the two U-turn segments at the southern end of the circle.	Medium	Long-Term	High	DCR
Geometry	Conduct origin-destination counts to determine the need for the right-turn only lane from Pond Street to Francis Parkman Drive and the overall lane usage through the rotary and restripe as necessary.	Medium	Mid-Term	Medium	DCR
Geometry	Provide advanced wayfinding and guide signage for entering and circulating vehicles to inform motorists on lane usage and destinations at exits of the rotary.	Medium	Short-Term	Low	DCR
Geometry	Consider reconstructing the legs to the rotary to provide more deflection, especially at the Arborway northbound approach, and help reduce vehicle speeds, improve sight lines, and provide a safer crossing for pedestrians and cyclists.	High	Long-Term	High	DCR
Geometry	Provide merge signage for the Carriage Road northbound approach.	Low	Short-Term	Low	DCR
Geometry	Evaluate alternatives for full intersection reconstruction including, but not limited to, decreasing the width of the rotary, converting the rotary into a modern roundabout, or converting into one or multiple signalized intersections.	High	Long-Term	High	DCR
Geometry	Determine right-of-way at the northbound entrance to the rotary. Provide yield signs at the U-turn or a flashing yellow light at the Arborway northbound approach, depending on the resolution.	Medium	Mid-Term	Medium	DCR

Table 7: Potential Safety Enhancement Summary – Kelley Circle and Eliot Street (continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Pedestrian, Bicycle, and ADA Accommodations	Evaluate the pedestrian phasing and/or pedestrian recall to help reduce delay at both the signal at Pond Street/Cataumet Street and at the pedestrian signal across the Arborway northbound entrance to the rotary. Pedestrian timings and clearance intervals should also be checked to ensure adequate time is provided to cross the intersection. Signal equipment should be updated, as necessary.	Medium	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Provide crosswalk and reciprocal ramp across the northern Prince Street leg to continue pedestrian accommodations around the circle, as well as across Orchard Street and Dunster Road.	Medium	Mid-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Consider providing a shared-use path for pedestrians and cyclists connecting the Emerald Necklace at Jamaica Pond to Forest Hills.	Medium	Long-Term	High	DCR
Pedestrian, Bicycle, and ADA Accommodations	Check all wheelchair ramps and pedestrian crossings for ADA compliancy and perform any upgrades necessary.	Low	Short-Term	Medium	DCR
Pedestrian, Bicycle, and ADA Accommodations	Improve signage to provide adequate warning signage at all crossings and consider providing wayfinding signage for pedestrians and cyclists for major destinations.	Low	Short-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Evaluate the potential for a contra-flow bicycle lane on the Pond Street one-way extension from Pond Street/Jamaicaway to Orchard Street.	Medium	Mid-Term	Low	DCR
Pedestrian, Bicycle, and ADA Accommodations	Consider an off-road bicycle connection between the shoulder at the Carriage Road northbound, where the road begins to narrow to the Pond Street extension road to direct cyclists to the local roads, as well as to the signal across Pond Street/Jamaicaway.	Medium	Mid-Term	Low	DCR

Appendix A. RSA Meeting Agenda

Agenda

Road Safety Audit

Boston, MA

Arborway – West of South Street to Eliot Street

Meeting Location:
Arnold Arboretum of Harvard University
Hunnewell Building Meeting Room
125 Arborway, Boston, MA

Monday, April 22nd, 2019
9:00 a.m.-1:30p.m.

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** • Meet at Arnold Arboretum Hunnewell Building Meeting Room
9:15 AM	**Discussion of Safety Issues** • Crash history – provided in advance • Existing Geometries and Conditions • Observe site from videos, street view, aerial maps • As a group, identify areas for improvement
10:00 AM	**Site Visit – Arborway, from west of South Street to Eliot Street**
12:00 PM	**Discussion of Potential Improvements (please feel free to bring a lunch)** • Discuss observations and finalize safety issue areas • Discuss potential improvements and finalize recommendations
1:30 PM	**Adjourn for the Day – but the RSA has not ended**

Instructions for Participants:

- **Before attending the RSA on Monday, April 22, 2019, participants are encouraged to drive through the parkway 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

Date: Monday, April 22, 2019 Location: Arnold Arboretum, Boston

Audit Team Members	Agency/Affiliation	Email Address	Phone Number
Sarah Freeman	Arborway Coalition	freemansherwood@hotmail.com	617-276-5093
Stephen Schneider	Arnold Arboretum	stephen_schneider@harvard.edu	
Eliza Parad	Boston Cyclists Union	eparad@bostoncyclistsunion.org	
James Salvia	Boston EMS	salvia@bostonems.org	
James Fitzgerald	Boston Planning & Development Agency (BPDA)	james.fitzgerald@boston.gov	
Chris Comeaux	BTD	chris.comeaux@boston.gov	
Nathaniel Fink	BTD Planning	nathaniel.fink@boston.gov	
Casey Claude	Central Transportation Planning Staff (CTPS)	cclaude@ctps.org	
Anne Fiesinger	DCR	anne.fiesinger@state.ma.us	617-626-1312
Patrice Kish	DCR	patrice.kish@mass.gov	617-626-1378
Jeff Parenti	DCR	jeffrey.parenti@mass.gov	617-626-1499
Karen Mauney-Brodek	Emerald Necklace Conservancy (ENC)	kmauney-brodek@emeraldnecklace.org	617-522-2700
Michael Pezzullo	FHWA	michael.pezzullo@dot.gov	
Amy Ingles	Howard Stein Hudson	aingles@hshassoc.com	617-348-3393
Michaela Savran	Howard Stein Hudson	msavran@hshassoc.com	617-348-3377
Bob Stathopoulos	Howard Stein Hudson	bstathopoulos@hshassoc.com	617-348-3364
Tony Lechuga	Livable Streets	tony@livablestreets.info	
Hameed Pervez	MassDOT District 6	hameed.pervez@state.ma.us	
Zach Veaner	MassDOT District 6	zachary.veaner@state.ma.us	
Michelle Deng	MassDOT Traffic Safety	michelle.deng@state.ma.us	
Ana Fill	MassDOT Traffic Safety	ana.fill@state.ma.us	
Lt. James Bassinotti	Massachusetts State Police	james.bazzinotti@state.ma.us	
Sarah Kurpiel Lee	Metropolitan Area Planning Council (MAPC)	skurpiel@mapc.org	
Wendy Landman	WalkBoston	wlandman@walkboston.org	

Appendix C. Detailed Crash Data

massDOT
Massachusetts Department of Transportation
Highway Division

CRASH DIAGRAM

SYMBOLS

Involved / Non-Involved

- Moving Vehicle
- Backing Vehicle
- Non-Involved Vehicle
- Pedestrian
- Bicycle
- Animal
- Direction of Motion
- Parked Vehicle
- Fixed Object

TYPE OF CRASH

- Head on
- Rear End
- Angle
- Turning Movement
- Sideswipe
- Out of Control
- Night Time Crash

SEVERITY

- (#) Injury
- (#) Fatal
- # Property Damage Only

BOSTON, MA

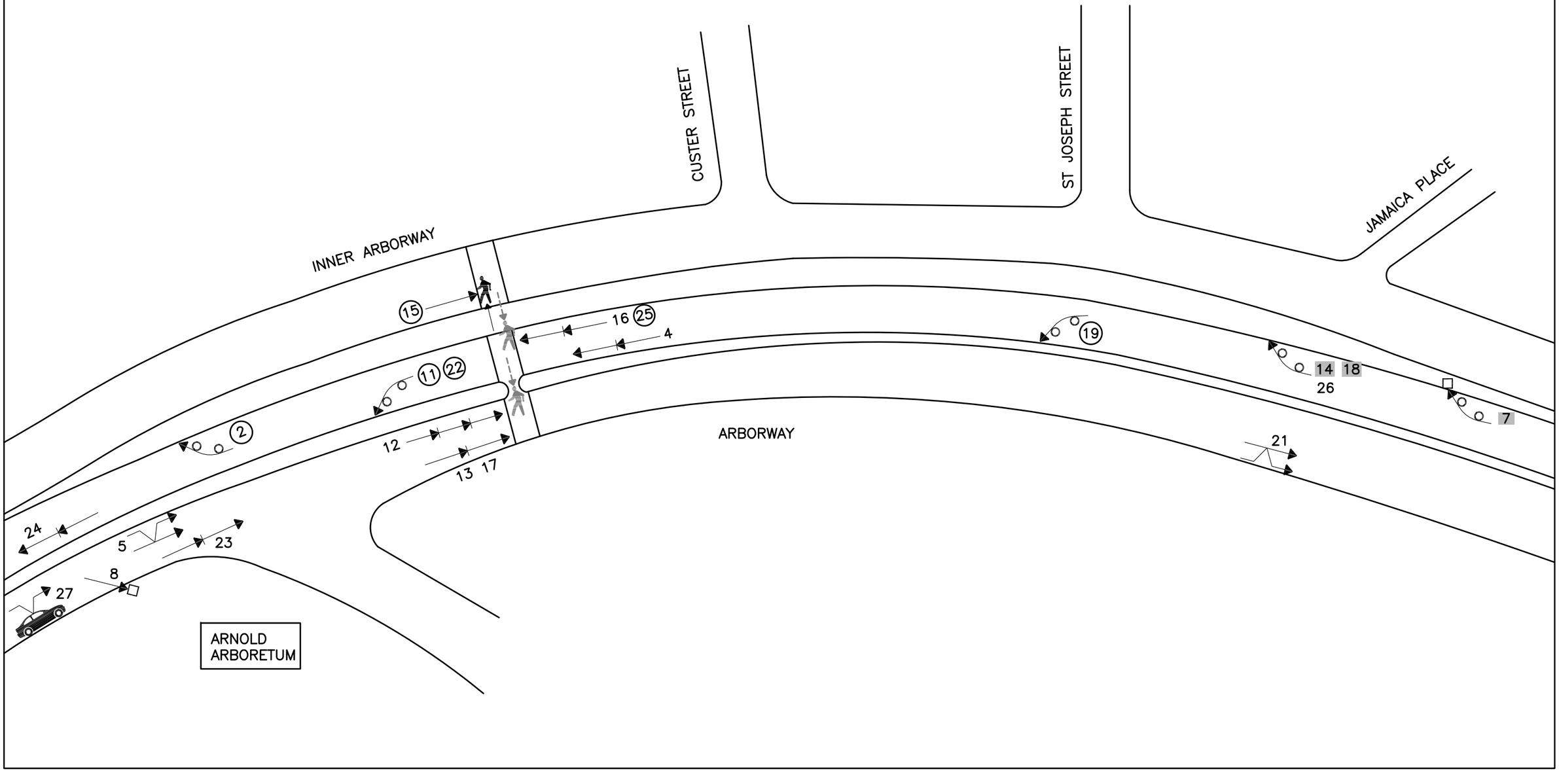
ARBORWAY – NORTH OF SOUTH STREET TO SOUTH OF MURRAY CIRCLE

REGION: MAPC

TIME PERIOD ANALYZED: 2015–2017
SOURCE OF CRASH REPORTS: STATE POLICE DEPARTMENT
DATE PREPARED: 2/8/2019
PREPARED BY: ACF

N

*NOT TO SCALE



massDOT
Massachusetts Department of Transportation
Highway Division

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- Angle
- Turning Movement
- Sideswipe
- Out of Control
- Night Time Crash

SEVERITY

- # Injury
- # Fatal
- # Property Damage Only

BOSTON, MA

ARBORWAY – NORTH OF SOUTH STREET TO SOUTH OF MURRAY CIRCLE

REGION: MAPC

TIME PERIOD ANALYZED: 2015–2017
SOURCE OF CRASH REPORTS: STATE POLICE DEPARTMENT
DATE PREPARED: 2/8/2019
PREPARED BY: ACF

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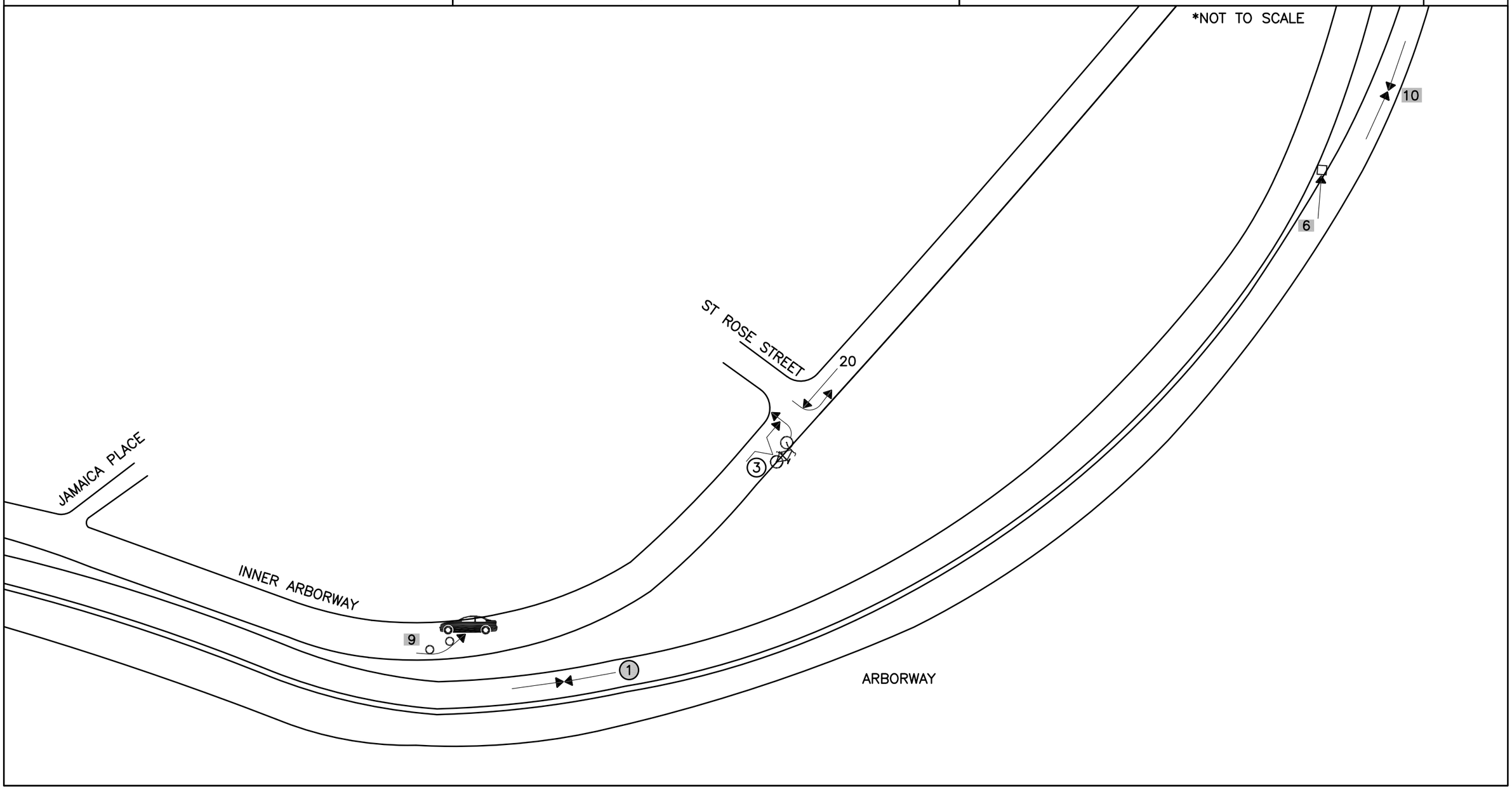
*NOT TO SCALE



