

ROAD SAFETY AUDIT

West End Rotary

Barnstable, MA

June 30, 2021

Prepared For:
MassDOT



On Behalf Of:
Town of Barnstable



Prepared By:
Cape Cod Commission
3225 Main St, Barnstable, MA 02630



CAPE COD
COMMISSION

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Background

The Federal Highway Administration (FHWA) defines a Road Safety Audit (RSA) as the formal safety examination of an existing or future road or intersection by an independent, multidisciplinary team. The purpose of a Road Safety Audit is to identify potential safety issues and opportunities for safety improvements while considering all roadway users. Potential safety improvements can range from short-term to long-term improvements and reference the 4 E's: Engineering, Education, Emergency Response, and Enforcement. This RSA evaluates the West End Rotary and its four approaches – Main Street, North Street, West Main Street and Scudder Avenue – as shown in Figure 1.

The Cape Cod Commission (CCC), serving as the regional planning agency for the fifteen towns on Cape Cod, has reviewed the existing safety issues and potential improvements at many transportation locations for various planning efforts, including the Regional Transportation Plan, the Transportation Improvement Program, and Developments of Regional Impact. In 2019, CCC Staff developed a Top Crash Locations report and the Cape Cod Crash Dashboard, which serve as a resource to make Cape Cod safer for motorists, pedestrians, and bicyclists. CCC staff reference the Top Crash Locations report and dashboard to prioritize locations for future Road Safety Audits. The Top Crash Locations report also serves as a resource for transportation safety professionals looking to make strategic investments to improve safety in the region.

The Town of Barnstable Department of Public Works (DPW) requested that an RSA be conducted at the West End Rotary to examine the existing safety issues and compile a list of potential improvements for the rotary and its approaches. In addition, the Barnstable Police Department noted that West Main Street is ranked as #4 in the town for highest number of crashes within a corridor based on 2020 crash data.

Project Data

The RSA was held on Wednesday, June 30, 2021, with representatives from state, regional and local agencies and organizations providing expertise in the engineering, planning, maintenance, transit, and emergency response fields. Due to the COVID-19 pandemic, the RSA was held virtually in accordance with MassDOT policy. Attendees were encouraged to visit the site prior to the audit and review the collision diagram and crash summary to become familiar with the existing safety issues. Videos of the rotary and its approaches were also presented during the virtual meeting. A list of attendees is provided in Table 1 with their contact information provided in Appendix B. A copy of the RSA Agenda can be found in Appendix A.

Table 1: Participating Audit Team Members

Audit Team Member	Agency/Affiliation
Griffin Beaudoin	Town of Barnstable Town Engineer
Nathan Collins	Town of Barnstable Assistant Town Engineer
Elizabeth Jenkins	Town of Barnstable Director of Planning & Development
Matthew Lounsbury	Town of Barnstable Police Department
Noah Berger	Cape Cod Regional Transit Authority
Ana Fill	MassDOT Safety & Engineering
Dakota DelSignore	MassDOT Safety & Engineering
Bianca Marshall	MassDOT District 5 Traffic
David Soares	MassDOT District 5 Traffic Operations Engineer
Nick Hudanich	MassDOT Intern
Lauren McNaughton	MassDOT Intern
Jane Richardson	MassDOT Intern
David Nolan	Cape Cod Commission
Colleen Medeiros	Cape Cod Commission
Corey Velho	Cape Cod Commission

Project Location and Description

Study Area Roadways

Main Street

Main Street connects the West End Rotary to downtown Hyannis, just east of the rotary. Main Street is a two-way roadway leading into the rotary but transitions to a one-way roadway in the westbound direction approximately 700 feet east of the rotary. South Street is one-way eastbound where it splits off from Main Street at the transition point. Main Street provides access to downtown Hyannis, Cape Cod Hospital, and Hyannis Harbor with ferry access to the Islands. Land use in the vicinity of Main Street is mainly commercial, with shops and restaurants lining the roadway. Main Street is classified as an urban principal arterial under Town of Barnstable jurisdiction and is not speed zoned. At its intersection with the rotary, Main Street has approximately 18-foot wide entry and exit legs separated by a splitter island. There are five-foot wide sidewalks located on both sides of Main Street within the study area. No bike facilities are present. The Cape Cod Regional Transit Authority (CCRTA) provides a seasonal Hyannis Trolley along Main Street and within the study area intersection, with a transit stop at the Hyannis Resort and Conference Center from the end of June to Labor Day.

North Street

North Street is a two-way roadway classified as an urban collector roadway under Town of Barnstable jurisdiction. The roadway is not speed zoned and runs parallel to Main Street in Hyannis. North Street provides access to mainly commercial land uses and is an alternate route to Main Street businesses with

large parking facilities located on North Street. Additionally, North Street provides access to the Hyannis Fire Station and the Hyannis Youth and Community Center. At its intersection with the rotary, North Street has approximately 18-foot wide entry and exit legs separated by a splitter island. There are currently no bicycle or pedestrian facilities on North Street within the study area. The CCRTA provides bus service via the Hyannis Crosstown along North Street and in the vicinity of the West End Rotary with a transit stop at Mass Hire on North Street, which is located approximately 700 feet east of the rotary.

West Main Street

West Main Street is a two-way roadway classified as an urban principal arterial under Town of Barnstable jurisdiction. This roadway is not speed zoned, however there is a 35 miles per hour (mph) sign west of Pitchers Way. West Main Street provides access between Route 28 and downtown Hyannis, and mainly consists of residential and commercial land uses. In the vicinity of the West End Rotary, West Main Street provides access to the Cape Cod Melody Tent, Sturgis Charter School West, Hyannis West Elementary School, and Barnstable High School. There is a five-foot sidewalk within the study area on both sides of West Main Street. No bike facilities are present. Approaching the rotary, West Main Street consists of approximately 17-foot wide entry and exit legs separated by a splitter island.

Scudder Avenue

Scudder Avenue is a two-lane roadway classified as an urban minor arterial under Town of Barnstable jurisdiction. Scudder Avenue generally provides access to residential land uses, however in the vicinity of the rotary, the roadway provides access to the Cape Cod Melody Tent, the Hyannis Resort and Conference Center and Sturgis Charter School West. Approaching the rotary, Scudder Avenue consists of 18-footwide entry and exit legs separated by a splitter island with a five-foot sidewalk located on both sides of the roadway. There is no posted speed limit on Scudder Avenue, however there is a “30 MPH Thickly Settled” warning sign just east of Marston Avenue as well as a 20 MPH school speed zone sign in the immediate vicinity of Sturgis Charter School West. No formal bike facilities are present; however there is an approximate five-foot wide shoulder present on both sides of the roadway approaching the rotary.

