



CAPE COD  
COMMISSION

# Intersection Before and After Safety Study

**AN EXAMINATION OF CRASHES AT INTERSECTION  
RECONSTRUCTION PROJECTS ON CAPE COD  
(2011-2016)**

NOVEMBER 21, 2022

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# Before- and After Safety Study

## AN EXAMINATION OF RESULTS FROM CAPE COD COMMISSION-ENDORSED SAFETY PROJECTS

*The information depicted on the maps and figures in this report are for planning purposes only. They are not adequate for legal boundary definition, regulatory interpretation, or parcel level analysis. They should not substitute for actual on-site survey or supersede deed research. Unless otherwise noted, the source for road data and information for maps and figures in this report is the Massachusetts Department of Transportation (MassDOT) (2015) and Cape Cod Commission planimetric data (2014). Unless otherwise noted, parcel data is from a Cape Cod Commission regional parcel data set (2018).*

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CAPE COD COMMISSION

3225 Main Street • P.O. Box 226 • Barnstable, MA 02630

508-362-3828 • Fax: 508-362-3136 • Email: [frontdesk@capecodcommission.org](mailto:frontdesk@capecodcommission.org)

[www.capecodcommission.org](http://www.capecodcommission.org)

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## Executive Summary

Cape Cod Commission staff performed a before and after comparison at six different intersections throughout the Cape that were improved between 2011 and 2016 to address high crash locations. Staff reviewed the number and severity of crashes (along with other crash characteristics) of the following locations:

- Route 6A/Route 28/Canal Road, Orleans
- Route 28 at Lumbert Mill Road, Barnstable
- Route 28 at Jones Road/Worcester Court, Falmouth
- Route 28 at Davisville Road/Old Meetinghouse Road, Falmouth
- Cotuit Road/Harlow Road/South Sandwich Road, Sandwich
- Route 130 at Route 6 Eastbound Ramps, Sandwich

These diverse locations represent different areas throughout the Cape and various type of intersection improvements, providing an overview of the types of safety benefits that can be expected with related infrastructure investments.

Overall, the results of the safety interventions are promising. Of the six locations, four saw a decline in the overall number of crashes during our initial analysis. The remaining two locations were further investigated to analyze crash trends within a larger timeframe and crash severity statistics. Both of those locations saw a decline in more serious crashes (those leading to injuries). These positive outcomes are encouraging in that they show that targeted interventions at high-crash locations can make a real difference.

Many of the safety interventions seen here on Cape Cod are classified as proven safety countermeasures by U.S. Department of Transportation's Federal Highway Administration (FHWA). The FHWA states that the conversion of a two-way stop-controlled intersection into a roundabout is shown to have an 82% reduction in fatalities and injuries, which is true for the Cotuit Road roundabout location in Sandwich that was studied in this report. Additionally, as studied by FHWA, a simple modification to the yellow change intervals at a signalized intersection can have promising results:

- 36% to 50% reduction in red light running
- 8% to 14% reduction in total crashes
- 12% reduction in injury crashes

Additional safety benefits of the intersection improvements, though significant, many not be observable within the range of crash data that was analyzed. For example, the installation of a roundabout Route 6A/Route 28/Canal Road in Orleans introduced marked crosswalks across low-speed traffic where crossing opportunities had not previously existed. While no pedestrian crashes were observed during the before or after analysis periods, the new design is an improvement from a pedestrian safety perspective.

In many cases, crashes will not be completely eliminated at a particular intersection, but it is hopeful that not only the total number, but the severity of the crashes can be significantly reduced in alignment with a Vision Zero strategy, where there are no fatalities or serious injuries. The U.S. DOT's National Roadway Safety Strategy and the Department's ongoing safety programs are working towards a future with zero roadway fatalities and serious injuries. These metrics will be used moving forward in the Commission's safety-related planning and programming.

# Orleans - Route 6A / Route 28 / Canal Road Roundabout

## PROJECT DESCRIPTION

The unsignalized intersection of Route 6A and Route 28 and Canal Road in Orleans was recently improved with the installation of a roundabout in 2015. Previously, this intersection was considered a high crash location and was identified as a priority intersection for improvement in the region through the 2013 Cape Cod Transportation Improvement Program (TIP).

Under existing conditions prior to 2015, this intersection was operating as an unsignalized four-legged unsignalized intersection, with stop signs controlling Route 28 northbound left turning traffic and the southbound Canal Road approach. Traffic on Route 6A in both directions and Route 28 right-turns were uninterrupted. The intersection was a high crash location and operated with significant congestion with a Level of Service, or LOS, of "F" on the stop-controlled Route 28 northbound and Canal Road approaches. The unique geometry, lack of intersection control, high speeds and disproportionate volume of turning movements were all contributing factors to crashes at this intersection.

Three different improvement alternatives were considered with the redesign, with a roundabout ultimately being the preferred choice. The roundabout would provide the much-needed safety elements to slow vehicular traffic down, balance heavy turning movement traffic while reducing congestion and providing a more friendly design for pedestrians and bicyclists.



BEFORE



AFTER

## CRASH ANALYSIS

As referenced in the project’s Functional Design Report (FDR), there were 33 crashes recorded at the intersection in the three-year time span of 2005-2007 under the original layout. Construction of the new roundabout ended in the fall of 2015. A review of crash data during the post intervention period of 2016-2018 was selected and revealed that 13 crashes were reported over the three-year period, representing an approximately 60% decrease in comparison to existing conditions. Table 1 presents a summary of the pre- and post-intervention crash totals at the study area intersection.

### TIMELINE FOR CRASH ANALYSIS

- Existing Crash Analysis: 2005-2007
- Construction Completion: 2015
- Post Intervention Crash Analysis: 2016-2018

Period	Year	# Crashes
Before	2005	5
	2006	10
	2007	18
<b>Before Total</b>	<b>2005-2007</b>	<b>33</b>
After	2016	8
	2017	0
	2018	5
<b>After Total</b>	<b>2016-2018</b>	<b>13</b>

Table 1: Crashes by Year

As shown in Table 2, the intersection originally had an above average crash rate of 1.83 crashes/million entering vehicles (mev) for an unsignalized intersection. In comparison, the statewide average crash rate and the MassDOT District 5 average crash rate for unsignalized intersections are 0.6 crashes/mev and 0.58 crashes/mev, respectively. Post installation of the roundabout, the intersection has a calculated crash rate of 0.59 crashes/mev which is a significant improvement over existing conditions.