Crash Data Summary Table

Arborway (South of Murray Circle), Boston, MA
2015 - 2017

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	D1 Age	D2 Age	D3 Age	D4 Age	Comments
#	*mm/dd/yy*	*Day*	*hh:mm*	*Type*	*Type*	*Type*	*Type*	*Type*	*#*	*#*	*#*	*#*	
1	01/01/15	Thursday	4:20 AM	Head on	Dark - lighted roadway	Clear	Dry	Wrong side or wrong way	39	25			MV 1 NB on Arborway and MV 2 SB on Arborway NB lanes. MV 2 struck MV 1 head-on.
2	03/09/15	Monday	10:48 AM	Single vehicle crash	Daylight	Clear	Dry	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	51				OUI crash (pain medicine). MV 1 NB on Arborway rolled on its side.
3	03/25/15	Wednesday	4:09 PM	Sideswipe, same direction	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	56	31			Inner Arborway. Bike SB on Inner Arborway making left turn when struck by bus traveling SB on Inner Arborway NB lanes.
4	08/12/15	Wednesday	8:15 AM	Rear-end	Daylight	Clear	Dry	Other improper action	61	51			MV 1 and MV 2 NB on Arborway. MV 1 slowed for pedestrian signal and MV 2 rear-ended MV 1.
5	09/07/15	Monday	5:05 PM	Sideswipe, same direction	Daylight	Clear	Dry	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	54	65			OUI crash. MV 1 and MV 2 SB on Arborway. MV 2 sideswiped MV 1 and then fled the scene.
6	10/13/15	Tuesday	8:02 PM	Single vehicle crash	Dark - lighted roadway	Unknown	Dry	Disregarded traffic signs, signals, road markings	34				MV 1 SB on Arborway struck attenuation barrier.
7	12/23/15	Wednesday	5:36 AM	Single vehicle crash	Dawn	Rain	Wet	Driving too fast for conditions	19				MV 1 NB on Arborway struck fence on side of the road. Vehicle lost control on wet pavement.
8	12/23/15	Wednesday	9:55 AM	Single vehicle crash	Daylight	Clear	Dry	Failure to keep in proper lane or running off road	82				MV 1 SB on Arborway drove off road and struck sign and small tree.
9	02/15/16	Monday	11:00 PM	Angle	Dark - lighted roadway	Snow	Snow	No improper driving	24	Unknown			Inner Arborway. MV 1 SB on Inner Arborway lost control and struck parked car in the NB lane.
10	03/05/16	Saturday	1:00 AM	Head on	Dark - lighted roadway	Clear	Dry	Disregarded traffic signs, signals, road markings	53	36			MV1 SB on Arborway. MV2 drove North in the South Lane on Arboway and headed on MV1.
11	04/04/16	Monday	1:18 PM	Single vehicle crash	Daylight	Snow	Snow	Driving too fast for conditions	26				MV 1 NB on Arborway lost control and hit light pole. Roadway was covered by snow and in the process of being plowed.
12	04/20/16	Wednesday	11:30 AM	Rear-end	Daylight	Clear	Dry	No improper driving	90	56	79		MV1, MV2 and MV3 EB on Arborway. MV2 slowed down to turn left and was rear-ended by MV1. MV3 Stopped for pedestrain and was rear-ended by MV2.
13	05/23/16	Monday	11:28 AM	Rear-end	Daylight	Clear	Dry	Unknown	57	29			MV 1 and MV 2 SB on Arborway. MV 1 stopped for pedestrian at crosswalk and MV 2 rear-ended MV 1. Signal was green at the time - pedestrian did not activate it. MV1 switched lanes just prior to crash.
14	6/29/16	Wednesday	6:26 AM	Single vehicle crash	Dawn	Cloudy	Wet	Fatigued/asleep	57	41			MV 1 NB on Arborway crashed through fence onto Inner Arborway. Operator had fallen asleep.
15	08/28/16	Sunday	6:18 PM	Single vehicle crash	Daylight	Clear	Dry	No improper driving	54	17	28		Inner Arborway. MV 1 SB on Inner Arborway. Pedestrian proceeded into crosswalk and MV 1 did not have time to stop. MV 1 indicated that pedestrian was obstructed from view by fence.
16	10/05/16	Wednesday	8:15 AM	Rear-end	Daylight	Clear	Dry	Followed too closely	58	58			MV1 and MV2 WB on Arborway. MV1 stoped for pedestrian and was rear-ended by MV2.
17	11/10/16	Thursday	1:50 PM	Rear-end	Daylight	Unknown	Dry	Followed too closely	40	42			MV 1 and MV 2 SB on Arborway. MV 2 slowed for pedestrian signal and MV 1 rear-ended MV 2.
18	11/30/16	Wednesday	10:40 PM	Single vehicle crash	Dark - lighted roadway	Rain	Wet	Driving too fast for conditions	21				MV 1 NB on Arborway lost control (hydroplaned) and hit fence.
19	01/10/17	Tuesday	9:10 AM	Single vehicle crash	Daylight	Clear	Dry	Exceeded authorized speed limit	25				MV 1 NB on Arborway lost control and struck a light pole due to a tire blow out.
20	05/25/17	Thursday	10:45 AM	Angle	Daylight	Rain	Wet	Failed to yield right of way	51	23			Inner Arborway. MV 1 WB on St. Rose St. MV 2 NB on Inner Arborway.
21	05/27/17	Saturday	3:19 PM	Sideswipe, same direction	Daylight	Clear	Dry	Inattention	25	27			MV 1 SB on Arborway. MV 2 parked on Arborway SB. MV 2 struck MV 1 pulling out of parking space.
22	05/28/17	Sunday	1:29 PM	Single vehicle crash	Daylight	Clear	Dry	History heart/epilepsy/fainting	37				MV 1 NB on Arborway. Operator appeared to have a seizure, lost control, struck the median and came to rest on the SB lanes.
23	06/22/17	Thursday	4:30 PM	Rear-end	Daylight	Clear	Dry	Followed too closely	41	41			OUI crash. MV 1 and MV 2 SB on Arborway. MV 1 rear-ended MV 2.
24	07/06/17	Thursday	11:57 AM	Rear-end	Daylight	Clear	Dry	No improper driving	54	61			MV1 and MV2 WB on Arborway. MV1 was cut off by a blue car and braked suddenly. MV2 rear-ended MV1.
25	08/20/17	Sunday	4:20 PM	Rear-end	Daylight	Clear	Dry	Distracted	19	56			MV 1 and MV 2 NB on Arborway. MV 1 distracted by P.E.D. being used for GPS rear-ended MV 2, stopped due to red light at pedestrian crossing.

Crash Data Summary Table

Arborway (South of Murray Circle), Boston, MA
2015 - 2017

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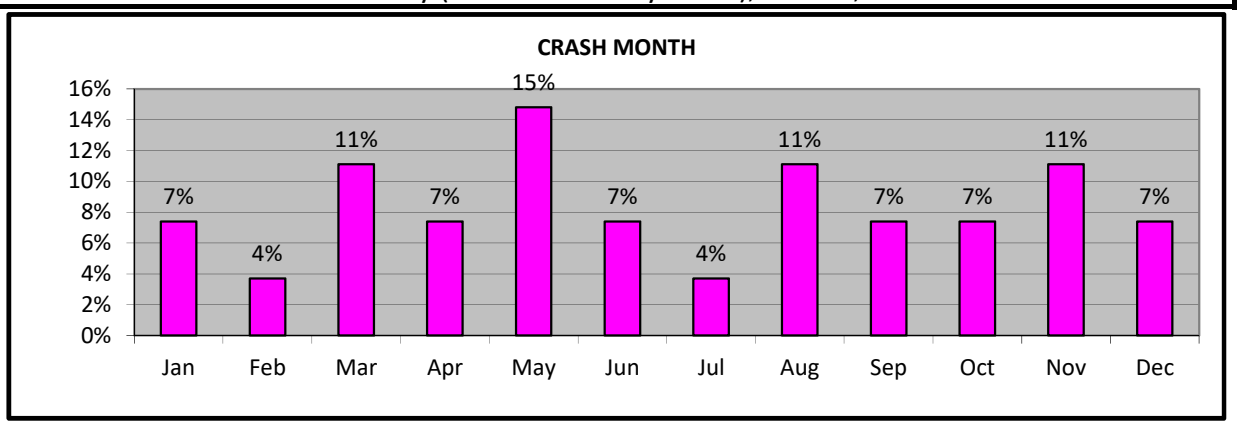
#	*mm/dd/yy*	*Day*	*hh:mm*	*Type*	*Type*	*Type*	*Type*	*Type*	#	#	#	#	
26	09/03/17	Sunday	1:22 PM	Single vehicle crash	Daylight	Rain	Wet	Failure to keep in proper lane or running off road	20				MV 1 NB on Arborway lost control of vehicle. MV 1 spun around after striking the curb and then struck small tree.
27	11/01/17	Wednesday	3:15 PM	Sideswipe, same direction	Daylight	Clear	Dry	Inattention	23	Unknown			MV2 legally parked on Arborway. MV1 travelled on Arborway and struck MV2.

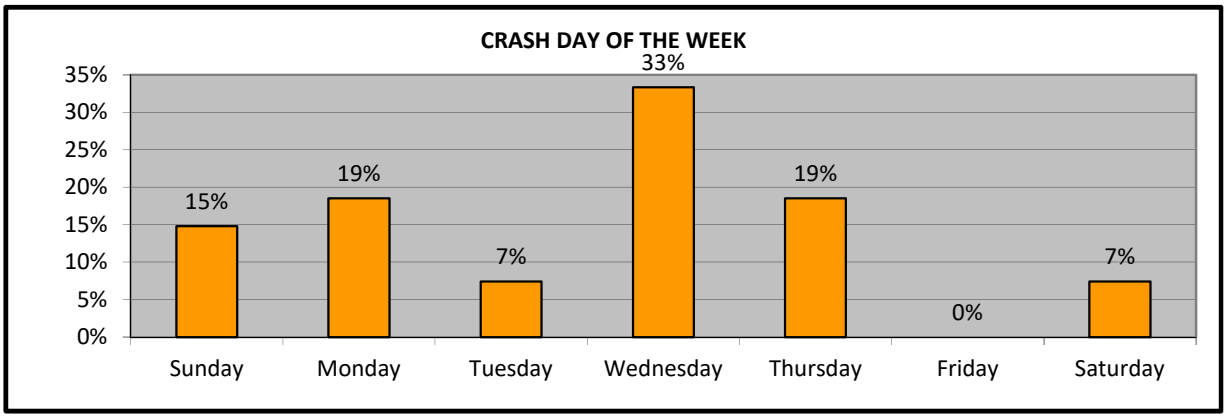
*Courtesy Crash - A term used to describe a crash that occurs subsequent to a non-involved mainline driver who gives the right of way, contrary to the rules of the road, to another driver.

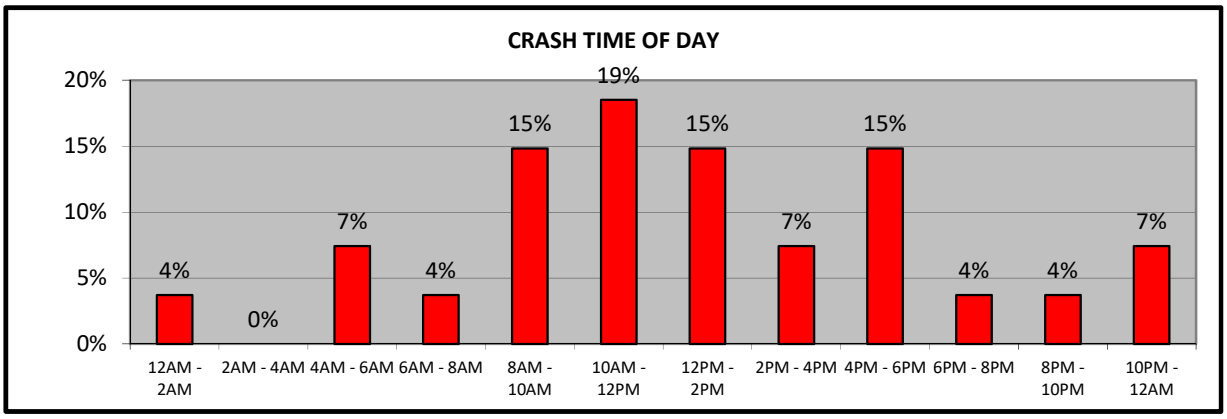
Summaries based on crash reports obtained from the State Police Department.