West End Rotary

The West End Rotary is a large circular intersection that provides one general use circulating lane measuring approximately 30-feet wide. There are no pavement markings within the rotary except for edge lines. Multi-modal accommodations are generally lacking with no crosswalks provided at any of the approaches. There are sections of sidewalk on three of the four approaches to the rotary, although they are in varying conditions and are discontinuous. Three of the four legs are under yield control while the North Street approach is under stop control. There are five curb cuts with direct access to the rotary. These curb cuts serve the following businesses: Subway Sandwich, The West End Restaurant, Rockland Trust Bank, Hyannis Package Store, and an office building (Gill Devine & White PC).

Crash Data

Crash reports were supplied by the Barnstable Police Department. The crash reports were reviewed, and a collision diagram was developed for the rotary. The crash diagram is provided in Appendix C.

In total, there were 19 crashes at the West End Rotary for the five-year period of 2016-2020, which resulted in an average crash rate of 0.43 crashes per million entering vehicles. It should be noted that crash data for 2020 may be atypical due to the COVID-19 pandemic that disrupted normal traffic patterns and volumes. The equivalent property damage only (EPDO) index was also calculated to be 43 for years 2016 through 2020. The CCC calculates EPDO based on the following weighting factors; property damage only crashes are 1 point; injury crashes are 5 points and fatal crashes are 10 points. The EPDO calculation helps identify high crash locations with there is a high number of injury related crashes. Based on the latest Top 50 Crash Locations reported prepared by the CCC, the West End Rotary is not identified as a high crash location as the top 50 locations all have an EPDO higher than 75. Since the report was published, the methodology for calculating EPDO has changed with weighting factors now being 21 points for fatal and injury crashes; property damage only crashes continue to be 1 point. Based on the new methodology, the EPDO for this location is calculated to be 94 for the time period between 2017 and 2019. The most recent HSIP threshold (top 5% in the region) for CCC is 111.

The majority of crashes (47%) were rear-end crashes. Single-vehicle crashes (including a crash involving a pedestrian), angle crashes, and sideswipe (same direction) crashes each accounted for 16% of the crashes at the rotary, with 5% of crashes (one crash) being a head-on collision. Six crashes (32%) resulted in an injury (including one crash where a pedestrian was struck at the North Street approach to the rotary). There were no fatal crashes at the rotary. April and September had the highest percentage (16%) of crashes at the rotary, while March and July had no crashes in any of the years studied. A heavy majority of crashes (74%) occurred in the afternoon hours (from noon to 6:00 pm). Four crashes occurred under dark roadway conditions (21%) and five crashes occurred under wet roadway conditions (26%). There were no crashes reported between 2 AM and 10 AM or between 8 PM and midnight.

Figure 1: Locus Map



Audit Observations and Potential Safety Enhancements

The Road Safety Audit team met virtually to discuss existing conditions, safety issues, and potential countermeasures. The provided data included a crash summary, collision diagram, RSA prompt list, and a series of bar graphs depicting safety trends found at the West End Rotary, all of which are included in the Appendices. The virtual RSA also included a review of video drone footage as well as a collection of dashboard camera videos of the rotary. Additionally, the Road Safety Audit team used pedestrian level videos to analyze the accommodations at the West End Rotary from a non-motorist perspective.

The following safety issues and potential enhancements were identified through discussions with the Road Safety Audit team. Several of the issues require further study and engineering to determine the feasibility of implementing enhancements.

Safety Issue #1: Multi-Modal Accommodations

Observations:

RSA participants noticed the West End Rotary lacked proper multi-modal accommodations even though many pedestrians walk through the area (for example, many pedestrians use this rotary to walk between downtown Hyannis and the Melody Tent). Some audit team members noted pedestrians have been seen crossing through the center of the rotary due to the lack of crosswalks and sidewalks that contribute to poor connectivity for non-motorists. There is an overall lack of defined bicycle accommodations within the rotary.



Image 1: Crosswalk across Rockland Trust driveway at the West End Rotary.

While three of the four approaches have sidewalks, with North Street as the exception, the pedestrian accommodations provided are confusing, incomplete and not useful. Expansive driveway crossings along businesses on the rotary are challenging to pedestrians and give the impression that the sidewalk is discontinued. The sidewalk on West Main Street and the sloped sidewalk between Main Street and North Street are in poor condition. Additionally, the sloped sidewalk between Main Street and North Street causes bikes and pedestrians to use the insurance business parking lot as a cut through, thereby creating conflicts in the parking lot. This bituminous sloped sidewalk transitions into a semi-driveway along the Main Street approach to the rotary with vehicles entering the parking lot quickly. This creates a difficult crossing for pedestrians. Historic images from the Google Street View of this sidewalk show yellow striped pavement markings present past the driveway.

The rotary's design can also encourage indirect routes for pedestrians. For example, there is a short sidewalk segment that runs along the guardrail near North Street and leads into a crosswalk in the Subway Sandwich driveway entrance. The location of the crosswalk does not follow pedestrian desire lines and is likely unused. Also, there are no marked crosswalks at any of the approaches, creating a barrier for those walking through the rotary.

Of the 19 crashes at the rotary, one (crash #15) involved an injury to a pedestrian at the North Street approach to the rotary. The pedestrian crash was attributed to the wide entry leg where a vehicle tried to pass a stopped vehicle on the left who was yielding for a crossing pedestrian.

Other audit members noted there are wide shoulders on Scudder Avenue and Main Street, which provide space for bicyclists; however, they quickly narrow at the entry legs of the rotary.

Enhancements:

- Install new sidewalks along the rotary and its approaches.
- Provide ADA-compliant crossings at all approaches with appropriate warning signage.
- Install crosswalks at all existing driveways where there are current sidewalk connections. (Currently only Rockland Trust driveways have crosswalks).
- Review ADA compliance and upgrade existing sidewalk connections as necessary. Improve sidewalk conditions where appropriate, in particular at the sloped sidewalk between Main Street and North Street.
- Evaluate providing bike accommodations where possible, such as consistent shoulder widths or a striped bike lane.
- Consider the installation of a shared-use path around the rotary.



Image 2: Sloped sidewalk between Main Street and North Street

Safety Issue #2: Intersection Operations & Geometry

Observations:

RSA participants identified several issues with the design and layout of the West End Rotary. Inconsistencies were noted with the splitter island geometries and lane widths. All rotary entry legs are striped as a one-lane approach but are wide enough to fit two vehicles. As seen with crashes #13 and 15, two vehicles were able to queue side-by-side on North Street. It should be noted that the North Street entry leg was previously striped as two lanes. The width of Main Street, coupled with its grade and lack of deflection, allows drivers entering the rotary to maintain higher speeds, discouraging yielding to drivers in the rotary (crash #4 and #9).