Table 2: Crash Rates

Location	Pre-Intervention Crash Rate (crashes/mev)	Post-Intervention Crash Rate (crashes/mev)
Study Intersection	1.83	0.59
District 5 Average	0.58*	0.57**
MA Average	0.60*	0.57**

\*MassDOT average crash rates for unsignalized intersections from FDR dated 2010

\*\*MassDOT average crash rates for unsignalized intersections based on latest data from 2018

As can be seen in Figure 1, angle crashes saw a drastic decrease (from 18 to 6) and rear-end crashes also fell dramatically, from 9 to 3. Sideswipe crashes declined and the only crash type that increased was single vehicle crashes.

Crashes were also analyzed by severity as shown in Figure 2. There was a decline for both injury related crashes and property damage only crashes at this intersection with the installation of the roundabout.

Figure 1: Crash Types, Before Intervention & After Intervention

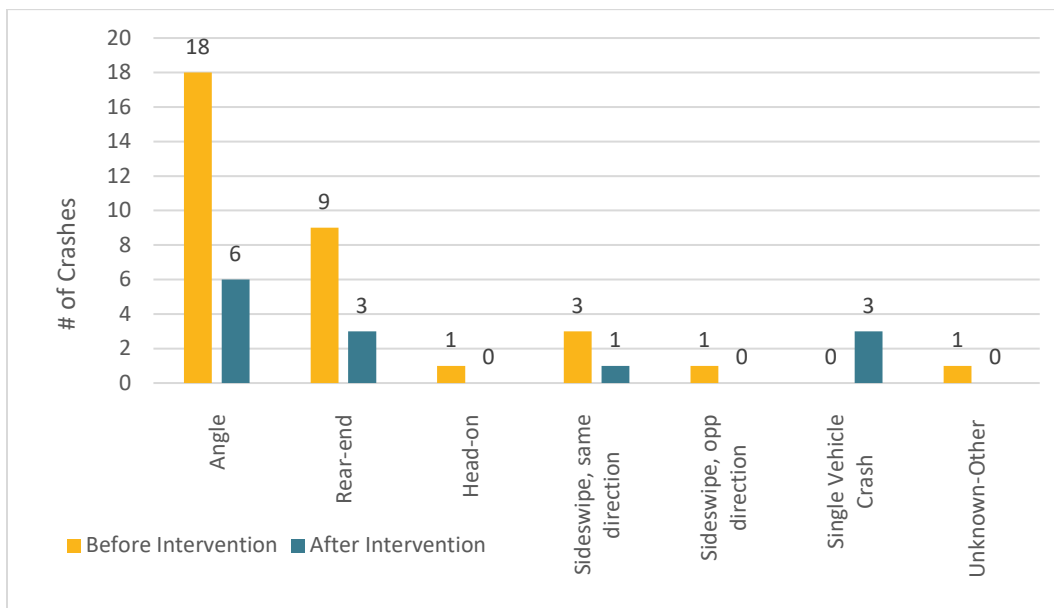
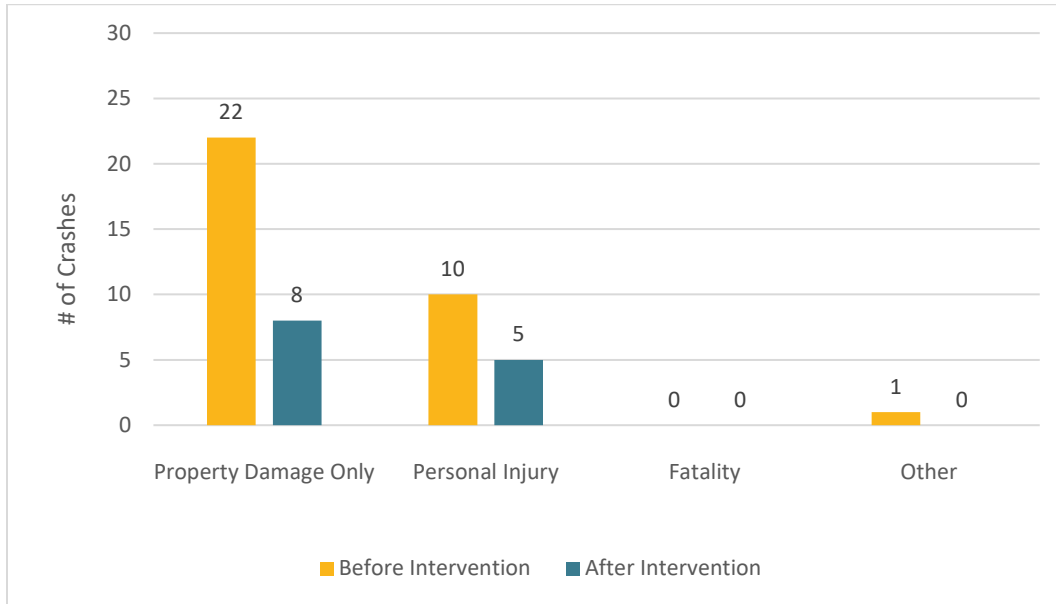




Figure 2: Crashes by Crash Severity, Before Interventions & After Interventions



# Barnstable - Route 28 & Lumbert Mill Road

## PROJECT DESCRIPTION

The intersection of Route 28 at Lumbert Mill Road in Barnstable was previously an unsignalized intersection operating under two-way stop control. Both approaches on Route 28 were under free flow conditions while the two minor approaches on Lumbert Mill Road were under stop control. All four approaches consisted of one lane in each direction and there were no left turn lanes. The intersection was considered a high crash location and was operating with significant congestion at LOS "F".

The intersection was prioritized for improvement by MassDOT through the 2009 Statewide TIP and a new traffic signal system was installed in 2011. As part of the proposed project, left turn lanes were installed on Route 28 along with an emergency vehicle pre-emption system.