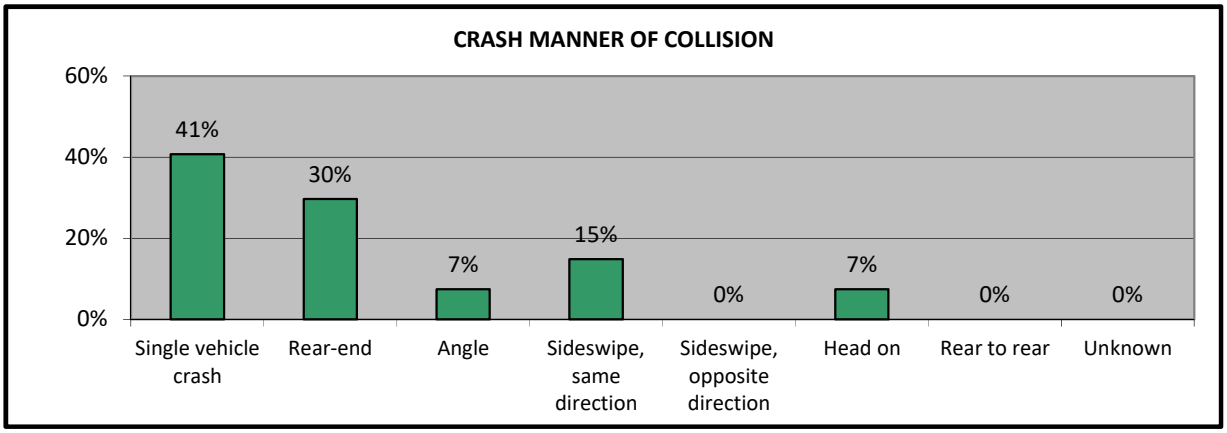
Crash Data Summary Charts

Arborway (South of Murray Circle), Boston, MA



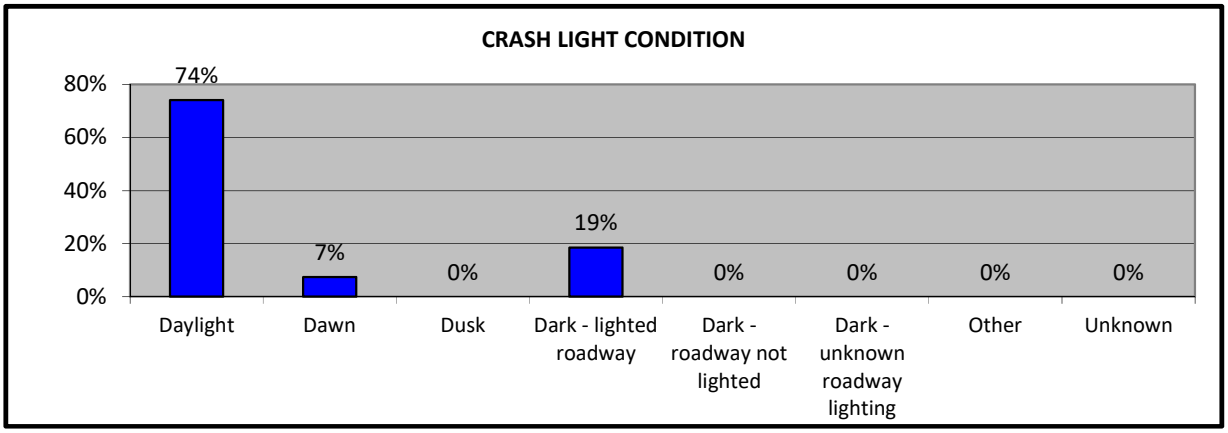


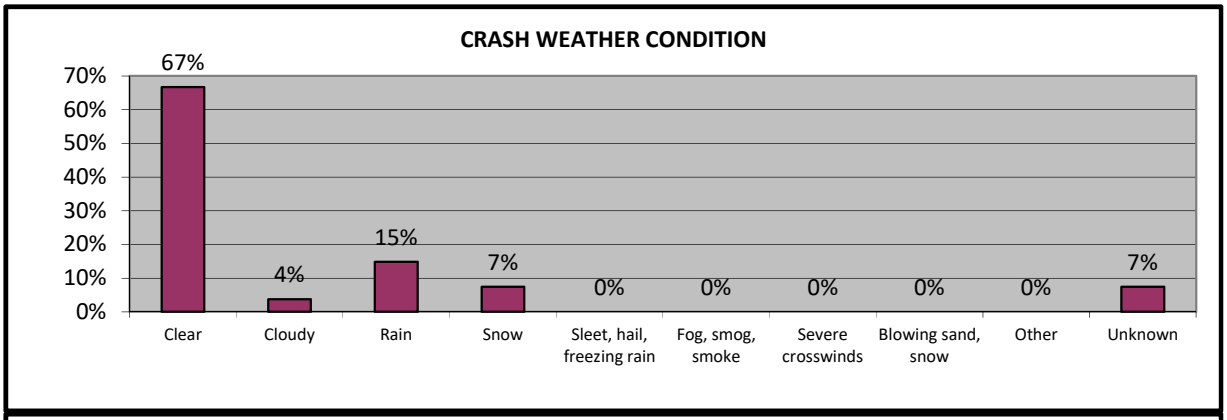


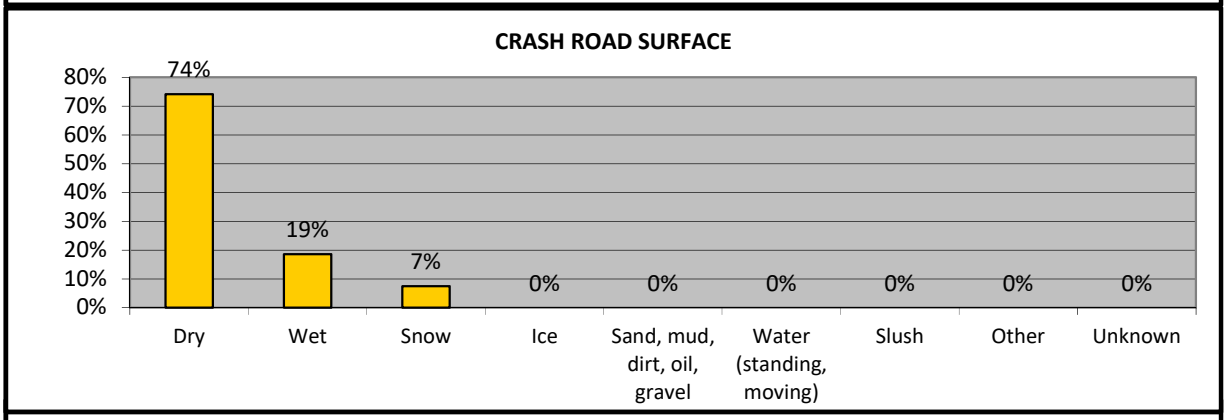


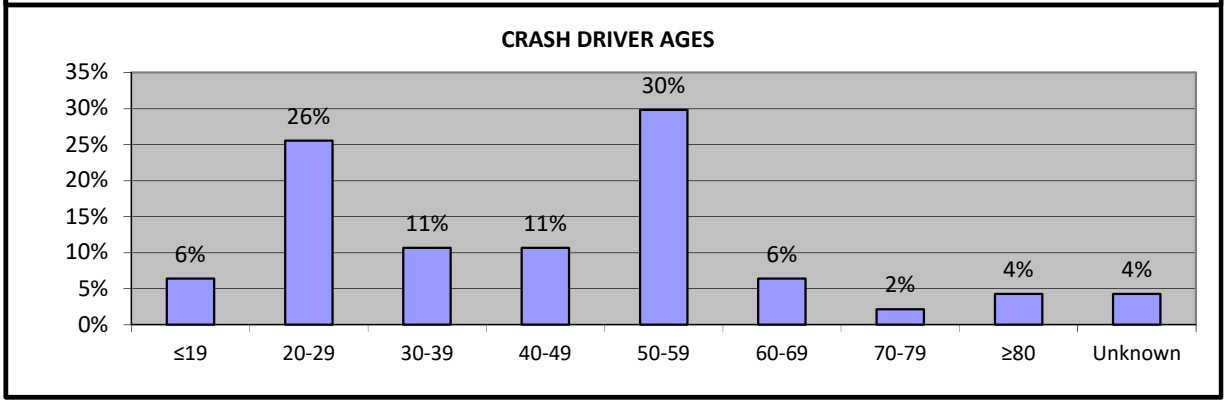
Crash Data Summary Charts

Arborway (South of Murray Circle), Boston, MA









massDOT
Massachusetts Department of Transportation
Highway Division

CRASH DIAGRAM

SYMBOLS

- Moving Vehicle
- Backing Vehicle
- Non–Involved Vehicle

Involved / Non–Involved

- Pedestrian
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- Direction of Motion
- Parked Vehicle
- Fixed Object

TYPE OF CRASH

- Head on
- Rear End
- Angle
- Turning Movement
- Sideswipe
- Out of Control
- Night Time Crash

SEVERITY

- (#) Injury
- (#) Fatal
- # Property Damage Only

BOSTON, MA

ARBORWAY – MURRAY CIRCLE & CENTRE STREET

REGION: MAPC

TIME PERIOD ANALYZED: 2013–2017
SOURCE OF CRASH REPORTS: STATE POLICE DEPARTMENT
DATE PREPARED: 03/07/2019
PREPARED BY: ZJH

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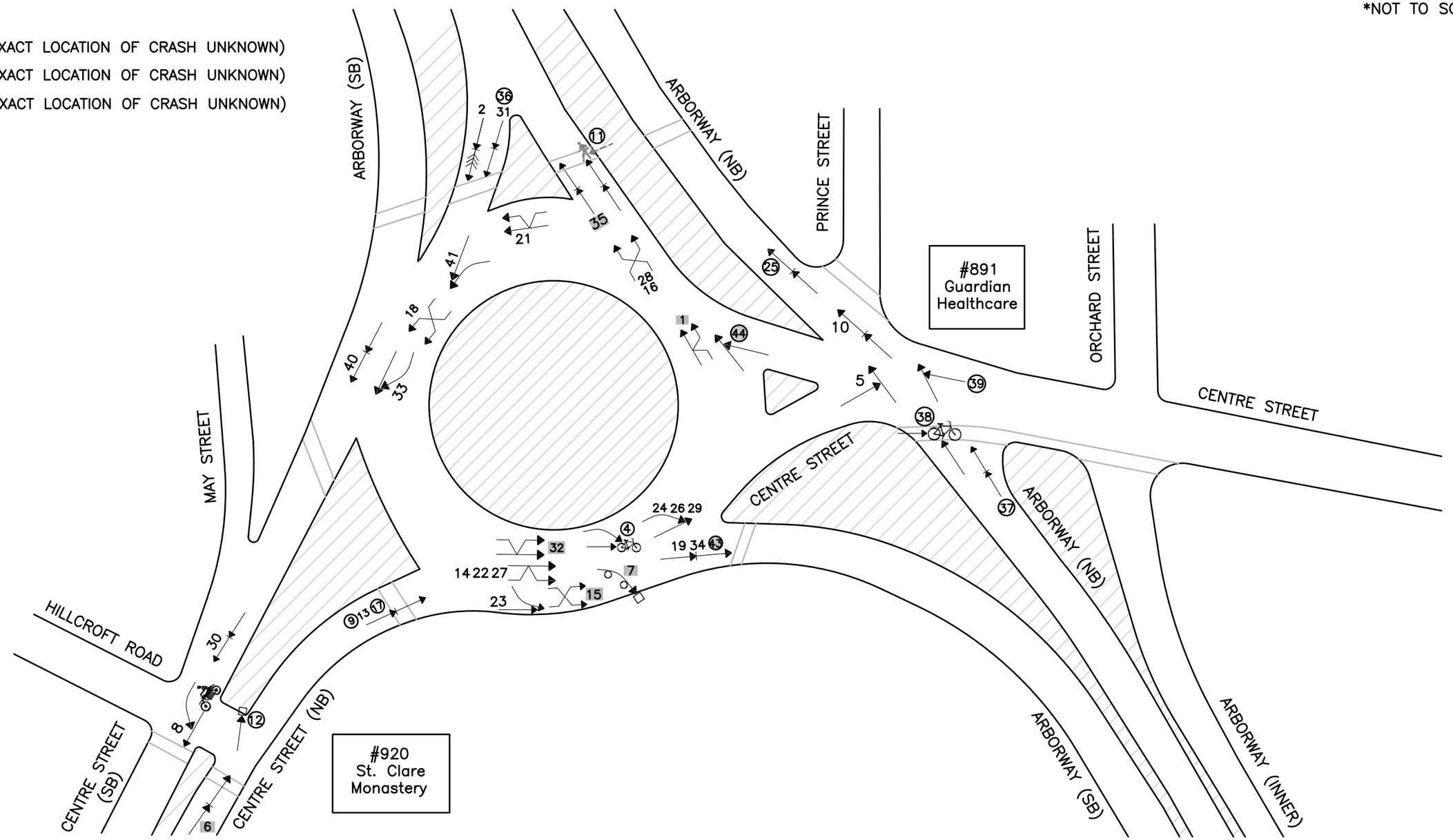
*NOT TO SCALE

③ (EXACT LOCATION OF CRASH UNKNOWN)
20 (EXACT LOCATION OF CRASH UNKNOWN)
42 (EXACT LOCATION OF CRASH UNKNOWN)