Image 3: North Street approach to rotary

The lack of deflection also contributed to crashes near the North Street and Scudder Avenue entry points, which offer near-straight alignments into the rotary (see crash #11). Drivers at the North Street approach have been observed blatantly running the stop sign or rolling through it. Most movements from North

Street are right turns onto West Main Street, which is a near-straight path for vehicles to make at any break in traffic. The previous switch from yield to stop control was likely an attempt to enforce yielding prior to entering the rotary.

Additionally, several rear-end collisions occurred at the entry points where the second driver incorrectly thought the first driver had entered the rotary already (crashes #2, 5, 14, and 17). Other rear-end collisions were attributed to traffic queuing on Main Street exiting the rotary (see crashes #6, 18, and 19). Some of these crashes involved vehicles exiting the parking lots of Bank of America and Rockland Trust.



Image 4: Scudder Ave approach to rotary

Modern design of circular intersections now typically consists of roundabouts, which greatly improve safety for all users and reduce injury related crashes. The main difference between a rotary and a roundabout is the overall smaller footprint and inscribed diameter of the center island. Vehicles must yield upon entry and choose the proper lane prior to entering the roundabout. Roundabout design includes deflection created by approach alignment at entry points which reduce entering speeds and require vehicles to travel at a much lower speed than a rotary, thereby reducing serious injury related crashes.

Additionally, it was noted that two crashes (crashes #7 and 16) occurred due to solar glare in the westbound direction in the afternoon time period, while four crashes occurred during nighttime hours. It was observed that no lighting is present at the rotary. Additionally, there is a utility pole on the north side of Scudder Avenue in the sidewalk that is very close to the roadway and may be forcing vehicles to take a wider right turn when exiting the rotary and encroach further into the roadway, causing instances of near misses with opposing vehicles.

Enhancements:

- Consider reconstructing the rotary intersection into a modern roundabout with improved deflection, a smaller center island and smaller overall footprint.
- Evaluate the existing splitter island design and consider redesigning to improve deflection to slow entering and exiting vehicles.
- Relocate the existing utility pole on Scudder Avenue.
- Evaluate lighting conditions and implement improvements.
- Review lane assignments for entry lanes and modify as needed. Consider opportunities to use that space for sidewalks, bike lanes, or a shared use path.

Safety Issue #3: Signage and Pavement Markings

Observations:

There is an overall lack of signage and pavement markings which lead to confusion for both motorists and non-motorists traveling within the rotary. Since speed regulations are not available for the roadways, speed limit signage is not present in the immediate area of the rotary. With the absence of pavement markings, signage and the wide roadway widths, vehicles tend to operate at a higher speed and not properly yield to circulating traffic, as noted in crashes #1,4,9, and 11.



Image 5: Wide circulatory lane with no pavement markings

There was also observed to be minimal advance warning, regulatory, and directional signage at the rotary. All approaches lack advance rotary warning signage, except for the Main Street approach. There is also no signage within the rotary itself. Drivers unfamiliar with the area may be confused on how to navigate the rotary to their intended destination. On the North Street approach, where a horizontal curve is present, there is only a Stop Ahead sign, with no advance warning signage noting the rotary ahead. Additionally, there is inconsistency with the regulatory signage on the rotary approaches, as North Street is signed under stop control while the remaining approaches are signed under yield control. There is only one yield sign on Main Street, while the other approaches all have two signs. The Main Street yield sign and one of the Scudder Avenue yield signs are both placed far into the rotary and are not effective

There is also an overall lack of pavement markings to support proper driver yielding behavior. Specifically, the lack of yield markings makes drivers more likely to enter the rotary even when other vehicles are present. Additionally, the lack of lane markings, combined with the wide nature of the rotary lanes, creates short weaving segments, as drivers are unsure as to whether the rotary has one or two lanes. This can cause crashes where drivers can enter the rotary thinking the other driver in the rotary is staying to the left; when the driver in the rotary moves right to exit, crashes can occur. An example of a short weaving segment is between Main Street and North Street, where crashes #1, 4, 9, and 16 were reported. It was also noted there is a slight crest on Main Street that may impact sight lines to/from the rotary and may affect the visibility of the Bank of America driveway.



Image 6: Lack of directional signage at exit points

Enhancements:

- Retrofit the rotary to include modern roundabout signage and pavement markings to improve safety and reduce lane widths within the existing rotary layout.

- Narrow the rotary circulatory lane width with pavement markings or a truck apron to narrow lanes and slow speeds, but still allow space for emergency vehicles.
- Review and improve placement of all yield/stop signs on the approach roadways to improve visibility. Consider installation of a second supplemental yield sign on Main Street.
- Install advance rotary warning signs on all approach roadways.
- Add yield lines to all entry legs.
- Add painted gore lines to all splitter islands.
- Develop a comprehensive signage plan for the rotary that includes chevrons for the center rotary island and supplemental directional signage at exit points.
- Review existing speed regulations and establish new speed regulations. Note that in order to install speed limit signs, speed studies would need to be conducted.
- Consider working through the Town of Barnstable to adopt Chapter 90, Section 17(c); that State Law allows jurisdictions to opt-in to establish a speed limit of 25 mph within a “thickly settled” area.
- Install street name signs.
- Consider installation of advisory speed limit signage for the rotary.

Safety Issue #4: Curb Cuts

Observations:

There are approximately five private driveways that have direct access or are near the rotary. The locations of these curb cuts result in additional conflict points for both vehicular and non-vehicular traffic. Specifically, there have been two crashes related to turning movements at these driveway locations (crashes #6 and 10). Specifically, both of those crashes were rear-end collisions caused when drivers on Main Street, close to the rotary, stopped to let vehicles out from the Bank of America and Rockland Trust driveways and were subsequently struck from behind. It was also mentioned that the stop bar at the Rockland Trust driveway is placed far back from the road which may be affecting the visibility of cars turning out from that location. Additionally, the Subway right-turn only exit driveway was noted to be missing a corresponding a left-turn restriction sign to match the layout of that driveway and enforce the turn restrictions in place.

Many of the rotary driveways are wide, with little delineation which can cause confusion to motorists. For example, there appears to be a large driveway opening on Main Street to an office building with no pavement markings or delineation to motorists to inform motorists or non-motorists of the driveway operations. The liquor store driveway is also a large curb cut and it was noted that vehicles can enter the site from either side of the splitter island on Scudder Avenue, which can cause confusion to vehicles maneuvering the rotary in this area.