**BEFORE**



**AFTER**

## CRASH ANALYSIS

As referenced in the project’s FDR, there were 37 crashes recorded at the intersection in the three-year time span of 2001-2004 prior to the installation of the traffic signal. Construction of the new traffic signal ended in the fall of 2011. A review of crash data during the post intervention period of 2012-2015 was selected and revealed that 27 crashes were reported over the three-year period, representing an approximately 27% decrease in comparison to existing conditions. Table 3 presents a summary of the pre- and post-intervention crash totals at the study area intersection.

*Table 3: Crashes by Year*

Period	Year	Crashes
Before	2001	10
	2002	12
	2003	10
	2004	5
<b>Before Total</b>	<b>2001-2004</b>	<b>37</b>
After	2012	7
	2013	6
	2014	5
	2015	9
<b>After Total</b>	<b>2012-2015</b>	<b>27</b>

### TIMELINE FOR CRASH ANALYSIS

- Existing Crash Analysis: 2001-2004
- Construction Completion: 2011
- Post Intervention Crash Analysis: 2012-2015

As shown in Table 4, the intersection originally had an above average crash rate of 0.98 crashes/million entering vehicles (mev) for an unsignalized intersection. In comparison, the statewide average crash rate and the MassDOT District 5 average crash rate for unsignalized intersections at the time was 0.58 crashes/mev and 0.59 crashes/mev, respectively. Post installation of the traffic signal, the intersection has a calculated crash rate of 0.70 crashes/mev which is a significant improvement and is below the state averages for a typical signalized intersection.

Table 4: Crash Rates

Location	Pre-Intervention Crash Rate (crashes/mev)	Post-Intervention Crash Rate (crashes/mev)
Study Intersection	0.98	0.70
District 5 Average	0.58*	0.75**
MA Average	0.59*	0.78**

\*MassDOT average crash rates for unsignalized intersections from FDR dated 2008

\*\*MassDOT average crash rates for signalized intersections based on latest data from 2018

As can be seen in Figure 3, angle crashes saw a drastic decrease (from 18 to 4) and head-on crashes halved. The occurrence of rear-end crashes did increase from 10 to 14, and side-swipe and single-vehicle increased slightly, which is typical with for a signalized intersection.

Crashes were also analyzed by severity as shown in Figure 4. Property damage crashes comprised essentially the same percentage of crashes before and after the intervention (62%). Personal injury crashes comprised 38% of all crashes before the intervention and comprised 33% of all crashes afterward.

Figure 3: Crash Types, Before Intervention & After Intervention

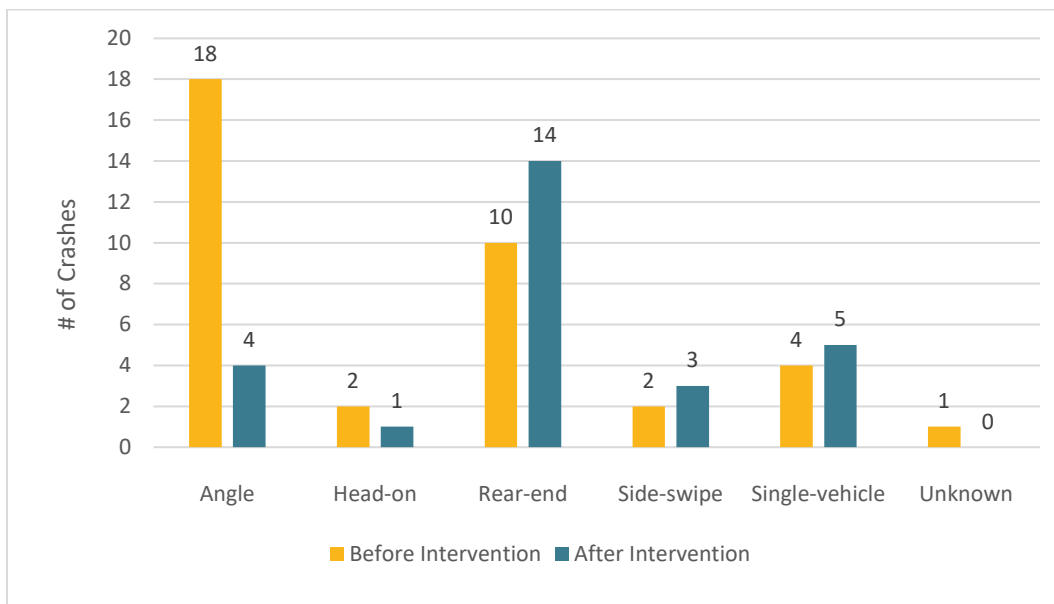
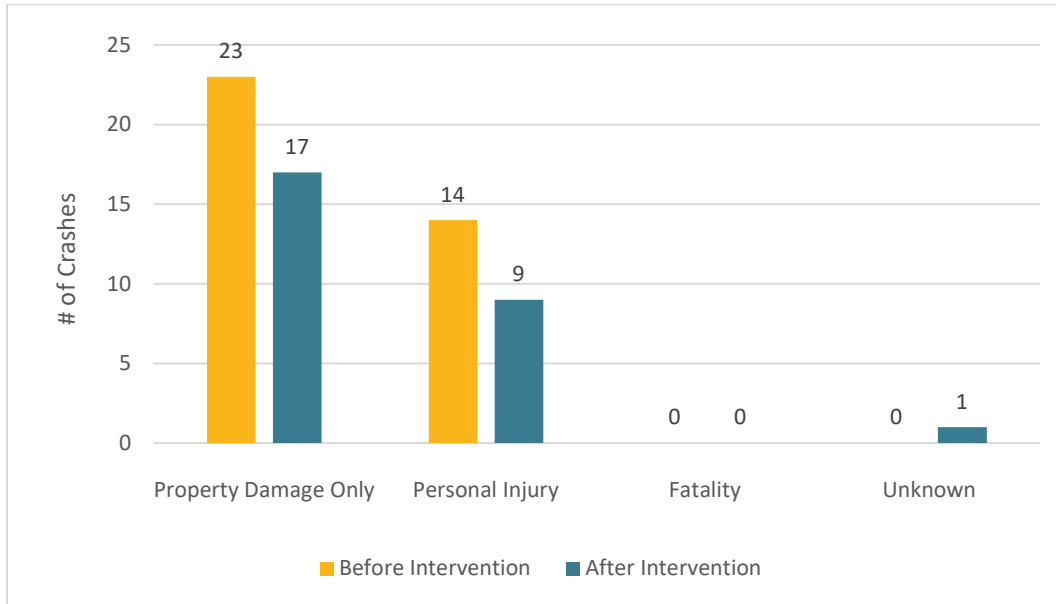


Figure 4: Crashes by Crash Severity, Before Interventions & After Interventions



# Falmouth – Route 28 & Jones Road and Worcester Court

## PROJECT DESCRIPTION

The intersection of Route 28 at Jones Road/Worcester Court in Falmouth was already a signalized intersection prior to the TIP improvement project, however, this experienced regular congestion and lacked adequate accommodations for pedestrians and bicyclists. The Town of Falmouth prioritized this location for improvement through funding in the 2013 Cape Cod TIP.