Crash Data Summary Table

Arborway (Murray Circle), Boston, MA
2015 - 2017

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	D1 Age	D2 Age	D3 Age	D4 Age	Comments
#	*mm/dd/yy*	*Day*	*hh:mm*	*Type*	*Type*	*Type*	*Type*	*Type*	#	#	#	#	
1	02/08/15	Sunday	7:20 PM	Sideswipe, same direction	Dark - lighted roadway	Snow	Snow	Unknown	Unknown	26			MV1 and MV2 traveled around Murray Circle. MV1 attempted to get over and struck MV2.
2	02/19/15	Thursday	5:35 PM	Rear-end	Dusk	Cloudy	Wet	Unknown	49	Unknown			MV1 and MV2 were stopped at the stop light on Arborway at the Rotary. MV2 rolled back and struck MV1 when light turned green.
3	05/14/15	Thursday	7:03 AM	Sideswipe, same direction	Daylight	Clear	Dry	Failure to keep in proper lane or running off road	34	43			MV1 WB in the left lane of the Arborway. MV2 WB on the right lane of the Arborway. MV2 attempted to change to the left lane and struck MV1.
4	06/16/15	Tuesday	6:36 AM	Single vehicle crash	Daylight	Clear	Dry	Failed to yield right of way	51	27			Both the vehicle and bike were travelling inbound in the rotary. The vehicle took a right turn striking the bike in the rear tire.
5	07/25/15	Saturday	4:20 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	31	26			MV1 EB on Centre Street crossing the Arborway. MV2 NB on Arborway. When light turned green, MV2 proceeded into the intersection. MV1 failed to stop when light turned red and struck MV2.
6	08/08/15	Saturday	10:40 PM	Rear-end	Dark - lighted roadway	Clear	Dry	Other improper action	23	22			MV1 and MV2 EB on Centre Street. MV1 was stopped at a red light. MV2 failed to stop and rear-ended MV1 due to the operator of MV2 was looking at the cell phone.
7	08/11/15	Tuesday	11:33 PM	Single vehicle crash	Dark - lighted roadway	Rain	Wet	Driving too fast for conditions	31				MV1 was travelling around the rotary. And the rear end of the vehicle slid on the wet surface and struck a tree.
8	08/12/15	Wednesday	12:58 PM	Sideswipe, same direction	Daylight	Clear	Dry	Made an improper turn	29	26			MV1 (motorcycle) SB in the left lane of Centre Street. MV2 SB in the right lane of Centre Street. MV2 attempted to switch to left lane and cut off the road, causing MV1 crashed into MV2.
9	08/17/15	Monday	12:40 PM	Rear-end	Daylight	Clear	Dry	Followed too closely	45	53			MV1 and MV2 were coming around the rotary from Centre Street. MV1 rear-ended MV2 when MV2 yielded for traffic inside the rotary.
10	08/25/15	Tuesday	3:40 PM	Rear-end	Daylight	Clear	Dry	Followed too closely	18	Unknown			MV1 and MV2 NB on Arborway. MV2 followed MV1 closely and rear-ended MV1.
11	09/16/15	Wednesday	2:30 PM	Rear-end	Daylight	Clear	Dry	Followed too closely	42	82			MV1 and MV2 WB on Arborway. MV2 followed MV1 closely. MV1 stopped for pedestrians. MV2 failed to stop and rear-ended MV1.
12	09/19/15	Saturday	12:06 PM	Single vehicle crash	Daylight	Clear	Dry	Fatigued/asleep	67				MV1 was travelling on Centre Street. The operator passed out due to diabetes and drove off the road.
13	10/15/15	Thursday	4:01 PM	Rear-end	Daylight	Clear	Dry	Inattention	39	34			MV1 and MV2 were approaching the rotary from Centre Street. MV1 stopped for the inside traffic and was rear-ended by MV2.
14	10/28/15	Wednesday	11:53 AM	Sideswipe, same direction	Daylight	Clear	Dry	Failed to yield right of way	46	34			MV2 pulled over in the rotary. MV1 was travelling in the rotary. MV2 attempted to merge back into traffic and struck MV1.
15	11/29/15	Sunday	4:33 PM	Sideswipe, same direction	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	55	34			MV1 was coming around the rotary. MV2 was coming from Centre Street EB and making a right turn to continue to Centre Street EB. MV1 turned into MV2 while MV1 attempting to turn right onto Arborway SB.
16	12/08/15	Tuesday	10:36 AM	Sideswipe, same direction	Daylight	Cloudy	Dry	Unknown	63	40			MV1 and MV2 were in Murray Circle. Both of them were attempting to enter the Arborway NB, and struck each other.
17	12/08/15	Tuesday	9:20 AM	Rear-end	Daylight	Cloudy	Dry	Unknown	34	27			MV1 was slowing or stopped at the yield sign on Centre Street NB where it meets the rotary. MV2 failed to stop and rear-ended MV1.
18	02/13/16	Saturday	3:50 PM	Sideswipe, same direction	Daylight	Clear	Dry	Unknown	51	44			MV1 and MV2 made contact with each other on Arborway where two lanes decrease into one lane. Which one at fault is unclear.
19	03/15/15	Sunday	7:20 AM	Rear to rear	Daylight	Rain	Wet	Unknown	49	58			MV1 and MV2 were travelling in Murray Circle. MV1 was attempting to exit on to the Arborway. And MV2 used to be right suddenly swerved left in front of MV1. MV1 rear-ended MV2. And MV2 was pushed in to an overhead light pole.
20	03/26/16	Saturday	4:26 AM	Single vehicle crash	Dark - lighted roadway	Unknown	Dry	Unknown	29				MV1 was travelling in Murray Circle and struck a light pole.
21	04/08/16	Friday	12:49 PM	Sideswipe, same direction	Daylight	Clear	Dry	Made an improper turn	44	36			MV1 and MV2 were travelling in Murray Circle. MV 1 changed position to the left and struck MV2.
22	05/04/16	Wednesday	11:30 AM	Sideswipe, same direction	Daylight	Unknown	Dry	Failure to keep in proper lane or running off road	53	27			MV1 was in the inside lane of the rotary and MV2 was in the outside lane. MV1 made contact with the left rear of MV2.
23	05/05/16	Thursday	10:00 AM	Sideswipe, same direction	Daylight	Rain	Wet	Failed to yield right of way	65	55			MV1 was travelling around the rotary in the direction towards Arborway SB. MV2 entered the rotary from Centre Street causing MV1 striking MV2.
24	05/07/16	Saturday	3:33 PM	Sideswipe, same direction	Daylight	Clear	Dry	Failed to yield right of way	30	55			MV1 entered the rotary from Centre street and stayed in the outside lane. MV2 stayed in the inside lane. MV2 struck MV1 while changing to right lane to exit onto Arborway SB.

Crash Data Summary Table

Arborway (Murray Circle), Boston, MA
2015 - 2017

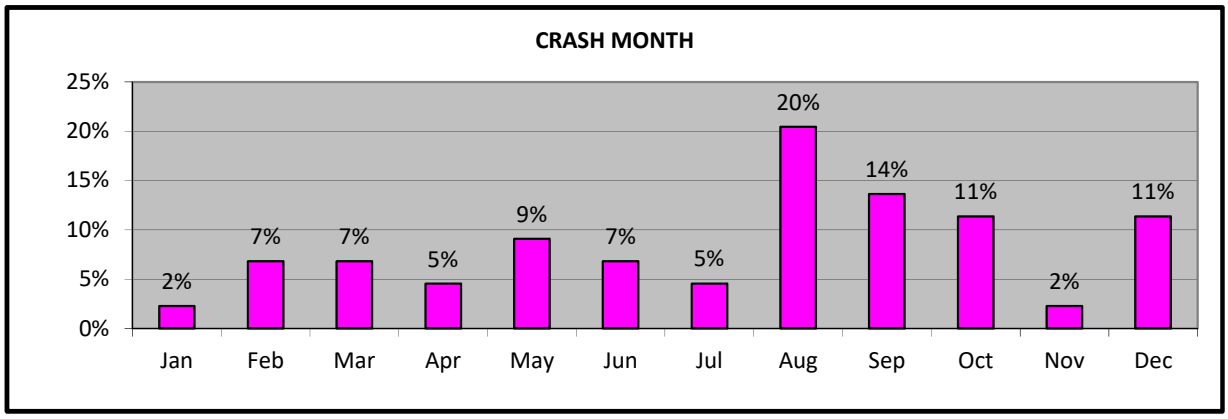
Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	D1 Age	D2 Age	D3 Age	D4 Age	Comments
#	*mm/dd/yy*	*Day*	*hh:mm*	*Type*	*Type*	*Type*	*Type*	*Type*	#	#	#	#	
25	06/08/16	Wednesday	6:55 AM	Sideswipe, same direction	Daylight	Clear	Dry	Followed too closely	56	31			MV1 and MV2 were travelling NB on Arborway. And MV2 rear-ended MV1.
26	07/08/16	Friday	6:36 AM	Angle	Daylight	Clear	Dry	Failed to yield right of way	24	29			MV1 and MV2 were in Murray Circle. MV1 was attempting to switch to right lane turn onto Arborway SB and Struck MV2.
27	08/06/19	Tuesday	12:10 PM	Sideswipe, same direction	Daylight	Clear	Dry	Made an improper turn	43	40			MV1 was travelling around the rotary on the inside lane. MV2 entered the rotary and merge left into the lane of MV1 causing the crash.
28	08/12/16	Friday	1:45 PM	Sideswipe, same direction	Daylight	Clear	Dry	Unknown	61	42			MV1 and MV2 were in Murray Circle and made contact. Reason is unknown.
29	08/24/16	Wednesday	6:25 PM	Angle	Daylight	Clear	Dry	Failed to yield right of way	25	30			MV1 and MV2 were travelling in the rotary. MV1 was attempting to exit the rotary onto Arborway SB from the right lane, cutting in front of MV2 then struck MV2.
30	09/08/16	Thursday	1:40 PM	Rear-end	Daylight	Clear	Dry	Followed too closely	48	48			MV1 and MV2 were travelling SB on Centre street. MV2 stopped at the red light and rear-ended by MV1.
31	09/21/16	Wednesday	8:15 AM	Rear-end	Daylight	Unknown	Dry	Followed too closely	23	59			MV1 and MV2 were attempting to enter the rotary from Arborway SB. MV2 stopped for the traffic. MV1 failed to stop and rear-ended MV2.
32	10/01/16	Saturday	1:25 AM	Sideswipe, same direction	Dark - unknown roadway lighting	Rain	Wet	Failed to yield right of way	28	51			MV1 (ambulance) and MV2 were travelling in the rotary. MV1 with the emergency lights on but MV2 did not yield right of way. MV1 passed MV2 and started to merge onto the Arborway. MV2 failed to stop in time and hit MV1.
33	10/10/16	Monday	11:00 AM	Angle	Daylight	Clear	Dry	No improper driving	79	38			MV1 and MV2 were travelling in the rotary, and MV1 was on the left of the MV2. MV1 struck MV2 while onto the Centre Street.
34	10/25/16	Tuesday	3:00 PM	Rear-end	Daylight	Clear	Dry	Inattention	34	40			MV1 and MV2 were travelling in the rotary. MV1 slowed due to the traffic. MV2 rear-ended MV1 from behind.
35	1/10/17	Tuesday	6:00 PM	Rear-end	Dark - lighted roadway	Rain	Wet	Inattention	50	64			MV1 was about to exit the rotary onto Arborway NB when it was stopped for traffic and rear-ended by MV2 from behind.
36	03/09/17	Thursday	12:15 PM	Rear-end	Daylight	Clear	Dry	Other improper action	36	38			MV2 was travelling on the inner Arborway directly followed by MV1. MV2 slowed and yielded to the traffic. MV1 failed to stop and struck MV2.
37	04/09/17	Sunday	6:34 AM	Sideswipe, same direction	Daylight	Clear	Dry	Inattention	49	39			MV1 and MV2 were travelling on Arborway. MV1 attempted to change lanes and entered rotary. However, it sideswiped MV2 and struck a traffic signal pole.
38	06/28/17	Wednesday	6:45 AM	Angle	Daylight	Clear	Dry	No improper driving	18	25			MV1 struck with a cyclist at the Arborway and Centre street intersection. They both claimed their light was green.
39	08/29/17	Tuesday	5:59 PM	Angle	Daylight	Clear	Dry	Failed to yield right of way	59	34			MV1 was travelling NB on the Arborway approaching the intersection. MV2 (AMBULANCE) was driving WB on Centre Street approaching the intersection with emergency lights and sirens on. MV1 entered the intersection and failed to stop and struck MV2.
40	09/10/17	Sunday	7:54 PM	Unknown	Unknown	Unknown	Unknown	Followed too closely	53	40			MV1 and MV2 were travelling in Murray Circle. MV1 was in the inside lane, and MV2 was in the outside lane. MV1 rear-ended MV2 due to following too closely.
41	09/17/17	Sunday	5:00 PM	Sideswipe, same direction	Daylight	Clear	Dry	Unknown	45	20			MV1 SB on Arborway. MV2 WB in the rotary. MV1 entered the rotary and was struck by MV2.
42	12/07/17	Thursday	2:40 PM	Rear-end	Daylight	Clear	Dry	No improper driving	33	35			MV1 and MV2 were travelling EB on the Centre street. MV2 stopped for the traffic in front of him. MV1 was unable to stop and rear-ended MV2.
43	12/09/17	Saturday	4:43 PM	Rear-end	Dark - lighted roadway	Snow	Snow	Driving too fast for conditions	32	76			MV1 and MV2 were travelling in Murray Circle. MV1 stopped due to traffic in the rotary. MV2 applied brakes, lost control, spun out and crashed into MV1.
44	12/22/17	Friday	9:29 PM	Sideswipe, same direction	Dark - lighted roadway	Snow	Snow	Failed to yield right of way	62	51			MV2 was travelling in Murray Circle. MV1 was travelling on the Arborway attempting to enter the rotary. MV1 failed to yield to MV2 and was rear-ended by MV2.

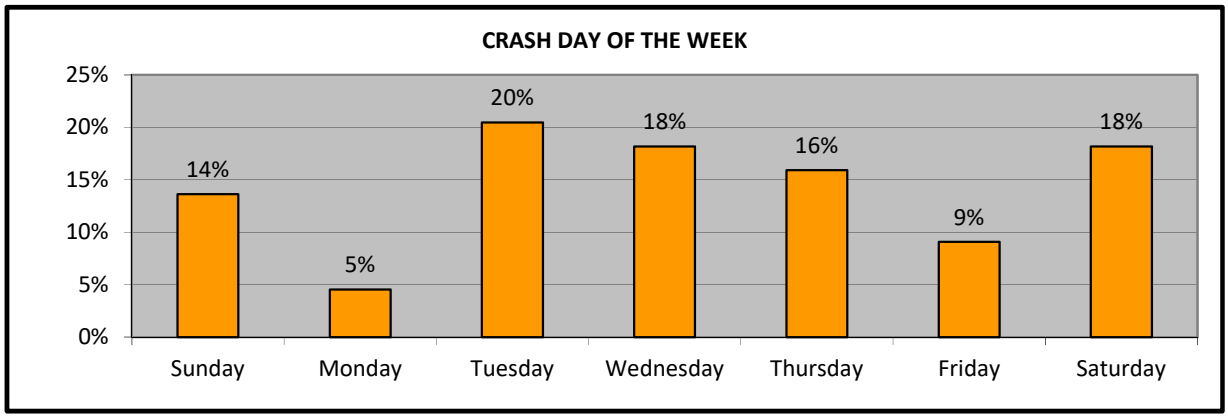
*Courtesy Crash - A term used to describe a crash that occurs subsequent to a non-involved mainline driver who gives the right of way, contrary to the rules of the road, to another driver.