Image 7: Large driveway opening to Liquor Store

Enhancements:

- Review and implement access management strategies for existing rotary driveways.
- Consider implementing turn restrictions on driveways within or near the rotary with appropriate signage or pavement markings.
- Consider striping driveways to narrow widths.
- Consider reconstructing rotary driveways to reduce widths by modifying curb lines.
- Modify the Scudder Avenue splitter island to restrict movement to the liquor store.
- Relocate Rockland Trust stop bar closer to roadway.
- Install missing left-turn restriction sign for West Main Street Subway driveway.

Summary of Road Safety Audit

The final section of the RSA included the discussion of potential safety enhancements to address the identified safety deficiencies. The range of safety enhancements included both short-term, low-cost improvements as well as long-term and higher-cost recommendations. Table 2 presents a summary of the estimated time frames and preliminary costs associated with each potential safety enhancement.

Table 3 presents a summary of the Road Safety Audit observations and enhancements to assist in the design and/or implementation of potential improvements elicited during the process. It is also recommended that any design process for more involved geometric changes include further analysis and public input. Safety payoff estimates are subjective judgement of the potential effectiveness of the potential enhancement.

Table 2: Estimated Time Frame and Costs Breakdown

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

Table 3: Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Jurisdiction
Multi-Modal Accommodations	Install new sidewalks along the rotary and its approaches.	High	Mid-Term	High	Town
Multi-Modal Accommodations	Provide ADA-compliant crossings at all rotary approaches with appropriate warning signage.	High	Mid-Term	Medium	Town
Multi-Modal Accommodations	Install crosswalks at existing driveways where there are current sidewalk connections.	Medium	Short-Term	Low	Town/Property Owners
Multi-Modal Accommodations	Review ADA compliance and upgrade existing sidewalk connections as necessary. Specifically, improve sidewalk condition at the sloped sidewalk between Main Street and North Street.	Medium	Mid-Term	High	Town
Multi-Modal Accommodations	Evaluate providing bike accommodations where possible, such as striping consistent shoulder widths or striping bike lanes.	Medium	Short-Term	Low	Town
Multi-Modal Accommodations	Consider installation of a shared use path.	High	Long-Term	High	Town/Property Owners
Intersection Control & Geometry	Consider reconstructing the rotary into a modern roundabout.	High	Long-Term	High	Town
Intersection Control & Geometry	Evaluate the existing splitter island design and locations. Consider redesigning to improve deflection.	High	Mid-Term	Medium	Town
Intersection Control & Geometry	Relocate existing utility pole on Scudder Ave.	Low	Mid-Term	Medium	Town/Utility Companies

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Jurisdiction
Intersection Control & Geometry	Evaluate lighting conditions and implement improvements.	Medium	Mid-Term	Medium	Town
Intersection Control & Geometry	Review lane assignments for entry lanes and modify as needed. Consider opportunities to use that space for sidewalks, bike lanes, or a shared use path.	Medium	Mid-Term	Medium	Town
Signage and Pavement Markings	Retrofit the rotary to include modern roundabout signage pavement markings to improve safety and reduce lane widths.	High	Mid-Term	Medium	Town
Signage and Pavement Markings	Review and improve location of all yield/stop signs on approach roadways to improve visibility. Consider installing a second yield sign at Main Street.	Medium	Short-Term	Low	Town
Signage and Pavement Markings	Narrow the rotary circulatory lane width with pavement markings or a truck apron.	Medium	Short-Term	Low	Town
Signage and Pavement Markings	Install advance rotary warning signs on all roadways.	Medium	Short-Term	Low	Town
Signage and Pavement Markings	Add yield lines to all entry legs.	Medium	Short-Term	Low	Town
Signage and Pavement Markings	Add painted gore lines to all splitter islands.	Medium	Short-Term	Low	Town
Signage and Pavement Markings	Develop a comprehensive signage plan for the rotary that includes chevrons for the center rotary island and supplemental, directional signage at exit points.	Medium	Short-Term	Low	Town

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Jurisdiction
Signage and Pavement Markings	Review existing speed regulations and establish new regulations (after conducting speed studies).	Medium	Short-Term	Low	Town
Signage and Pavement Markings	Consider working through the Town of Barnstable to adopt Chapter 90, Section 17(c); that State Law allows jurisdictions to opt-in to establish a speed limit of 25 mph within a “thickly settled” area.	Medium	Short-Term	Low	Town
Signage and Pavement Markings	Install street name signs.	Low	Short-Term	Low	Town
Signage and Pavement Markings	Consider installation of advisory speed limit signage.	Medium	Short-Term	Low	Town
Curb Cuts	Review and implement access management strategies for existing rotary driveways.	Medium	Long-Term	Medium	Town/Property Owners
Curb Cuts	Consider implementing turn restrictions on driveways within or near the rotary with signage and markings.	Low	Short-Term	Low	Town/Property Owners
Curb Cuts	Consider striping driveways to narrow widths.	Medium	Short-Term	Low	Town/Property Owners
Curb Cuts	Reconstruct driveways to modify curb lines and physically narrow widths.	Medium	Mid-Term	Medium	Town/Property Owners
Curb Cuts	Modify Scudder Ave splitter island to restrict movements to liquor store.	Medium	Mid-Term	Medium	Town
Curb Cuts	Relocate Rockland Trust stop bar closer to roadway.	Low	Short-Term	Low	Town/Property Owners
Curb Cuts	Install missing turn restriction signage for Subway driveway.	Low	Short-Term	Low	Town/Property Owners

Appendix A. RSA Meeting Agenda

Agenda

Road Safety Audit

Barnstable, MA

West End Rotary: North St, Main St, Scudder Ave,
West Main St.

ZOOM Link: <https://capecodcommission.org/transportation/join>

Wednesday, June 30, 2021

10:00AM – 1:00PM

Type of meeting:	Road Safety Audit
Attendees:	Invited participants to comprise a multidisciplinary team
Please bring:	Thoughts and enthusiasm!!
10:00 AM	Welcome and Introductions
10:15 AM	Discussion of Safety Issues <ul style="list-style-type: none">• Crash history, speed regulations, recent and existing projects• Existing geometries and conditions
11:00 AM	Virtual Site Visit <ul style="list-style-type: none">• View video footage of intersections and corridor• As a group, identify areas for improvement
11:30 AM	Discussion of Potential Improvements <ul style="list-style-type: none">• Discuss observations and finalize safety issue areas• Discuss potential improvements and finalize recommendations
1:00 PM	Adjourn for the Day – but the RSA has not ended

Instructions for Participants:

- Before attending the RSA on June 30, 2021, participants are encouraged to drive/walk through the intersection and complete/consider elements on the RSA Prompt List with a focus on safety.
- All participants will be actively involved in the process throughout. Participants are encouraged to come with thoughts and ideas, but are reminded that the synergy that develops and respect for others' opinions are key elements to the success of the overall RSA process.
- After the RSA meeting, participants will be asked to comment and respond to the document materials to assure it is reflective of the RSA completed by the multidisciplinary team.