The proposed project involved extending the left turn lanes on all four approaches, installing a new modern traffic signal system complete with flashing yellow arrow technology for protected/permissive left turns, installation of sidewalks and a protected pedestrian crossing on all four approaches, reconstruction of the medians on the side streets and bicycle lanes. The project elements were aimed at reducing congestion while improving safety for all users.



**BEFORE**



**AFTER**

## CRASH ANALYSIS

Under its original configuration, there were 31 crashes at this signalized intersection during the study period analyzed in the FDR (2007-2009), resulting in an above average crash rate of 0.99 crashes/million entering vehicles (mev). At the time of the FDR, the average statewide crash rate for

a signalized intersection was 0.82 crashes/mev while the MassDOT District 5 average crash rate was 0.77 crashes/mev. Table 5 presents a summary of the pre- and post-intervention crash totals at the study area intersection.

Table 5: Crashes by Year

Period	Year	Crashes
Before	2007	10
	2008	12
	2009	9
<b>Before Total</b>	<b>2007-2009</b>	<b>31</b>
After	2017	10
	2018	25
	2019	3
<b>After Total</b>	<b>2017-2019</b>	<b>38</b>

**TIMELINE FOR CRASH ANALYSIS**

- Existing Crash Analysis: 2007-2009
- Construction Completion: 2016
- Post Intervention Crash Analysis: 2017-2019

Construction on the intersection ended in 2016, and a post intervention crash analysis time period of 2017-2019 was selected. Based on the post intervention crash analysis, there is a slight increase (18%) in the total number of crashes with 38 crashes occurring within the three-year timeframe of 2017-2019. The post intervention crash rate was calculated to be 1.10 crashes/mev which is above both the MassDOT District 5 and Statewide average crash rates of 0.75 crashes/mev and 0.78 crashes/mev, respectively.

Table 6: Crash Rates

Location	Pre-Intervention Crash Rate (crashes/mev)	Post-Intervention Crash Rate (crashes/mev)
Study Intersection	0.99	1.10
District 5 Average	0.77*	0.75**
MA Average	0.82*	0.78**

\*MassDOT average crash rates for signalized intersections from FDR dated 2011

\*\*MassDOT average crash rates for signalized intersections based on latest data from 2018

As can be seen in Figure 5, angle crashes rose dramatically between pre- and post-intervention periods (going from 8 to 15), which is common when left turns operate under permissive/protective mode. Rear-end crashes, fell, however, from 17 to 12. Other crash types stayed broadly similar.

Crashes were also analyzed by severity, as shown in Figure 6, to understand the full extent of the safety improvements. Property damage only crashes—where no personal injuries occur—did



increase from 22 to 31, while personal injury crashes fell from 9 to 6. There were no fatal crashes in either period. Although the total number of crashes has risen at this intersection, it is prudent to see that the crashes have become less severe with the overall decrease in personal injury crashes and the rise of property damage only crashes.

Figure 5: Crash Types, Before Intervention & After Intervention

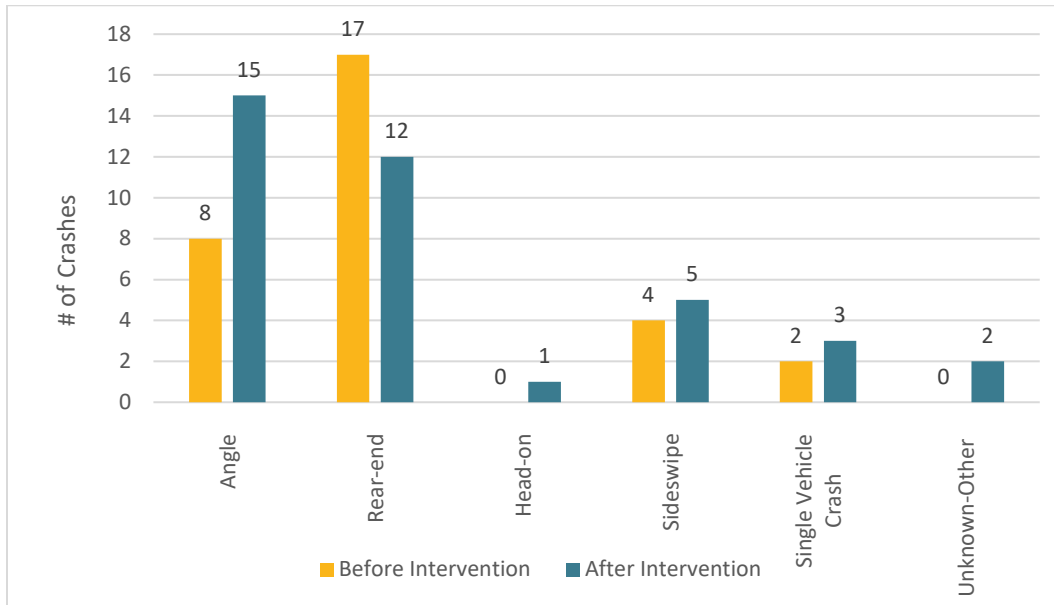
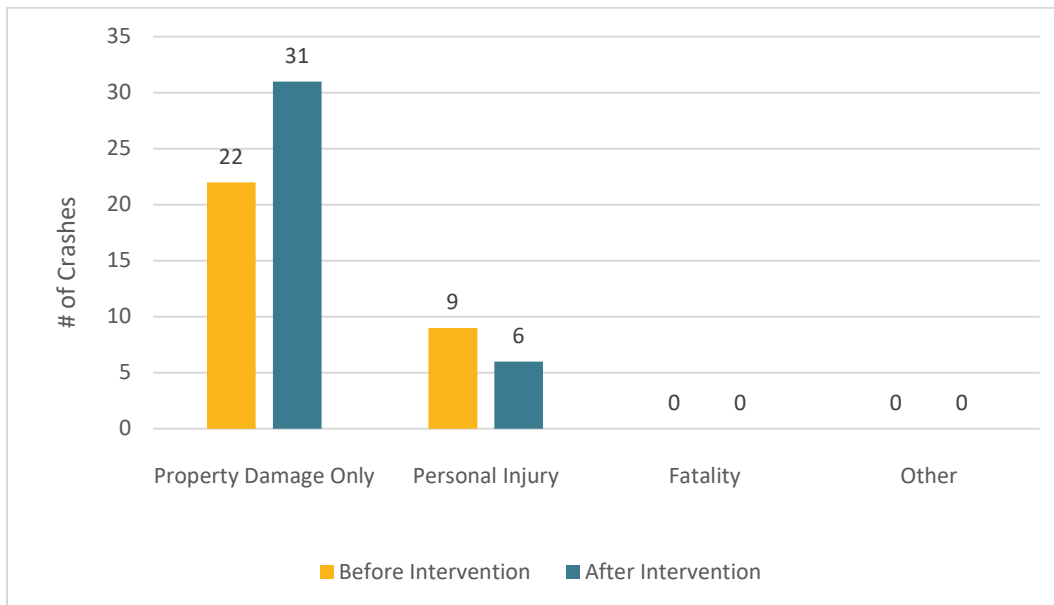