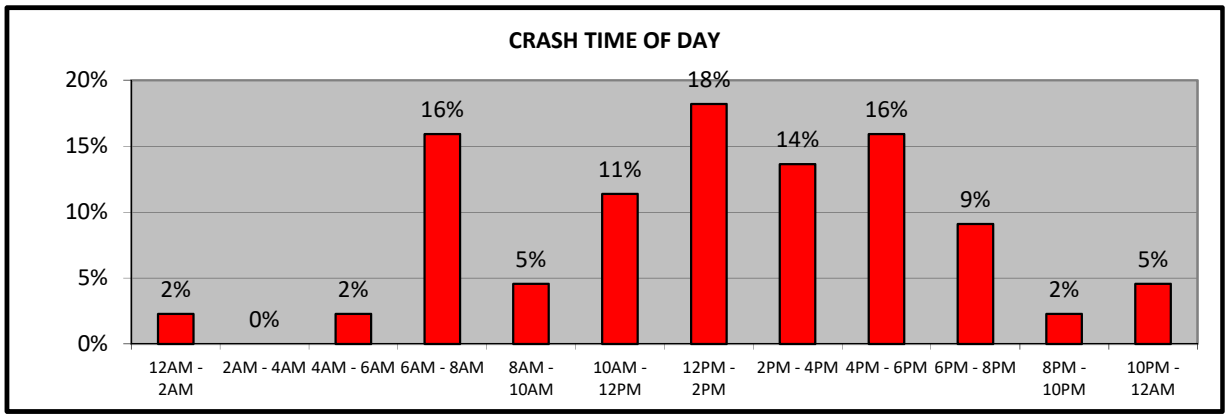
Summaries based on crash reports obtained from the State Police Department.

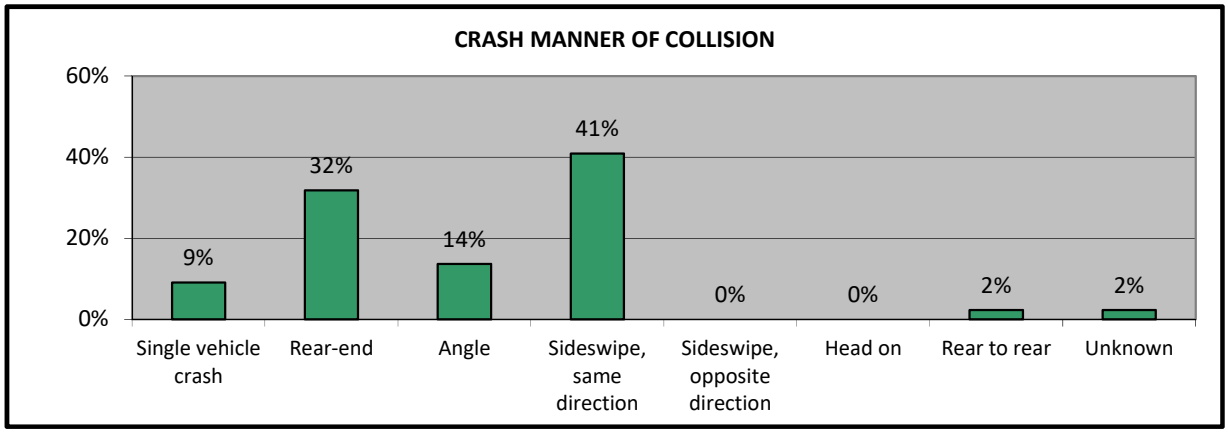
Crash Data Summary Charts

Arborway (Murray Circle), Boston, MA



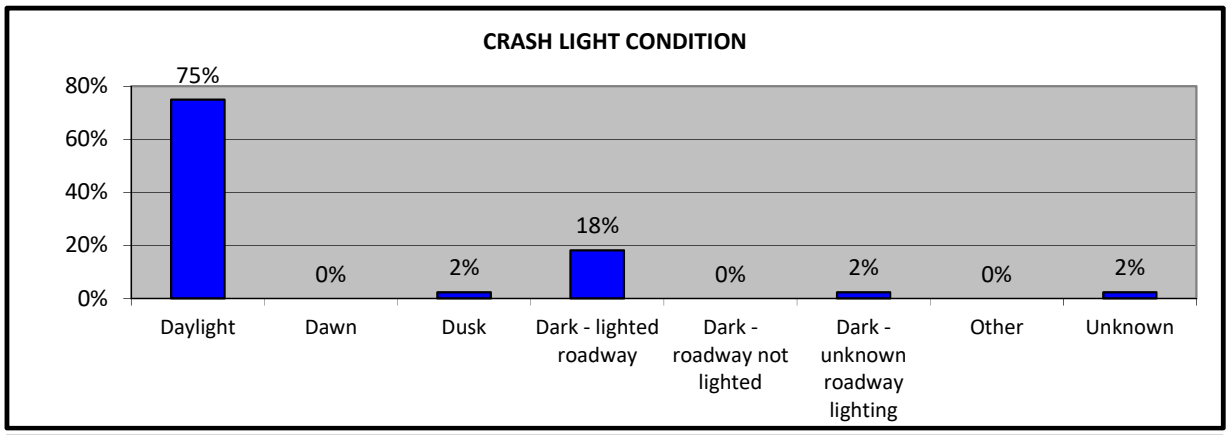


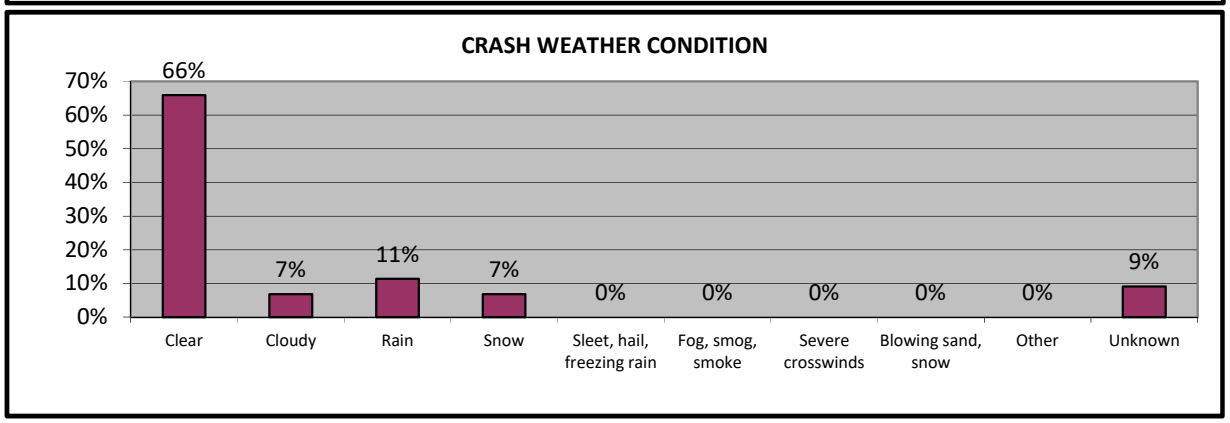


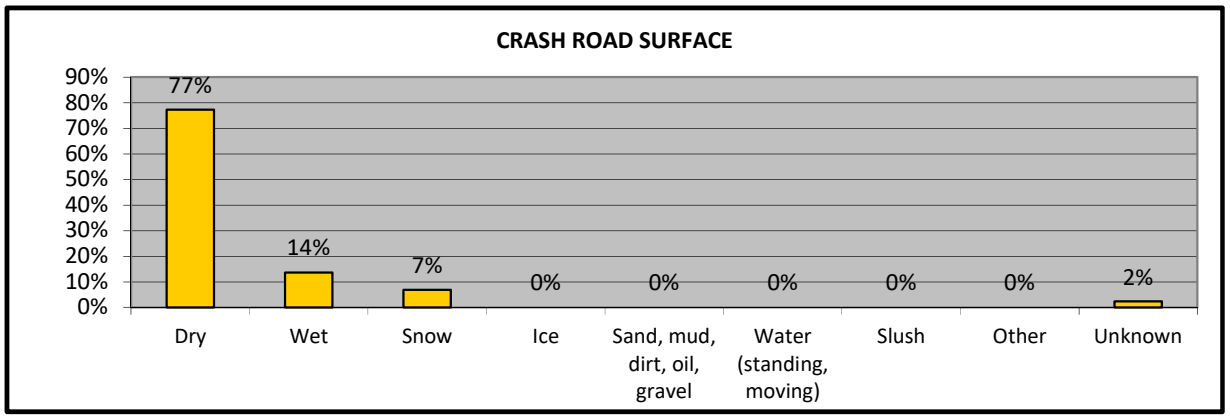


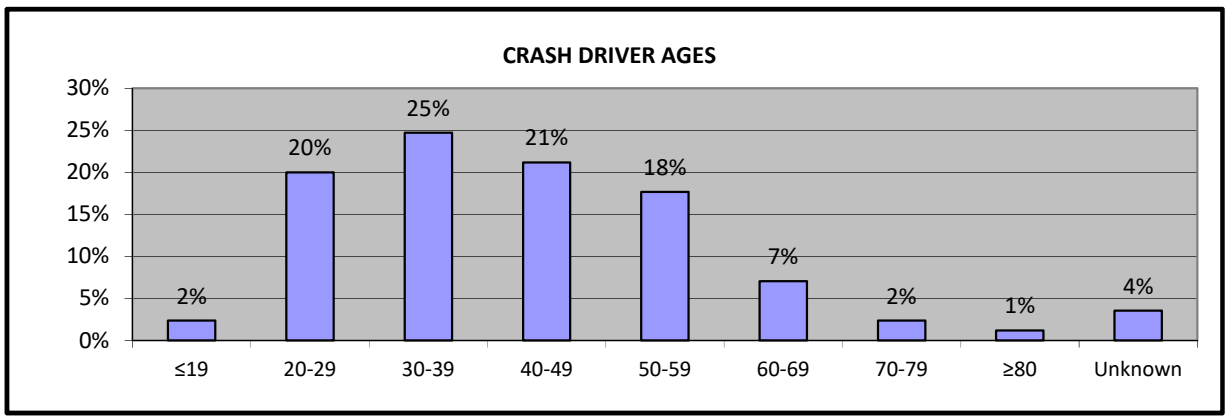
Crash Data Summary Charts

Arborway (Murray Circle), Boston, MA









massDOT
Massachusetts Department of Transportation
Highway Division

CRASH DIAGRAM

SYMBOLS

Moving Vehicle
Backing Vehicle
Non–Involved Vehicle

Involved	Non–Involved	
		Pedestrian
		Bicycle
		Animal
		Direction of Motion
		Parked Vehicle
		Fixed Object

TYPE OF CRASH

Head on
Rear End
Angle
Turning Movement
Sideswipe
Out of Control
Night Time Crash

SEVERITY

(#) Injury
(#) Fatal
Property Damage Only

BOSTON, MA

ARBORWAY – BETWEEN KELLEY CIRCLE & MURRAY CIRCLE

REGION: MAPC

TIME PERIOD ANALYZED: 2013–2017
SOURCE OF CRASH REPORTS: STATE POLICE DEPARTMENT
DATE PREPARED: 03/07/2019
PREPARED BY: ZJH

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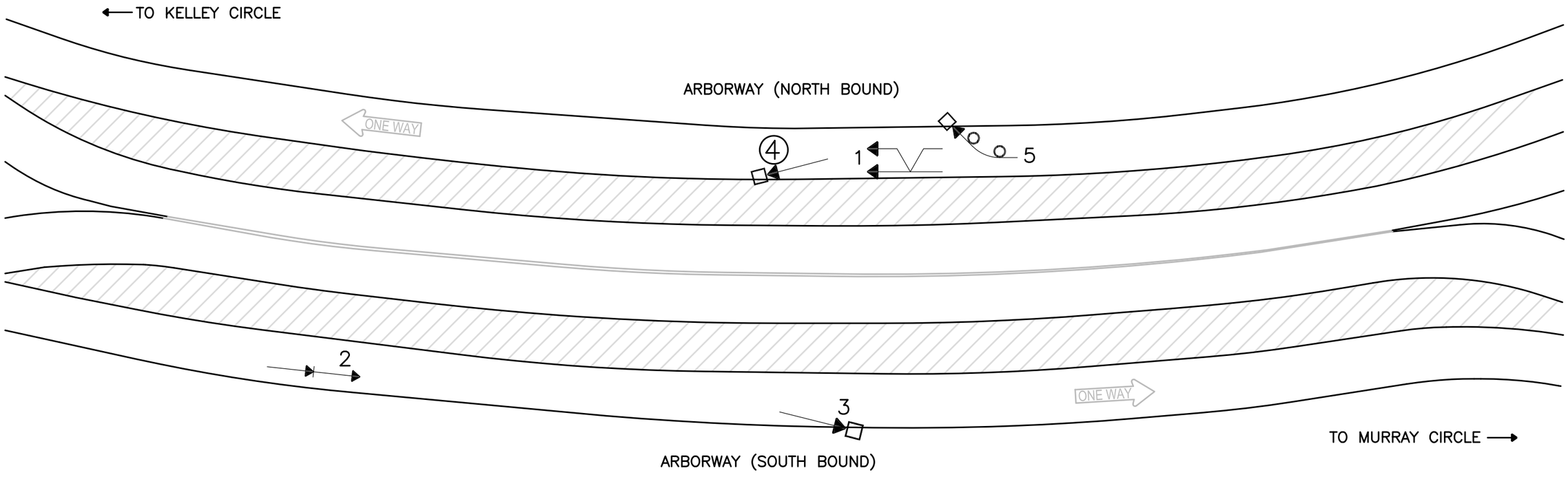

Crash Data Summary Table

Arborway between Murray Circle and Kelley Circle, Boston, MA
2015 - 2017

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	D1 Age	D2 Age	D3 Age	D4 Age	Comments
#	*mm/dd/yy*	*Day*	*hh:mm*	*Type*	*Type*	*Type*	*Type*	*Type*	#	#	#	#	
1	03/26/15	Thursday	9:10 AM	Sideswipe, same direction	Daylight	Cloudy	Dry	Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway, etc.	27	70			MV1 and MV2 were travelling NB on Arborway. MV2 attempted to change lane from right to left for police vehicle and struck MV1.
2	04/06/15	Monday	3:40 PM	Rear-end	Daylight	Clear	Dry	Followed too closely	69	46			NB MV1 attempted to switch lane from right to left with the blinker on, MV2 struck MV1 from behind while attempting to do the same as MV2.
3	06/04/15	Thursday	7:20 AM	Single vehicle crash	Daylight	Clear	Dry	Fatigued/asleep	22				MV1 was travelling SB on Arborway. The operator fall asleep and drove off the roadway and struck a tree.
4	12/02/15	Wednesday	6:50 AM	Single vehicle crash	Dawn	Clear	Dry	Other improper action	56				MV1 NB on Arborway. The operator violated the marked lane and travelled into grassy median and stuck a light pole.
5	12/17/16	Saturday	12:20 PM	Single vehicle crash	Daylight	Cloudy	Snow	Failure to keep in proper lane or running off road	40				MV1 was travelling on the Arborway inbound. The operator lost control of it. And MV1 began to skip and spin and crashed fire hydrant.