Appendix B. RSA Audit Team Contact List

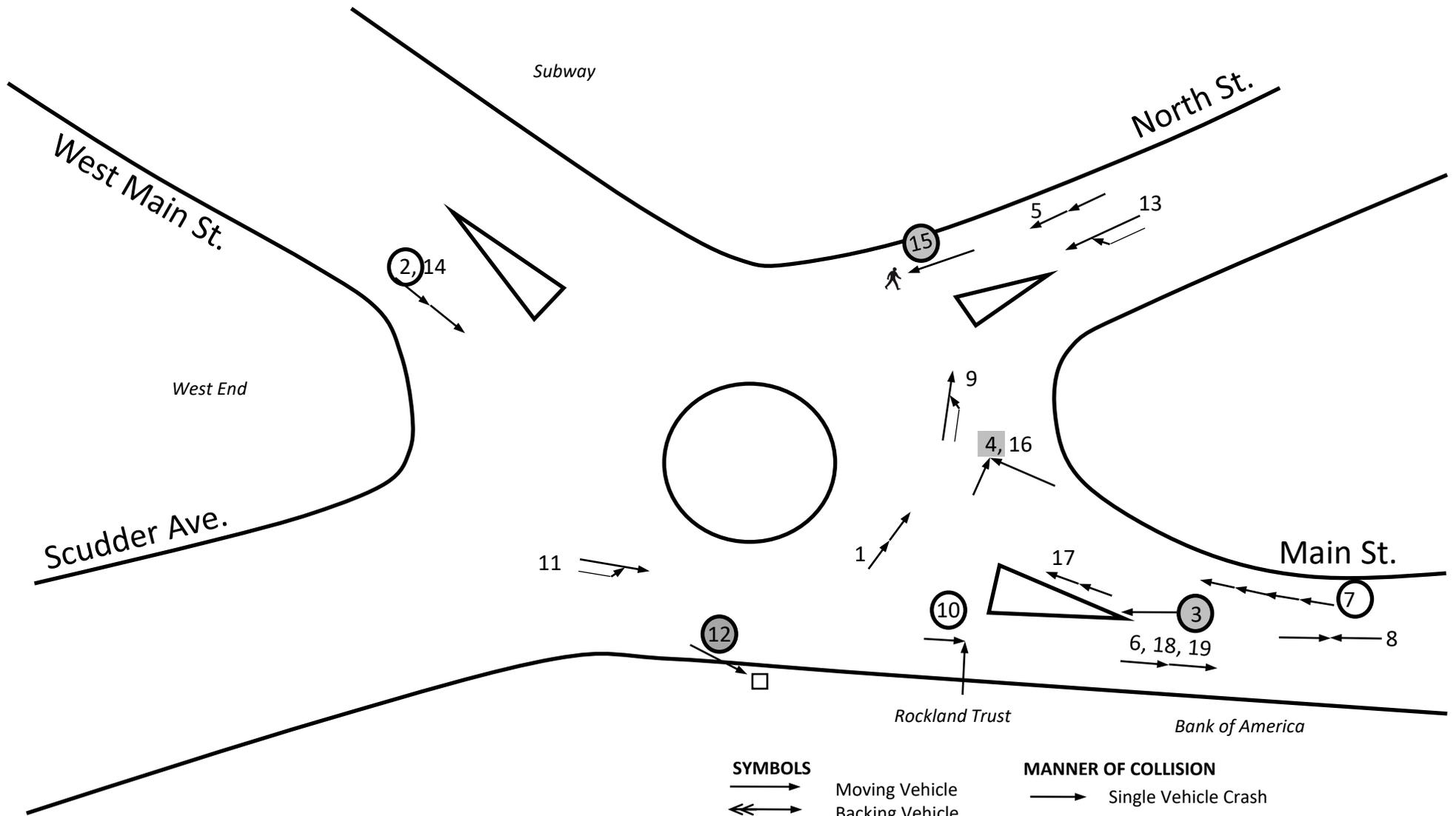
Participating Audit Team Members

Date: June 30, 2021

Location: Barnstable, MA

Audit Team Members	Agency/Affiliation	Email Address
Griffin Beaudoin	Town of Barnstable – Town Engineer	griffin.beaudoin@town.barnstable.ma.us
Nathan Collins	Town of Barnstable – Assistant Town Engineer	nathan.collins@town.barnstable.ma.us
Elizabeth Jenkins	Town of Barnstable – Director of Planning & Development	elizabeth.jenkins@town.barnstable.ma.us
Matthew Lounsbury	Barnstable Police Department	lounsbury@barnstablepolice.com
Noah Berger	Cape Cod Regional Transit Authority	nberger@capecodrta.org
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Corey Velho	Cape Cod Commission	

Appendix C. Detailed Crash Data



CRASH DIAGRAM

Location: West End Rotary

Town: Barnstable

Date of Crash Data: 1/1/16 - 12/31/20

Total Crashes: 19 Injury Crashes: 6 Fatal Crashes: 0

Note:

SYMBOLS

- Moving Vehicle
- Backing Vehicle
- Lane Change
- Turning Vehicle
- Out of Control
- Indirectly Involved Vehicle
- Bicycle
- Pedestrian
- Parked Vehicle
- Fixed Object