Figure 6: Crashes by Crash Severity, Before Interventions & After Interventions





## Crash Severity Analysis

The number of crashes alone do not tell a complete story. As with this study area intersection, which is a high-volume intersection that is heavily influenced by adjacent commercial land uses, not all roadway improvement projects reduce total crash numbers. An important metric to consider in this situation where there is an increase in total number crashes, is calculating the Equivalent Property Damage Only (EPDO). The EPDO metric attempts to weight more severe crashes more heavily than crashes that result only in property damage. The specific equation is as follows:

$(\text{Fatal Crashes} + \text{Injury Crashes}) * 21 + (\text{Property Damage Only Crashes}) * 1$

**Route 28 at Jones Rd EPDO = (9) \* 21 + (22) \* 1**

For this study area intersection, the EPDO score was calculated to be 211 for the pre-intervention time period, and 179 for the post-intervention period. Based on this calculation, it appears that while crashes increased, the crashes that *did occur were less severe*.

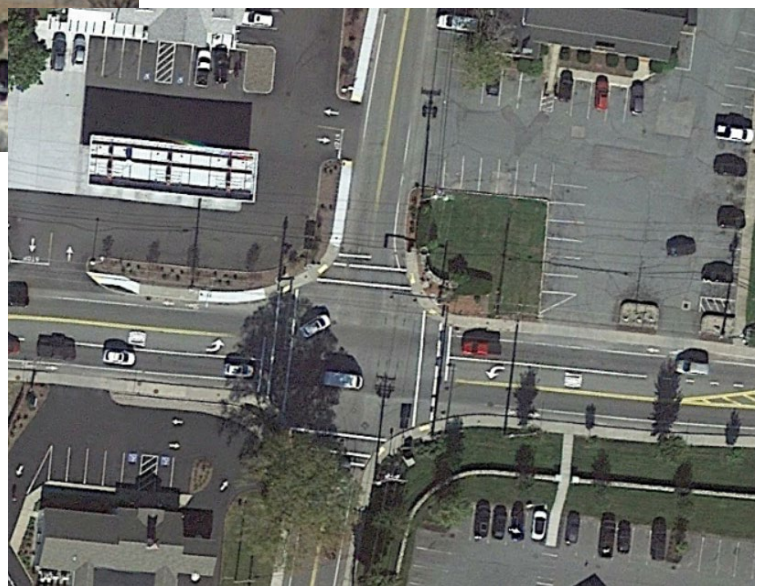
# Falmouth - Route 28 & Davisville Road / Old Meetinghouse Road

## PROJECT DESCRIPTION

Also prioritized by the Town of Falmouth, was an intersection improvement project at Route 28 at Davisville Road/Old Meetinghouse Road, which was another location of an outdated traffic signal system along the Route 28 corridor. The intersection was improved as part of the Cape Cod Transportation Improvement Program in 2013. The improvement project consisted of a new traffic signal system complete with signalized pedestrian crosswalks, the addition of left turn lanes on both Route 28 approaches and the installation of bicycle lanes. The Route 28 left turns now operate under a permissive/protected combination phasing scenario with flashing yellow arrow technology.



BEFORE



AFTER

## CRASH ANALYSIS

As referenced in the project’s FDR, there were thirteen (13) crashes measured at this intersection between 2007 and 2009 resulting in a crash rate of 0.50 crashes/mev, which was below the statewide and MassDOT District 5 averages of 0.82 crashes/mev and 0.77 crashes/mev, respectively, for a signalized intersection.

*Table 7: Crashes by Year*

### TIMELINE FOR CRASH ANALYSIS

- Existing Crash Analysis: 2007-2009 and 2010-2012
- Construction Completion: 2016
- Post Intervention Crash Analysis: 2017-2019

Construction on the intersection improvements concluded in 2016, and the timeframe of 2017-2019 was selected for the post intervention analysis. Table 7 presents a summary of the pre- and post-intervention crash totals at the study area intersection.

Period	Year	Crashes
Before (FDR analysis)	2007	5
	2008	3
	2009	5
<b>Before Total</b>	<b>2007-2009</b>	<b>13</b>
Before (CCC analysis)	2010	11
	2011	10
	2012	8
<b>Before Total</b>	<b>2010-2012</b>	<b>29</b>
After	2017	6
	2018	3
	2019	7
<b>After Total</b>	<b>2017-2019</b>	<b>16</b>

Sixteen (16) crashes were reported in the post-intervention period, which is a slight increase in the total number of the crash totals from the FDR analysis (2007-2009).

Additional crash data was pulled as part of this analysis for the time period before construction started in 2013 to further assess pre- and post-crash data. Based on the additional crash data, there were a total of 28 crashes in the before time period of 2010-2012, which shows the proposed improvement project did assist with reducing crashes at this intersection.