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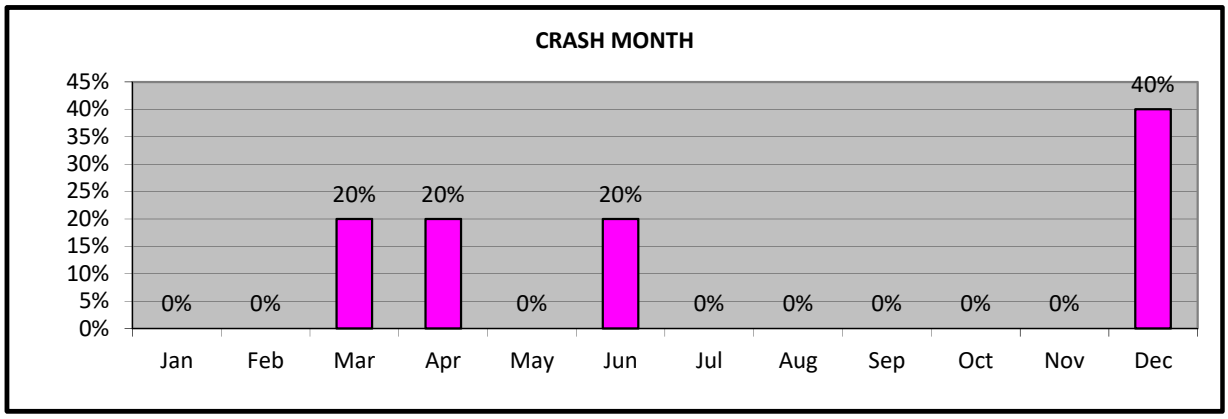
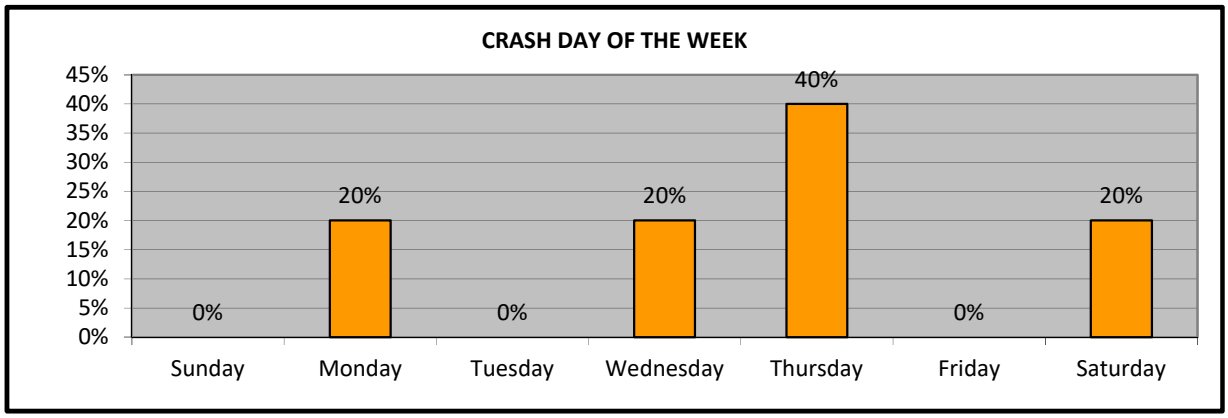
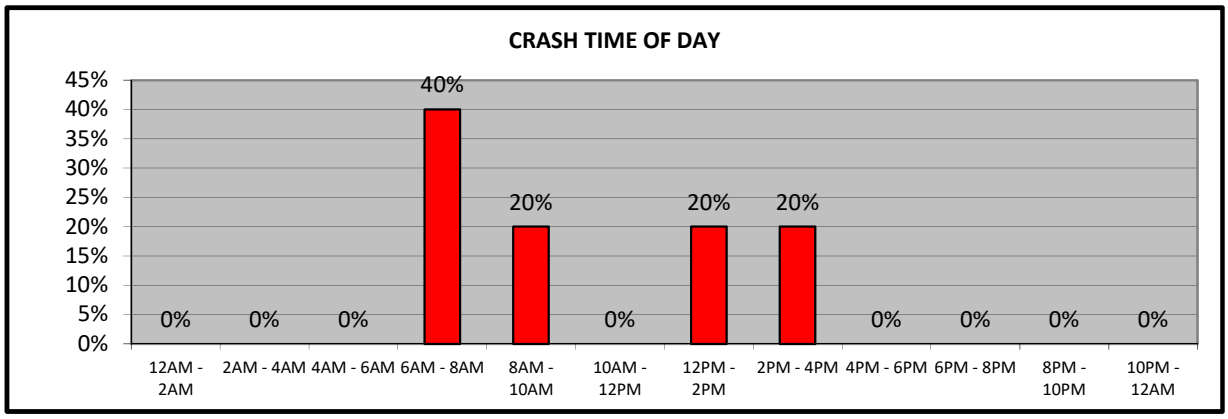
Summaries based on crash reports obtained from the State Police Department.

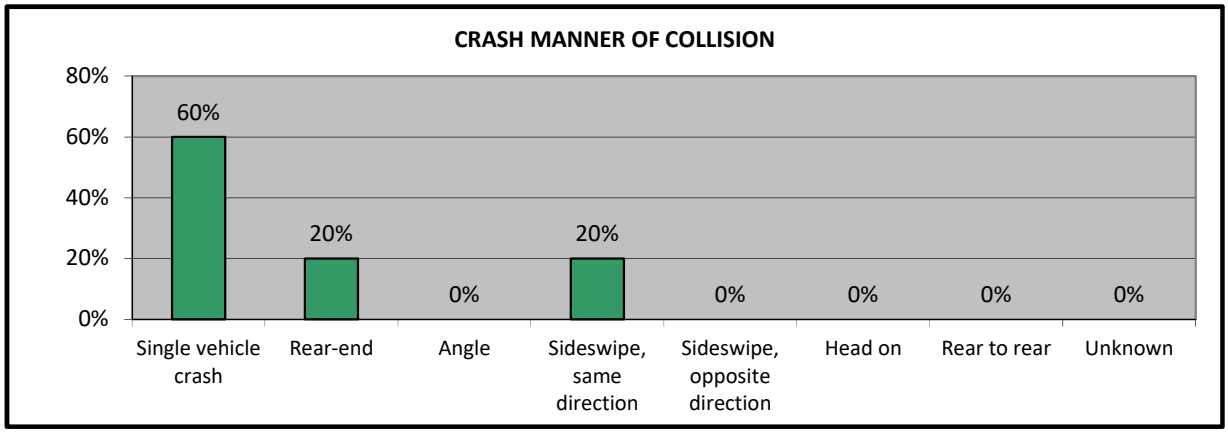
Crash Data Summary Charts

Arborway between Murray Circle and Kelley Circle, Boston, MA



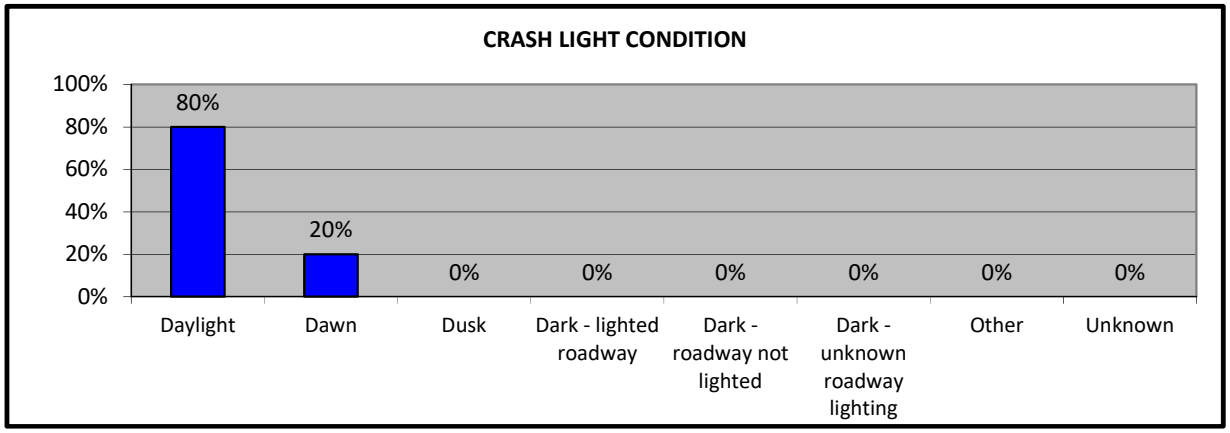


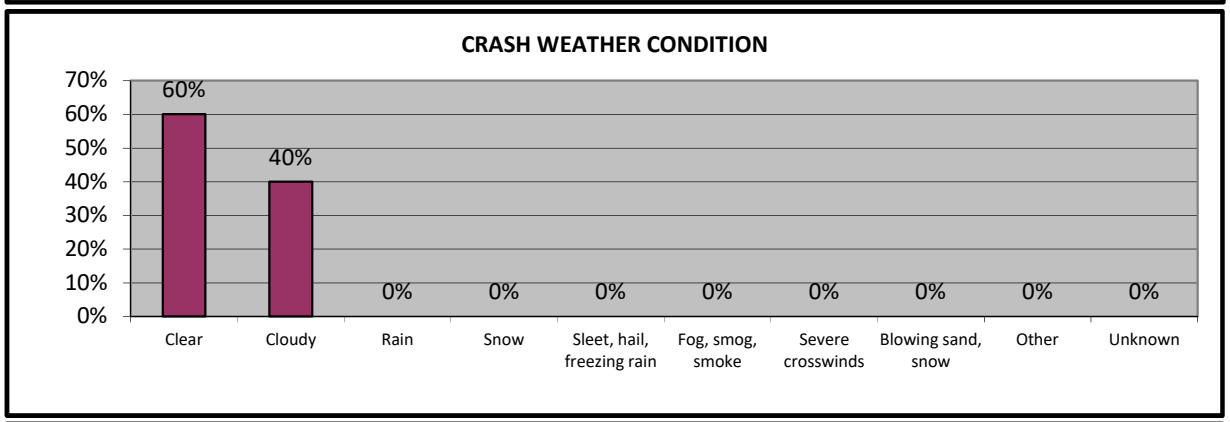


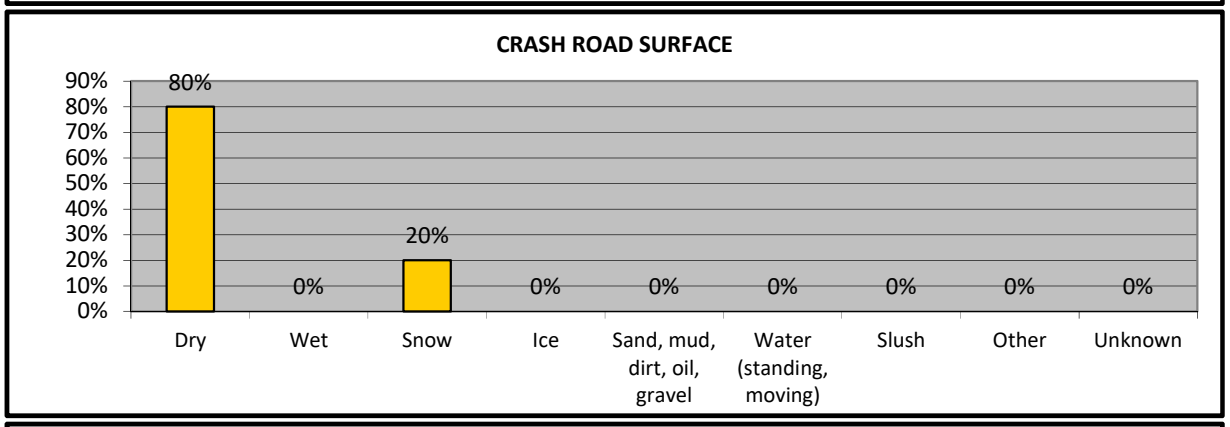


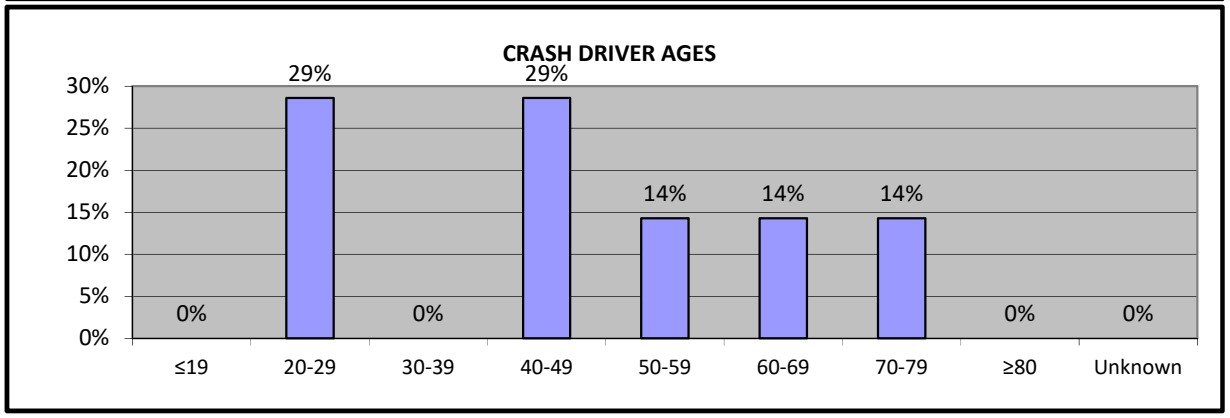
Crash Data Summary Charts

Arborway between Murray Circle and Kelley Circle, Boston, MA









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CRASH DIAGRAM

SYMBOLS

Moving Vehicle
Backing Vehicle
Non–Involved Vehicle

Involved	Non–Involved	
		Pedestrian
		Bicycle
		Animal
→	- - →	Direction of Motion
		Parked Vehicle
□	□	Fixed Object