MANNER OF COLLISION

- Single Vehicle Crash
- Rear-end
- Angle
- Sideswipe
- Head on
- Rear to Rear

SEVERITY

- Injury Crash
- Nighttime Crash
- Fatal Crash



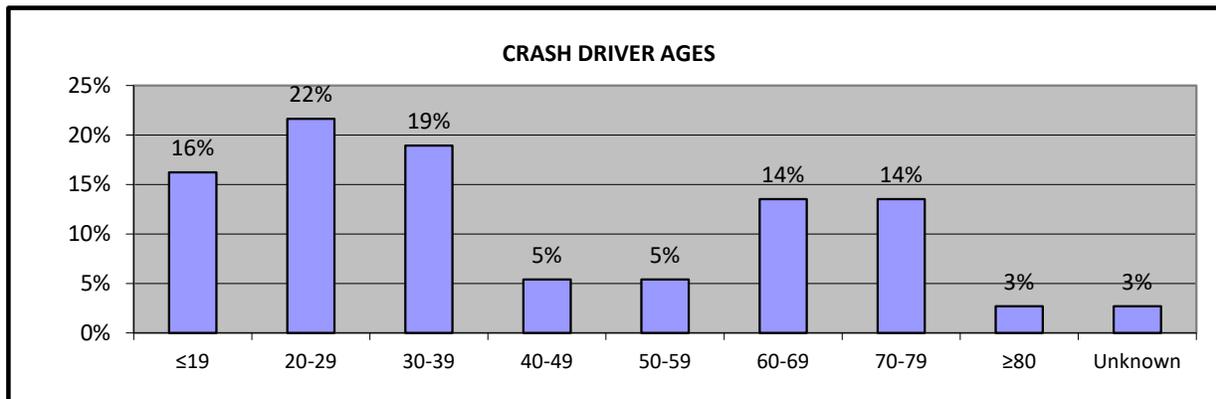
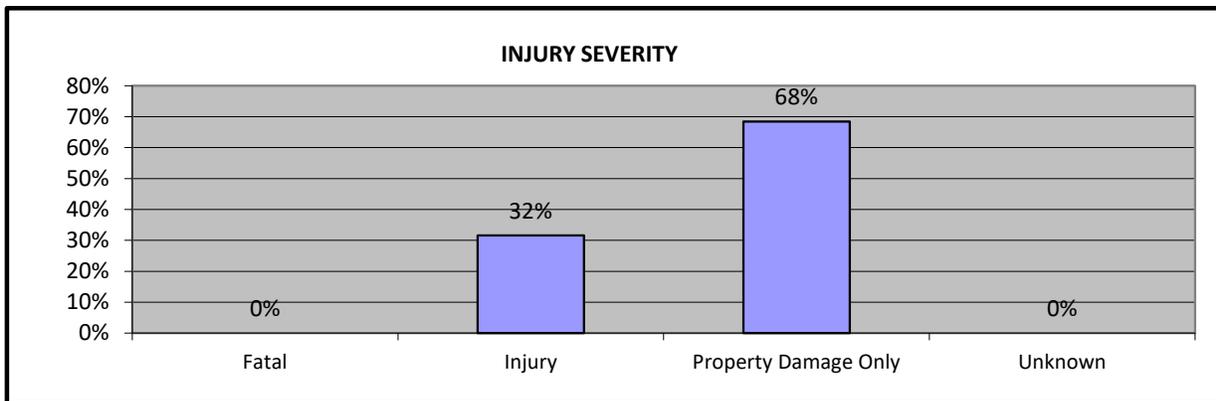
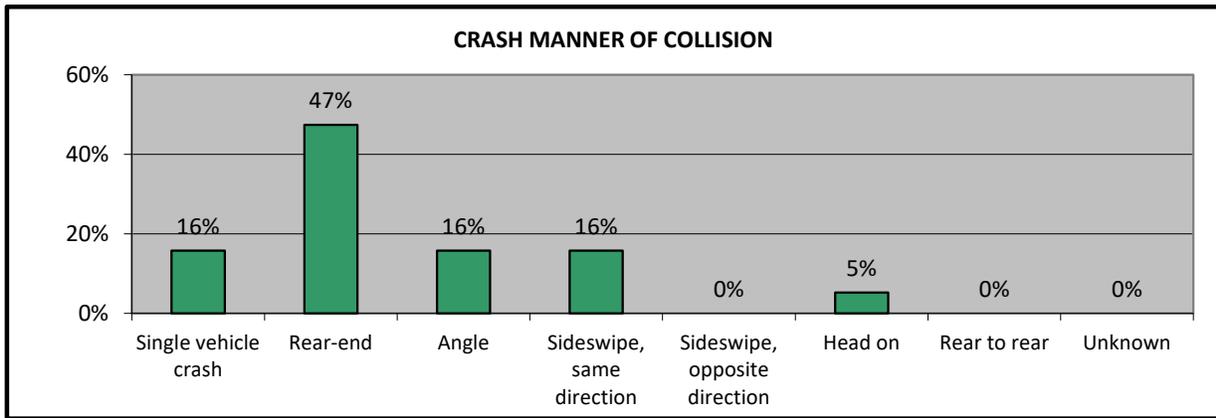
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Crash Data Summary Table

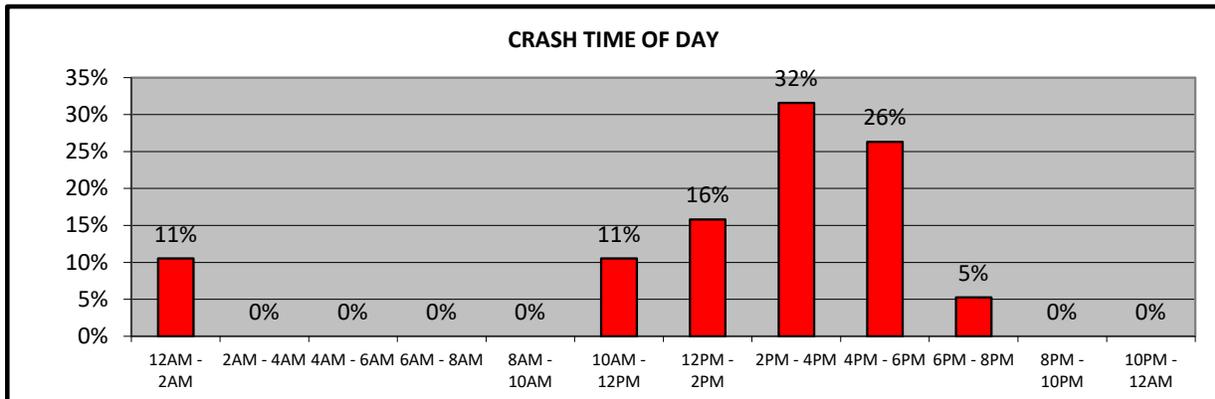
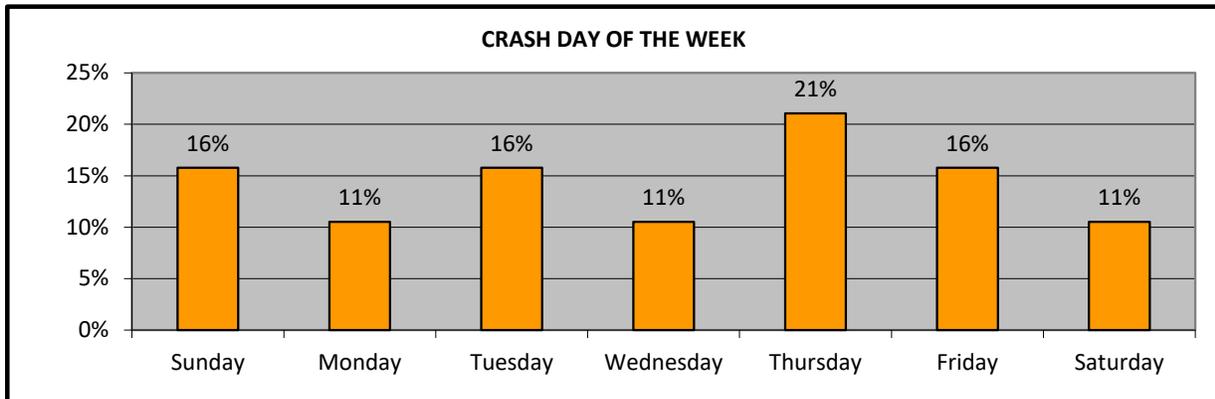
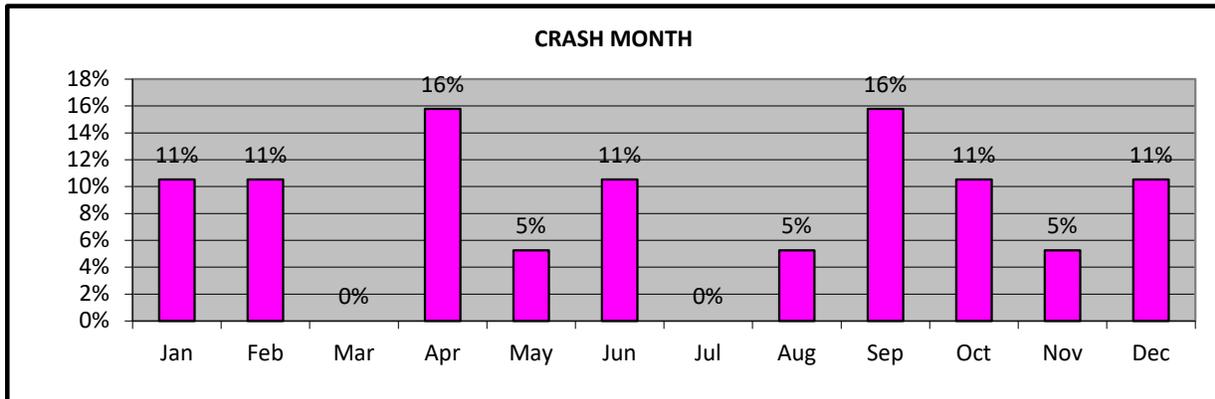
West End Rotary, Barnstable, MA
2016 - 2020