As shown in Table 8, the post intervention crash rate was calculated to be 0.60 crashes/mev, which is slightly higher than the existing crash rate documented in the FDR but is still considered below the average crash rates in the State and within MassDOT District 5.

Table 8: Crash Rates

Location	Pre-Intervention Crash Rate (crashes/mev)		Post-Intervention Crash Rate (crashes/mev)
Study Intersection	0.50	1.10	0.60
District 5 Average	0.77*		0.75**
MA Average	0.82*		0.78**

\*MassDOT average crash rates for signalized intersections from FDR dated 2011

\*\*MassDOT average crash rates for signalized intersections based on latest data from 2018

A deeper look into crash trends, by crash types and crash severity was also conducted using the before time period of 2010-2012. As shown in Figure 7, angle, single vehicle and head-on crashes both declined, but rear end crashes slightly rose.

Crashes were also analyzed by severity. Figure 8 shows there were 22 property damage only crashes—which are associated with less intense crashes— pre intervention with 10 property damage only crashes post intervention. Personal injury crashes were also reduced post intervention from 6 down to 4. Additionally, there was one fatal pedestrian crash at this intersection in 2010 and there have been no fatal crashes since then. The intersection improvement project included multi-modal improvements such as crosswalk upgrades, pedestrian countdown timers, bicycle lanes, sidewalk and curb ramp improvements, which should provide a safer environment for non-motorists.

Figure 7: Crash Types, Before Intervention & After Intervention

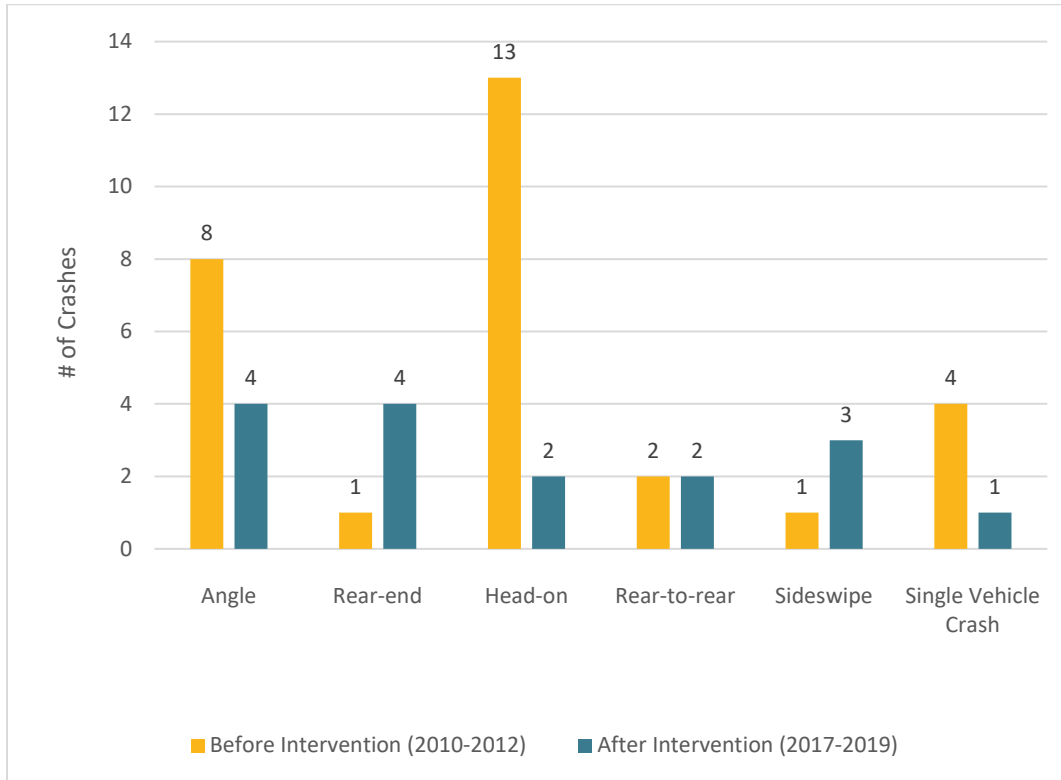
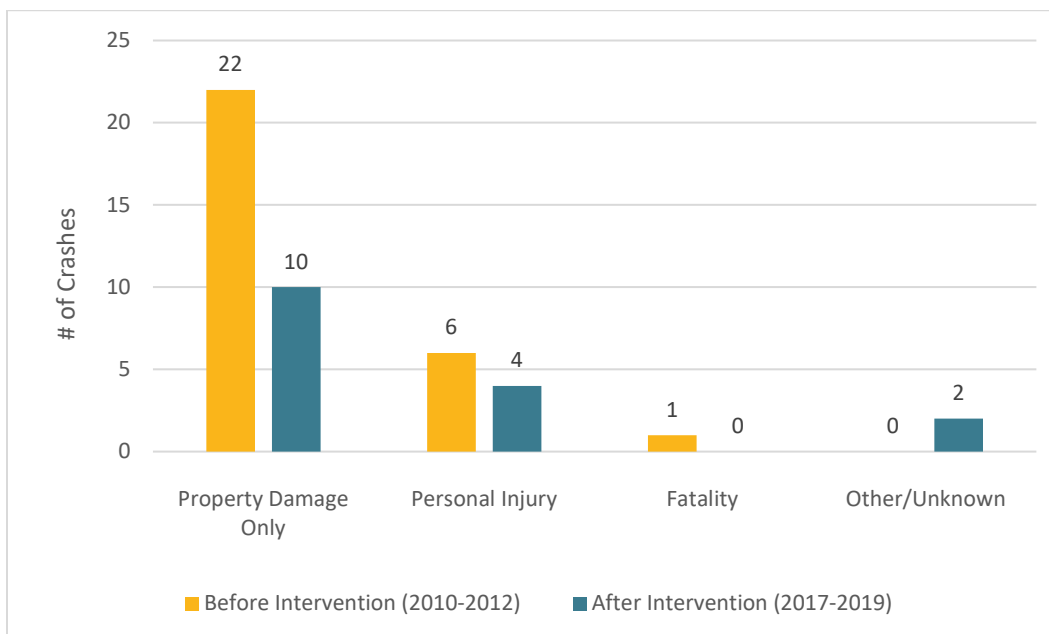