TYPE OF CRASH

Head on
Rear End
Angle
Turning Movement
Sideswipe
Out of Control
Night Time Crash

SEVERITY

(#) Injury
(#) Fatal
Property Damage Only

BOSTON, MA

ARBORWAY – KELLEY CIRCLE & POND STREET

REGION: MAPC

TIME PERIOD ANALYZED: 2013–2017
SOURCE OF CRASH REPORTS: STATE POLICE DEPARTMENT
DATE PREPARED: 03/07/2019
PREPARED BY: ZJH

SHEET 3 OF 3

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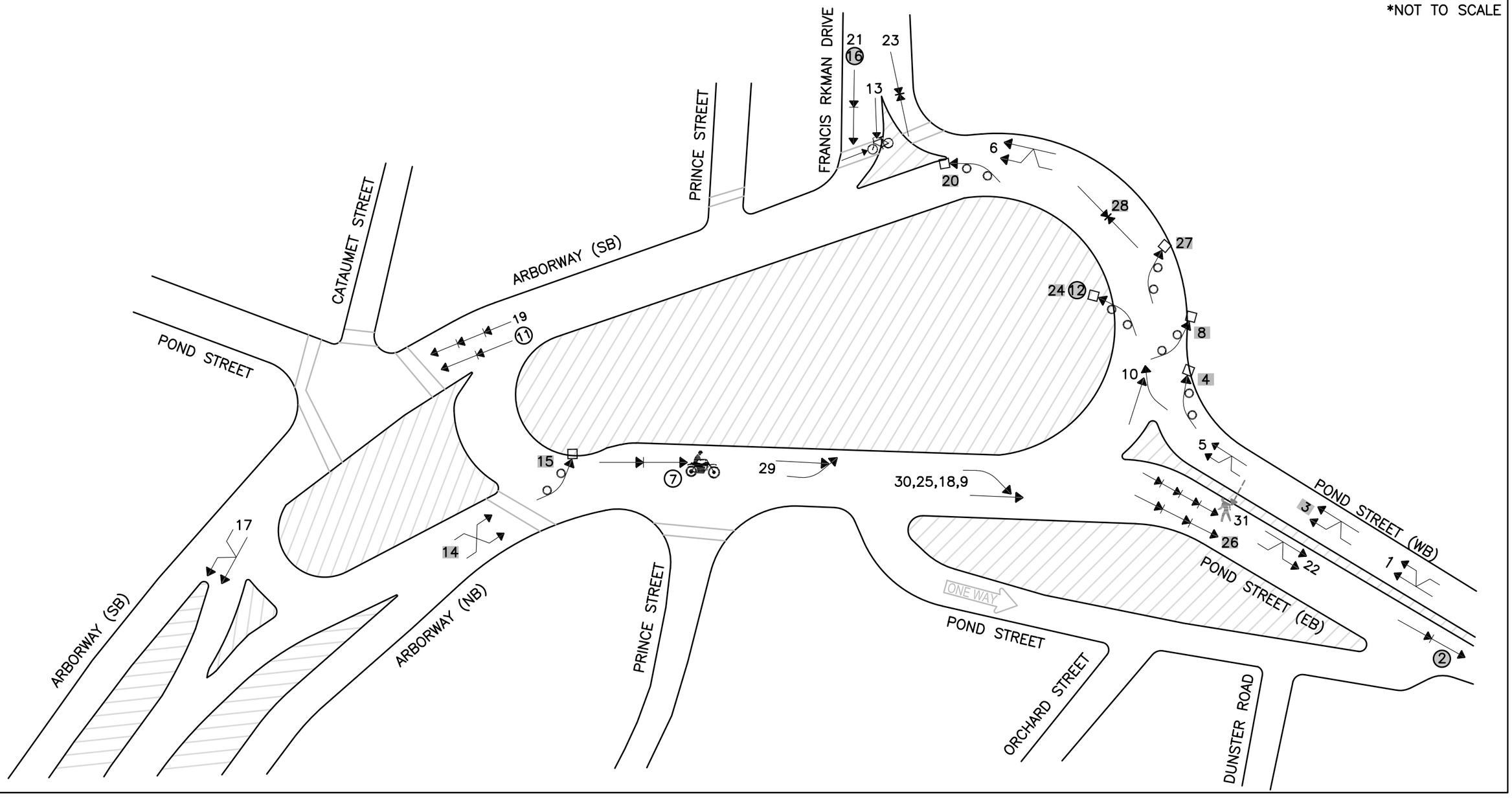
*NOT TO SCALE



Crash Data Summary Table

Arborway (Kelley Circle), Boston, MA
2015 - 2017

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	D1 Age	D2 Age	D3 Age	D4 Age	Comments
#	*mm/dd/yy*	*Day*	*hh:mm*	*Type*	*Type*	*Type*	*Type*	*Type*	#	#	#	#	
1	03/07/15	Saturday	8:00 AM	Sideswipe, same direction	Daylight	Clear	Dry	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	30	46			MV1 and MV2 were travelling SB on Pond Street. MV2 was changing lane, not seeing MV1 and struck it from the side.
2	04/02/15	Thursday	7:40 PM	Rear-end	Dark - lighted roadway	Unknown	Dry	Followed too closely	51	32			MV1 and MV2 were travelling EB on Pond Street. MV2 was slowed at the traffic light and was struck by MV1.
3	04/29/15	Wednesday	10:00 PM	Angle	Dark - lighted roadway	Clear	Dry	Unknown	23	56			MV1 and MV2 were travelling on Pond street. MV1 was in right lane and MV2 drifted into the right lane and collided with MV1.
4	05/18/15	Monday	10:43 PM	Single vehicle crash	Dark - lighted roadway	Clear	Dry	Distracted	45				MV1 was driving on Pond Street. The operator was looking at the houses while drive. She turned just before entering the rotary and crashed into a rock barrier.
5	06/01/15	Monday	12:30 PM	Sideswipe, same direction	Daylight	Clear	Dry	Unknown	30	26			MV1 and MV2 were entering the rotary from the Pond Street. MV1 clipped the side of MV2.
6	06/04/15	Thursday	8:07 AM	Angle	Daylight	Clear	Dry	Failed to yield right of way	37	23			MV1 and MV2 were travelling inside Kelley Circle. MV1 was in the outside lane and MV2 was in the inside. MV2 abruptly turned right and cut off MV1 causing the crash.
7	06/06/15	Saturday	7:43 PM	Rear-end	Daylight	Clear	Dry	Exceeded authorized speed limit	24	19			MV1 was travelling Arborway NB. MV1's rear tire struck the left curbing causing losing control and dump the motorcycle.
8	07/17/15	Friday	11:30 PM	Single vehicle crash	Dark - lighted roadway	Clear	Dry	Other improper action	23				MV1 was travelling at Arborway and Arborway Rotary. The operator was trying to reach her phone and lost control of MV1 and struck the stone barriers.
9	07/17/15	Friday	2:50 PM	Angle	Daylight	Clear	Dry	Failure to keep in proper lane or running off road	37	47			MV1 and MV2 were travelling on Arborway EB in Kelley Circle. MV1 made an unsafe lane change and struck MV2.
10	08/02/15	Sunday	5:32 PM	Sideswipe, same direction	Daylight	Clear	Dry	Unknown	20	21			MV1 was travelling on Pond Street into Kelley Circle. MV2 was travelling in the rotary. While MV1 was attempting to enter the rotary, MV2 struck it.
11	08/21/15	Friday	12:30 PM	Rear-end	Daylight	Clear	Dry	Inattention	43	44			MV1 and MV2 were travelling on Arborway and attempt to enter the rotary. MV1 slowed due to the heavy traffic. MV2 failed to stop and rear-ended MV1.
12	09/21/15	Monday	1:49 AM	Single vehicle crash	Dark - lighted roadway	Clear	Dry	Exceeded authorized speed limit	28				MV1 was travelling WB on Pond Street at a high speed entering Kelley Circle. The operator lost control of vehicle and crashed into a light pole.
13	09/22/15	Tuesday	9:10 AM	Single vehicle crash	Daylight	Clear	Dry	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	25	51			MV1 was travelling on Parkman Drive approaching the crosswalk and struck the cyclist who was already in the crosswalk.
14	12/09/15	Wednesday	10:20 AM	Angle	Daylight	Clear	Dry	Unknown	62	49			MV1 and MV2 were entering Kelley Circle from Ponds Street WB. When two lane merged into one lane before entering the rotary, they crash into each other. And both operators claimed crash occurred when the other attempted to pass.
15	12/30/15	Wednesday	7:30 PM	Single vehicle crash	Dark - lighted roadway	Rain	Wet	Driving too fast for conditions	21				MV1 was entering the Kelley rotary from Arborway (NB). The operator hit the brakes and lost control of MV1. MV1 slid into the intersection and struck the curb.
16	03/10/16	Thursday	7:15 PM	Rear-end	Dark - lighted roadway	Rain	Wet	Followed too closely	44	30			MV1 and MV2 were stopped to wait to enter Kelley Circle. MV2 believed MV1 had proceeded through the intersection and began to pull forward and rear-ended MV1.
17	05/20/16	Friday	2:00 PM	Angle	Daylight	Clear	Dry	Failed to yield right of way	50	69			MV1 was entering to Arborway from the left lane of Kelley Circle. MV2 was also attempting to enter Arborway from the right lane of Kelley Circle. MV2 merged into the left lane and struck MV1.
18	08/05/16	Friday	7:45 AM	Sideswipe, same direction	Daylight	Clear	Dry	Failed to yield right of way	18	38			MV2 was travelling NB in the left lane of the Kelley Circle approaching Pond street. MV2 was not in appropriate lane to exit and failed to yield to MV1 and struck MV1.
19	08/09/16	Tuesday	12:47 AM	Rear-end	Dark - lighted roadway	Clear	Dry	Unknown	28	44			MV3 and MV2 were stopped at the red light at the intersection of Arborway and Pond Street. MV1 failed to stop and rear-ended to MV2 and pushed it to MV1.
20	09/03/16	Saturday	1:12 AM	Single vehicle crash	Dark - lighted roadway	Clear	Dry	Exceeded authorized speed limit	22				MV1 was travelling to Kelley Rotary from Pond Street at a high rate of speed. The vehicle was lost control and struck the curbs.
21	10/13/16	Thursday	4:20 PM	Rear-end	Daylight	Clear	Dry	Inattention	38	56			MV1 was travelling from Parkman Drive onto Kelley Circle. MV1 stopped due to traffic congestion. MV2 failed to stop and struck MV1.
22	02/06/17	Monday	8:08 PM	Sideswipe, same direction	Dark - lighted roadway	Cloudy	Dry	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	22	40			MV1 was in the left lane of Pond street, and MV2 was in the right lane of Pond street. MV2 slammed into the right side of MV1 and forced it into left side curbs.

Crash Data Summary Table

Arborway (Kelley Circle), Boston, MA
2015 - 2017

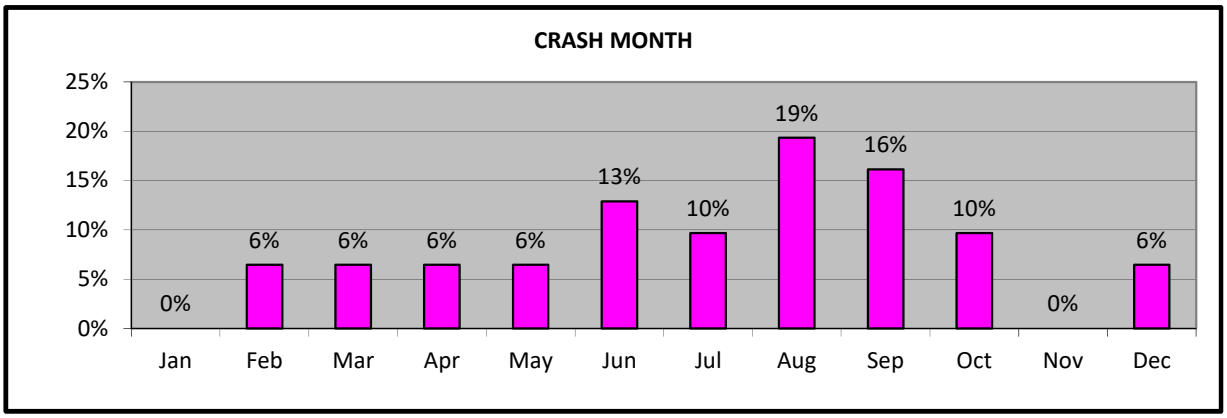
Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	D1 Age	D2 Age	D3 Age	D4 Age	Comments
#	*mm/dd/yy*	*Day*	*hh:mm*	*Type*	*Type*	*Type*	*Type*	*Type*	#	#	#	#	
23	02/09/17	Thursday	11:15 AM	Head on	Daylight	Snow	Snow	Driving too fast for conditions	44	26			MV1 was travelling EB on Parkman Drive. MV2 was travelling WB on Parkman Drive. MV1 lost control and struck MV2.
24	06/25/17	Sunday	3:00 AM	Single vehicle crash	Dark - lighted roadway	Clear	Dry	Other improper action	33				MV1 was cut off by unknown vehicle as it is entering the circle. This caused MV1 jerk the curb, go over the curb into the median and hit a light pole.
25	07/11/17	Tuesday	4:12 PM	Angle	Daylight	Clear	Dry	Other improper action	26	39			MV1 and MV2 were travelling at Kelley Circle to Pond Street. MV1 was in the center lane and MV2 in the inside lane. MV2 was attempting to exit right ramp from the left lane and struck MV1.
26	08/08/17	Tuesday	7:20 AM	Rear-end	Daylight	Clear	Dry	Inattention	39	45	47		MV1 MV2 and MV3 were on Pond Street NB. MV1 merged into the left lane and was cut off by MV2 which did the same. MV1 rear-ended MV2 and push it to MV3.
27	08/09/17	Wednesday	1:02 AM	Single vehicle crash	Dark - roadway not lighted	Clear	Dry	Exceeded authorized speed limit	37				MV1 was travelling in the Kelley Circle heading to Arborway. The operator lost control of the vehicle due to high speed and drove off roadway and struck the curb.
28	09/05/17	Tuesday	8:20 PM	Head on	Dark - lighted roadway	Clear	Dry	Disregarded traffic signs, signals, road markings	24	17			MV2 was following the GPS making a illegal turn into Kelley Circle and head-on with MV1.
29	09/27/17	Wednesday	8:15 AM	Angle	Daylight	Clear	Dry	Inattention	25	49			MV1 was travelling NB on the left lane of the Arborway. MV2 was travelling NB on the middle lane of Arborway and in front of MV1. MV2 switched to left lane and was struck by MV1 due to the operator stepping on gas pedal by mistake.
30	10/02/17	Monday	6:30 PM	Angle	Dusk	Clear	Dry	Disregarded traffic signs, signals, road markings	Unknown	22			MV1 was entering Kelley Circle. MV2 came from the inside lane and crossed in front of MV1 causing collision.
31	10/30/17	Monday	6:30 AM	Rear-end	Dawn	Rain	Wet	Followed too closely	42	30	57	59	MV1, MV2, MV3 and MV4 were travelling NB on the Arborway. MV1 stopped short for the pedestrian making MV4 rear-ended MV3. And the impact forced collision between MV1, MV2 and MV3.