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Driver Distracted By	Injury Severity	D1 Age	D2 Age	D3 Age	D4 Age	Comments
#	mm/dd/yy	Day	hh:mm	Type	Type	Type	Type	Type	Type	Type	#	#	#	#	
1	04/24/16	Sunday	5:49 PM	Rear-end	Daylight	Cloudy	Dry	Followed too closely	NA	No Injury	74	36			MV2 rear-ended MV1 who stopped within the rotary to yield to an oncoming MV entering from Main St.
2	08/24/16	Wednesday	4:28 PM	Rear-end	Daylight	Clear	Dry	Unknown	NA	Non-fatal injury	23	17			MV1 rear-ended MV2 while waiting to enter the rotary from West Main St.
3	10/06/16	Thursday	1:55 AM	Single vehicle crash	Dark - lighted roadway	Clear	Dry	Driving too fast for conditions	Not distracted	Non-fatal injury	26				Single-vehicle motorcycle crash onto the grass island at the Main St. approach to the rotary. The motorcycle operator claimed a MV cut them off at the rotary and lost control of their motorcycle.
4	02/09/18	Friday	5:50 PM	Angle	Dark - lighted roadway	Clear	Dry	Unknown	Unknown	No Injury	46	36			MV1 failed to yield to the right of way when entering the rotary from Main St and collided with MV2 who was driving within the rotary and exiting onto North St.
5	06/10/18	Sunday	12:37 PM	Rear-end	Daylight	Clear	Dry	Inattention	Other activity (searching, eating, personal hygiene, etc.)	No Injury	45	37			MV2 rear-ended MV1 while waiting to enter the rotary from North St. MV2 thought MV1 had entered the rotary.
6	09/24/18	Monday	3:43 PM	Rear-end	Daylight	Clear	Dry	No improper driving	Manually operating an electronic device (texting, typing, dialing)	No Injury	74	57			MV2 rear-ended MV1 on Main St in the eastbound direction at the intersection of Main St and the Bank of America driveway just east of the rotary. MV1 was stopped in traffic to allow a vehicle to exit the bank driveway.
7	10/16/18	Tuesday	4:30 PM	Rear-end	Daylight	Clear	Dry	Glare	Not distracted	Non-fatal injury	26	70	24	19	MV1 rear-ended MV2, who was slowing down for traffic, while traveling west on Main St due to solar glare. MV2 subsequently rear-ended MV3 which forced MV3 to rear-end MV4.
8	01/20/19	Sunday	12:47 PM	Head on	Daylight	Rain	Wet	Unknown	Unknown	No Injury	29	34			MV2 had just exited the rotary and fishtailed across the centerline on Main St and struck MV1 due to wet weather conditions.
9	02/08/19	Friday	11:39 AM	Sideswipe, same direction	Daylight	Clear	Dry	Failed to yield right of way	Not distracted	No Injury	34	93			MV2 failed to yield to the right of way when entering the rotary from Main St and collided with MV1 who was driving within the rotary and exiting onto North St.
10	04/13/19	Saturday	11:40 AM	Angle	Daylight	Rain	Wet	Failed to yield right of way	Unknown	Non-fatal injury	19	63			MV2 struck MV1 who was exiting the Rockland Trust driveway on Main St.
11	04/23/19	Tuesday	3:27 PM	Sideswipe, same direction	Daylight	Cloudy	Dry	Failed to yield right of way	Unknown	No Injury	61	16			MV1 failed to yield to the right of way when entering the rotary from Scudder Ave and collided with MV2 who was driving within the rotary towards Main St.
12	05/30/19	Thursday	12:20 AM	Single vehicle crash	Dark - roadway not lighted	Rain	Wet	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	Not distracted	Non-fatal injury	35				MV1 crashed into utility pole in front of Rockland Trust. Operator of MV1 was operating under the influence.
13	06/26/19	Wednesday	7:45 PM	Sideswipe, same direction	Daylight	Clear	Dry	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	Not distracted	No Injury	27	69			MV1 sideswiped MV2 while trying to enter the rotary from North St. MV1 was fleeing police and driving at a high rate of speed.
14	09/06/19	Friday	3:27 PM	Rear-end	Daylight	Cloudy	Dry	Unknown	Unknown	No Injury	Unknown	54			MV1 rear-ended MV2 while waiting to enter the rotary from West Main St.
15	11/14/19	Thursday	5:44 PM	Single vehicle crash	Dark - lighted roadway	Rain	Wet	Other improper action	Not distracted	Non-fatal injury	18				MV1 yielded to pedestrians attempting to cross the North St approach of the rotary. MV2 passed MV1 on the left to enter the rotary and collided with the two pedestrians attempting to cross.
16	12/07/19	Saturday	3:27 PM	Angle	Daylight	Clear	Dry	Glare	Not distracted	No Injury	74	18			MV1 was traveling within the rotary from Main St and collided with MV2 due to solar glare. MV2 was intending to exit onto North St.
17	12/10/19	Tuesday	1:31 PM	Rear-end	Daylight	Cloudy	Wet	Followed too closely	Unknown	No Injury	70	26			MV2 rear-ended MV1 while waiting to enter the rotary from Main St.
18	01/23/20	Thursday	3:42 PM	Rear-end	Daylight	Clear	Dry	Inattention	Unknown	No Injury	62	35			MV2 rear-ended MV1 while in traffic in the eastbound direction on Main St near Bank of America.
19	09/14/20	Monday	3:06 PM	Rear-end	Daylight	Clear	Dry	Inattention	Unknown	No Injury	22	66			MV1 rear-ended MV2 while in traffic in the eastbound direction on Main St near Rockland Trust.