Figure 8: Crashes by Crash Severity, Before Interventions & After Interventions



## Crash Severity Analysis

As with the other Falmouth signalized intersection, this intersection saw an increase in the total number of crashes post intervention. However, this metric alone does not tell a complete story of the overall intersection safety improvement project. The EPDO calculation was also analyzed at this intersection. The EPDO metric attempts to weight more severe crashes more heavily than crashes that result only in property damage. The specific equation is as follows:

$(\text{Fatal Crashes} + \text{Injury Crashes}) * 21 + (\text{Property Damage Only Crashes}) * 1$

**Route 28 at Davisville Road EPDO = (4) \* 21 + (12) \* 1**

For this location, the EPDO score was 73 based on the FDR crash analysis or 169 based on the pre-construction period of 2010-2012, and 96 in the post-construction period. Based on a comparison of the before time period of 2010-2012 and the post time period of 2017-2019, there has been a decrease in not only the total number of crashes but also the severity of crashes has decreased as well.



# Sandwich - Cotuit Road & Harlow Road/South Sandwich Road

## PROJECT DESCRIPTION

The intersection of Cotuit Road at Harlow Road/South Sandwich Road was previously a two-way stop controlled intersection with both Harlow Road and South Sandwich Road approaches operating under a stop condition, while Cotuit Road operated under a free flow condition. Crashes at this intersection had been a concern, with 27 crashes measured in the 2005–2008 period. A Road Safety Audit (RSA) was conducted in 2009 and identified many of the safety issues and potential countermeasures. The intersection's layout and skew of the roadways created visibility challenges. Motorists also had a challenge navigating between Harlow Road and South Sandwich Road due to the offset of the two roadways which were not properly aligned. A roundabout was identified as a preferred alternative that would greatly improve safety at this location and the project was advanced as part of 2011 Cape Cod Transportation Improvement Program.



**BEFORE**



**AFTER**

The roundabout alternative provided the much-needed safety elements to reducing vehicles speeds, installing intersection control to allow turning movements to move safely through the intersection.

## CRASH ANALYSIS

The pre-intervention crash analysis found 27 crashes occurred between 2005 and 2008 at this two-way stop-controlled intersection. The existing crash rate was calculated to be 2.06 crashes/mev which was drastically above the statewide average at 0.59 crashes/mev. Table 10 presents a summary of the pre- and post-intervention crash totals at the study area intersection.

Table 9: Crashes by Year

Period	Year	Crashes
Before	2005	8
	2006	7
	2007	7
	2008	5
<b>Before Total</b>	<b>2005-2008</b>	<b>27</b>
After	2015	1
	2016	3
	2017	1
	2018	1
<b>After Total</b>	<b>2015-2018</b>	<b>6</b>

### TIMELINE FOR CRASH ANALYSIS

- Existing Crash Analysis: 2005-2008
- Construction Completion: 2014
- Post Intervention Crash Analysis: 2015-2018

Construction of the roundabout was complete in 2014, and a 2015-2018 timeframe was selected the post-intervention analysis. The post intervention crash analysis found six crashes recorded in the 2015-2018 timeframe, resulting in a dramatic 77% decrease in the total number of crashes. As shown in Table 11, the post intervention crash rate was calculated to be 0.32 crashes/mev which is below both the Statewide and MassDOT District 5 average of 0.57 for an unsignalized intersection.

Table 10: Crash Rates

Location	Pre-Intervention Crash Rate (crashes/mev)	Post-Intervention Crash Rate (crashes/mev)
Study Intersection	2.06	0.32
District 5 Average	0.58*	0.57**
MA Average	0.59*	0.57**

\*MassDOT average crash rates for unsignalized intersections from RSA dated 2009

\*\*MassDOT average crash rates for unsignalized intersections based on latest data from 2018



As can be seen in Figure 9, angle crashes dramatically declined, going from 23 to 0. Sideswipe, opposite direction crashes also declined, from 3 to 0. Other crash types generally rose, albeit from low bases.

Crashes were also analyzed by severity in the pre- and post-intervention period. Under existing conditions, 5 of the 27 crashes resulted in injuries. Post-intervention, no crashes resulted in an injury and all six crashes were classified as property damage only crashes as shown in Figure 10. Due to their design and layout, roundabouts require vehicles to navigate the intersection at a slower speed, thereby reducing the likelihood of injury related crashes. This intersection is a prime example of the benefits associated with a roundabout.