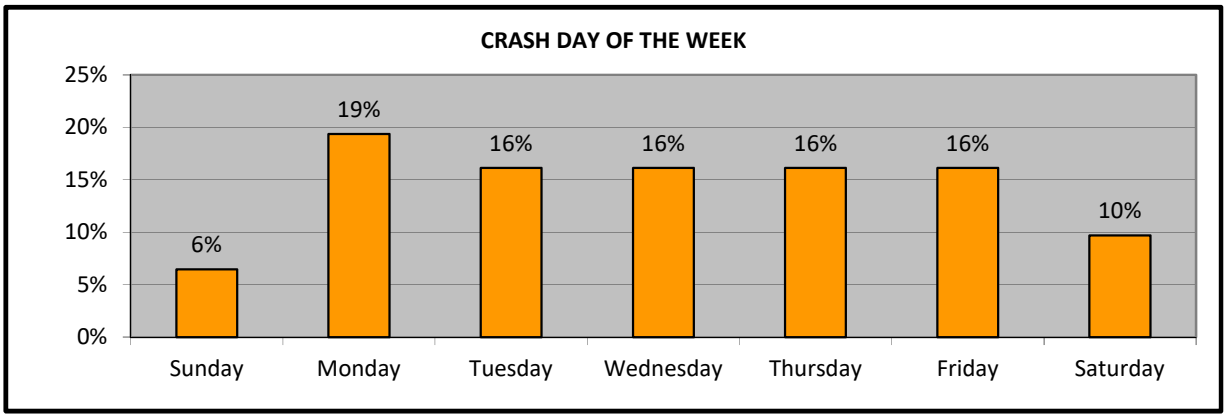
*Courtesy Crash - A term used to describe a crash that occurs subsequent to a non-involved mainline driver who gives the right of way, contrary to the rules of the road, to another driver.

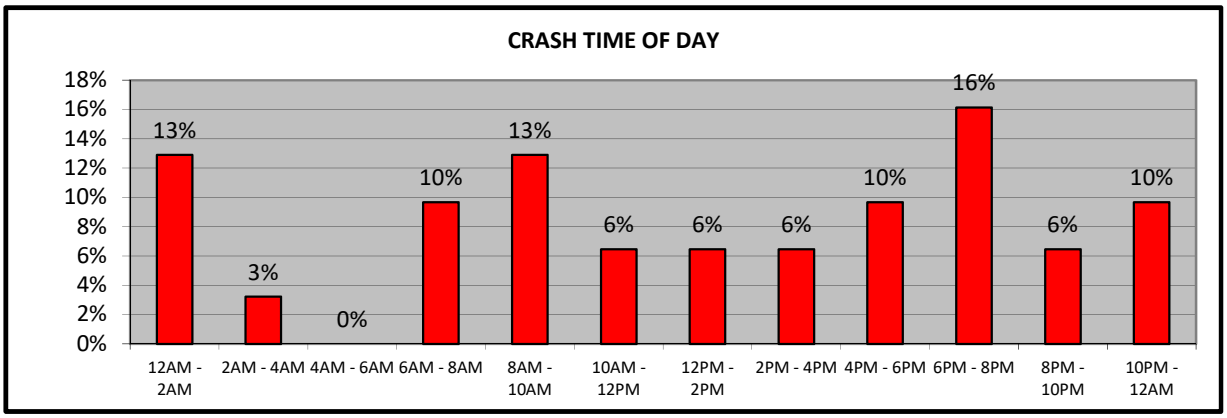
Summaries based on crash reports obtained from the State Police Department.

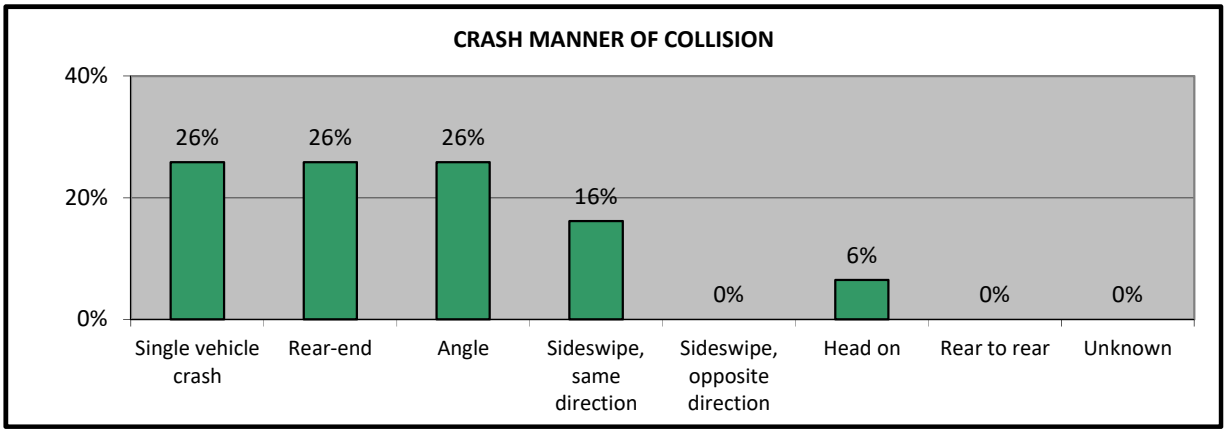
Crash Data Summary Charts

Arborway (Kelley Circle), Boston, MA



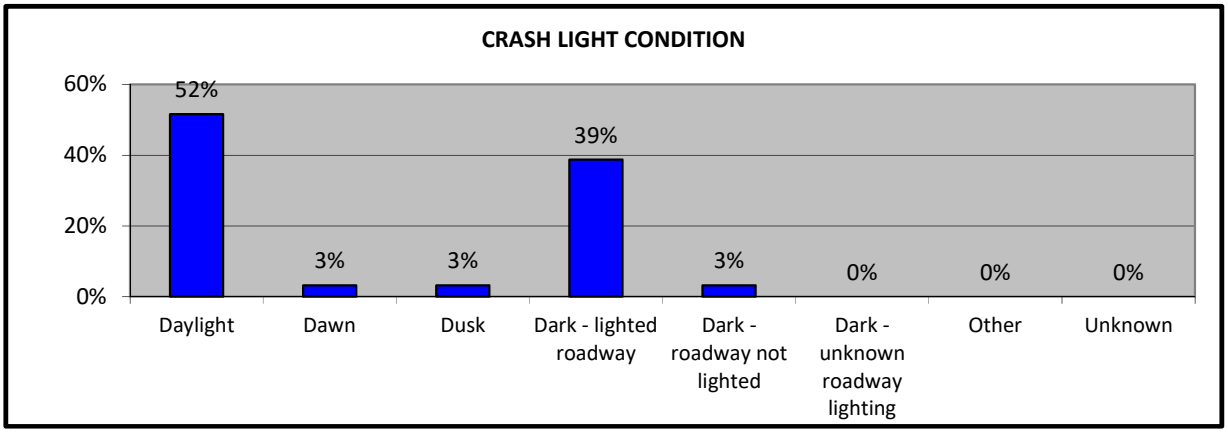


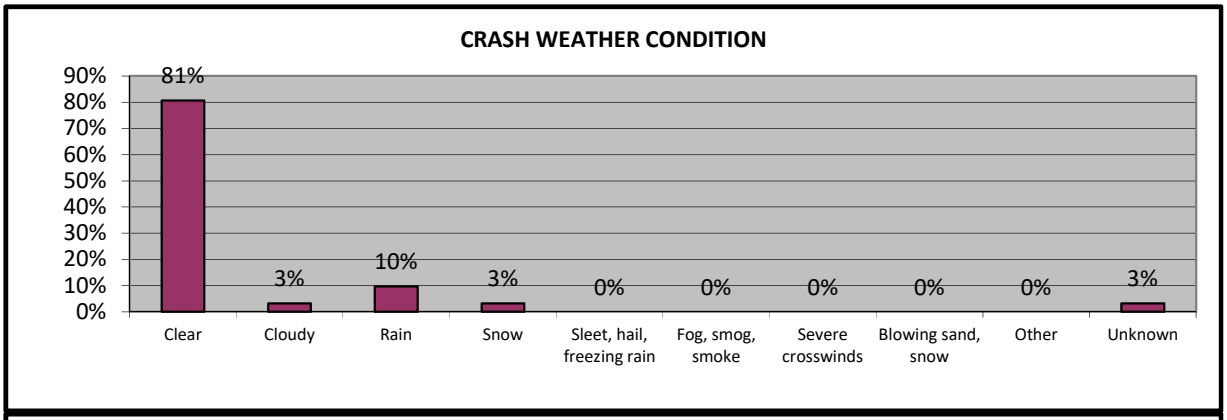


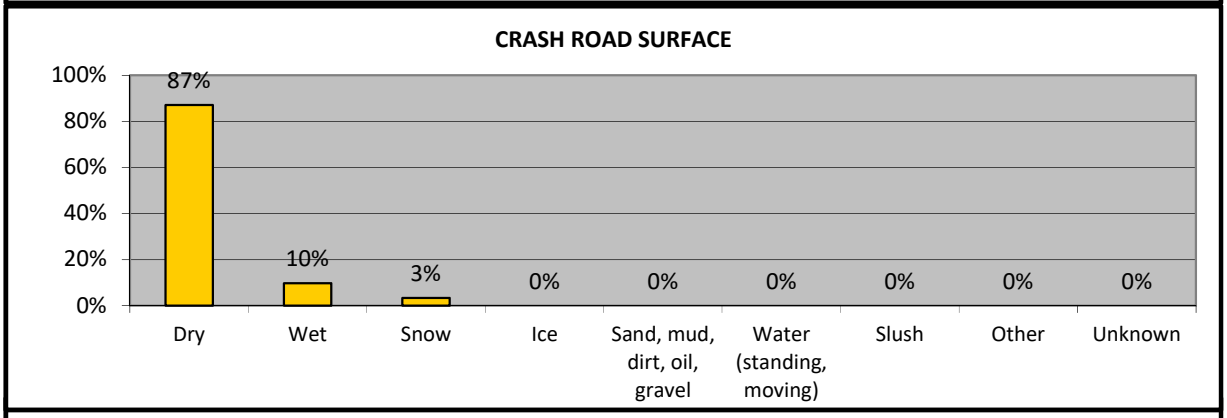


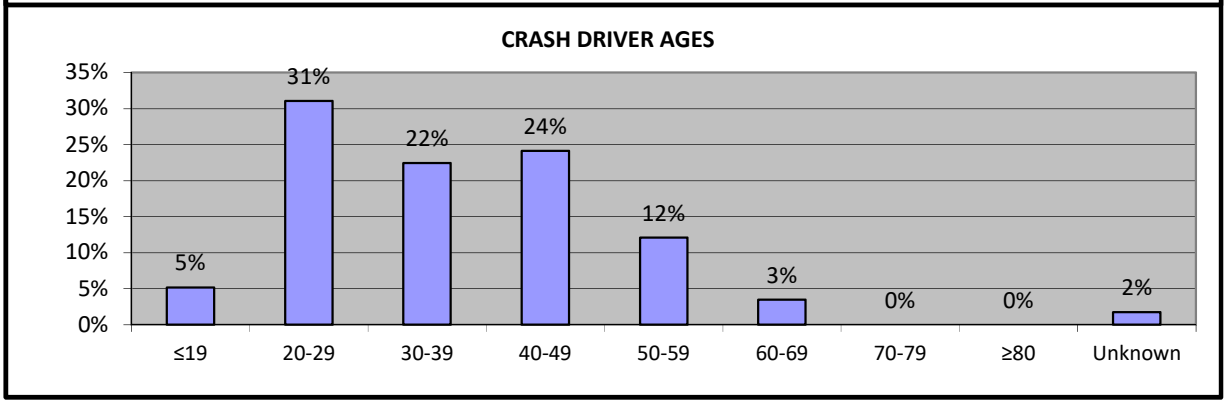
Crash Data Summary Charts

Arborway (Kelley Circle), Boston, MA









Appendix D. Road Safety Audit References

Road Safety Audit References

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