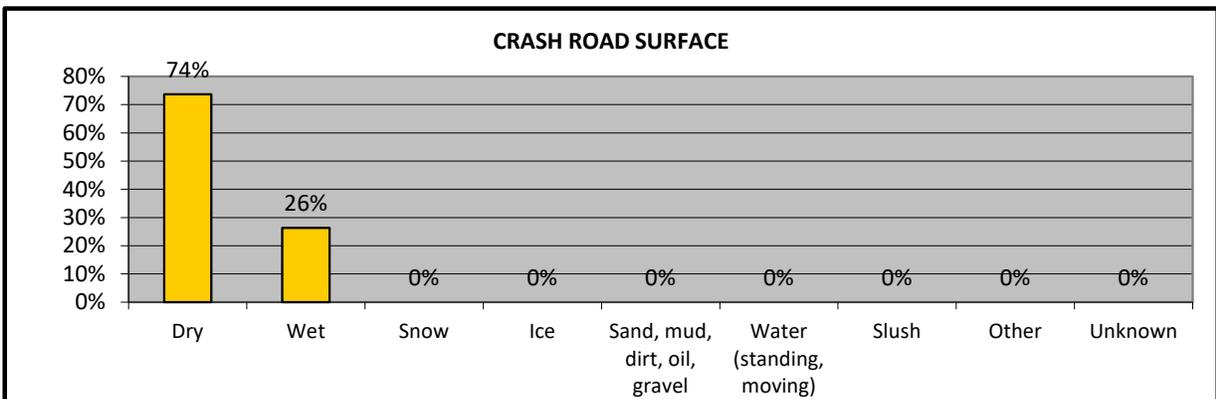
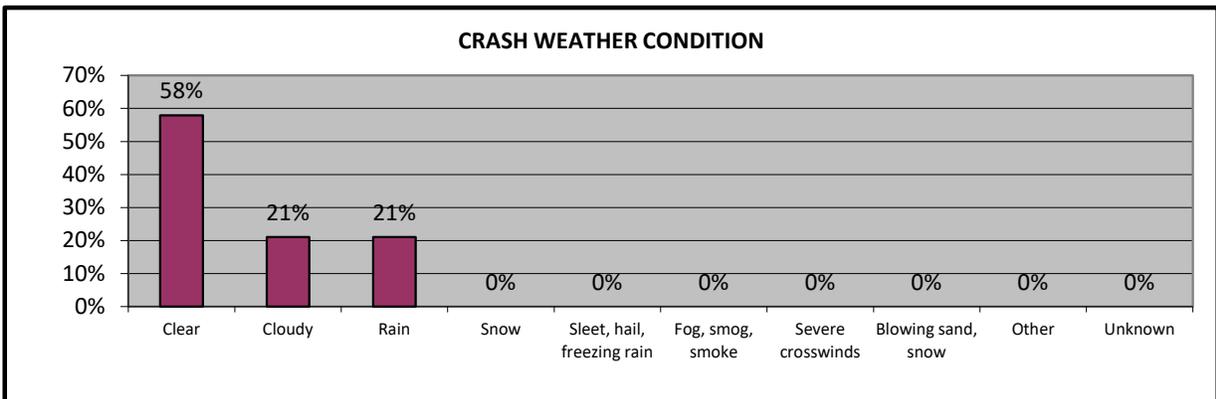
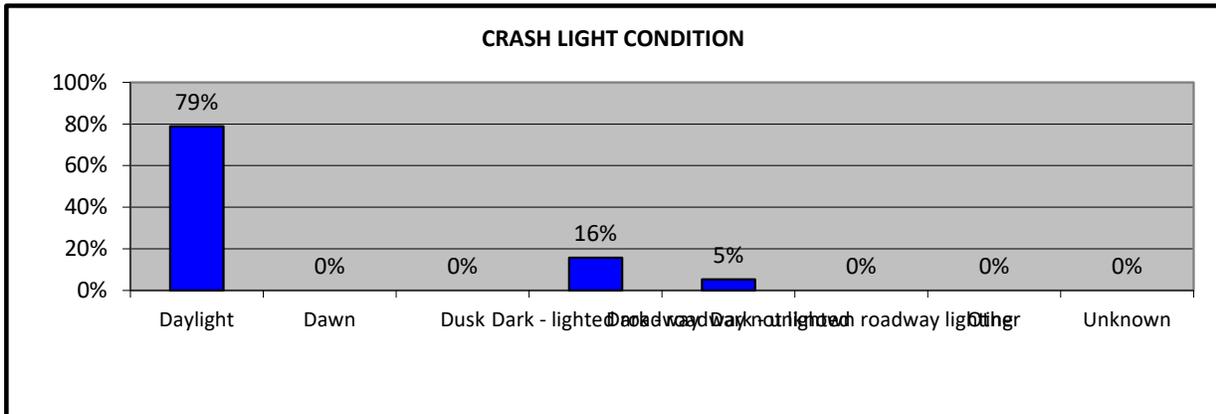
Crash Data Summary Charts West End Rotary, Barnstable, MA



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Crash Data Summary Charts West End Rotary, Barnstable, MA



Appendix D. Road Safety Audit References

Road Safety Audit References

FHWA Office of Safety - Proven Safety Countermeasures, U.S. Department of Transportation, Federal Highway Administration <https://safety.fhwa.dot.gov/provencountermeasures/>.

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

Road Safety Audits. U.S. Department of Transportation, Federal Highway Administration, <https://safety.fhwa.dot.gov/rsa/>

FHWA Road Safety Audit Guidelines. U.S. Department of Transportation, Federal Highway Administration, 2006.

Road Safety Audit, 2nd edition. Austroads, 2000.

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