Figure 9: Crash Types, Before Intervention & After Intervention

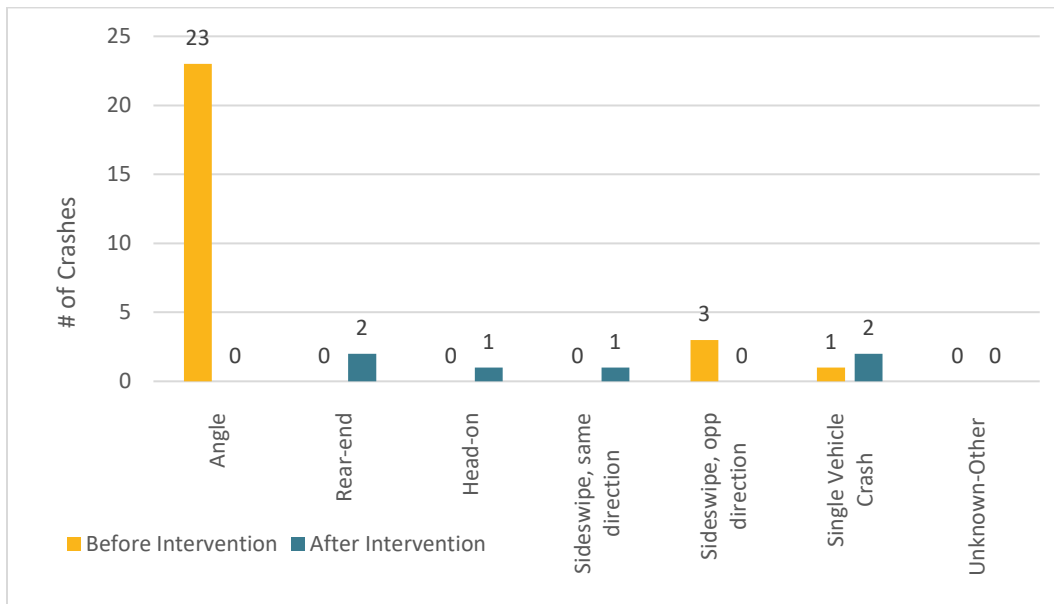
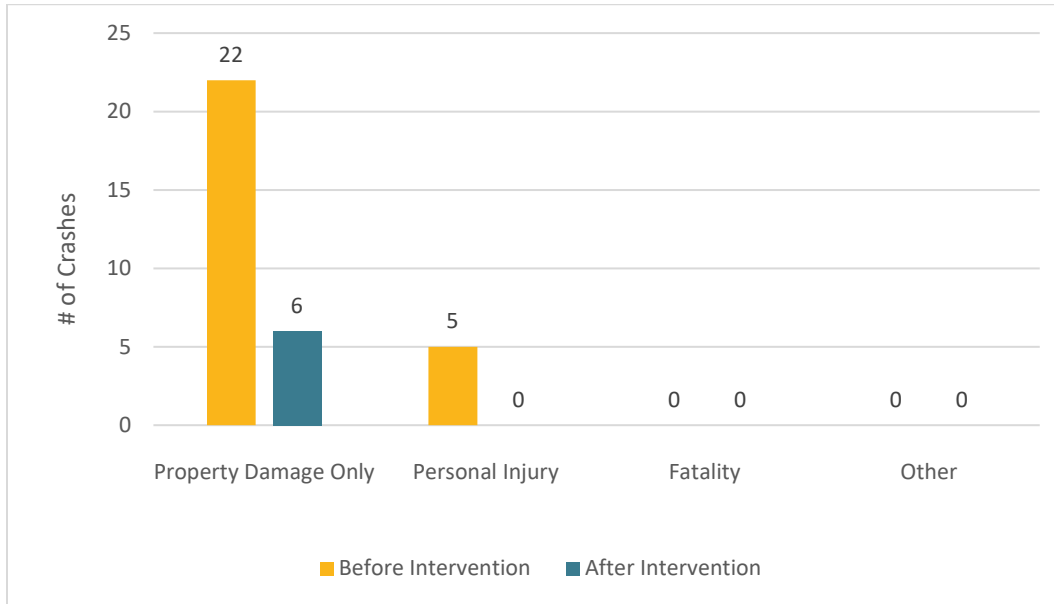


Figure 10: Crashes by Crash Severity, Before Interventions & After Interventions



# Sandwich - Route 6 and Route 130 Eastbound Ramps

## PROJECT DESCRIPTION

The Route 6 and Route 130 interchange ramps were upgraded as part of the 2010 Statewide TIP. Geometric improvements along with signalization were installed at both of the Route 6 eastbound and westbound off/on-ramp intersections. The crash analysis in this report focuses on the Route 6 eastbound ramp intersection as this location had a higher total number of crashes under existing conditions and significant geometric upgrades were incorporated as part of the improvement project. In comparison, the Route 6 westbound ramp intersection saw a small number of crashes pre-intervention, so comparisons would be minimal.

Under existing conditions, the Route 6 eastbound off/on-ramps intersected Route 130 at a skewed angle which encourage higher speeds when merging. As part of the improvement project, the Route 6 eastbound ramps were reconstructed to intersect Route 130 at a more traditional 90-degree angle to encourage lower speeds. Turn lanes were installed to separate turning movements and a traffic signal was installed to control the intersection. The Route 6 eastbound off-ramp was reconstructed to remove the high-speed right turn slip lane by incorporating the right turns closer to the signalized intersection and improving visibility for merging vehicles. In the end, the intersection was simplified to a more traditional and compact layout that is easier and safer to navigate.



**BEFORE**



**AFTER**

## CRASH ANALYSIS

As stated in the project’s 2009 FDR, twenty-two (22) crashes were recorded at the Route 6 eastbound ramps and Route 130 intersection between 2005 and 2007. The existing crash rate was calculated to be 0.95 crashes/mev, which was higher than both the statewide and the MassDOT District 5 averages of 0.60 crashes/mev and 0.58 crashes/mev, respectively, for an unsignalized intersection. In addition, the FDR notes that there were 14 crashes that could not be properly located between the Route 6 eastbound and westbound ramps due to lack of information, so the crash total was likely higher.

Table 11: Crashes by Year

Period	Year	Crashes
Before	2005	7
	2006	7
	2007	8
<b>Before Total</b>	<b>2005-2007</b>	<b>22</b>
After	2014	3
	2015	4
	2016	5
<b>After Total</b>	<b>2014-2016</b>	<b>12</b>

### TIMELINE FOR CRASH ANALYSIS

- Existing Crash Analysis: 2005-2008
- Construction Completion: 2013
- Post Intervention Crash Analysis: 2014-2016

Construction on the intersection improvements concluded in 2013, and a timeframe of 2014-2016 was selected for the post-crash analysis period. Table 12 presents a summary of the pre- and post-intervention crash totals at the study area intersection.

Table 12: Crash Rates

Location	Pre-Intervention Period (crashes/mev)	Post-Intervention Period (crashes/mev)
Study Intersection	0.95	0.69
District 5 Average	0.58*	0.75**
MA Average	0.60*	0.78**

\*MassDOT average crash rates for unsignalized intersections from FDR dated 2009

\*\*MassDOT average crash rates for signalized intersections based on latest data from 2018

Twelve (12) crashes were reported in the post-intervention period, representing a 45% decrease. In addition, this number probably understates the reduction due to the 14 additional crashes that could not be originally located in the FDR crash analysis. The post intervention crash rate was

calculated to be 0.69 crashes/mev, which is a reduction over existing conditions and is below the statewide and MassDOT District 5 averages for a signalized intersection.

As can be seen in Figure 11, angle crashes dramatically declined, going from nine to one. Rear-end crashes also declined, although more modestly. The decline in angle crashes are likely the result of the signal installation separating traffic movements and for facilitating safe gaps in traffic.

Crashes were also analyzed by severity in the pre- and post-intervention period as shown in Figure 12, where both injury and property damage crashes saw a decline. However, approximately half of the post intervention crashes are still resulting in an injury, which may need to be further monitored.

Figure 11: Crash Types, Before Intervention & After Intervention

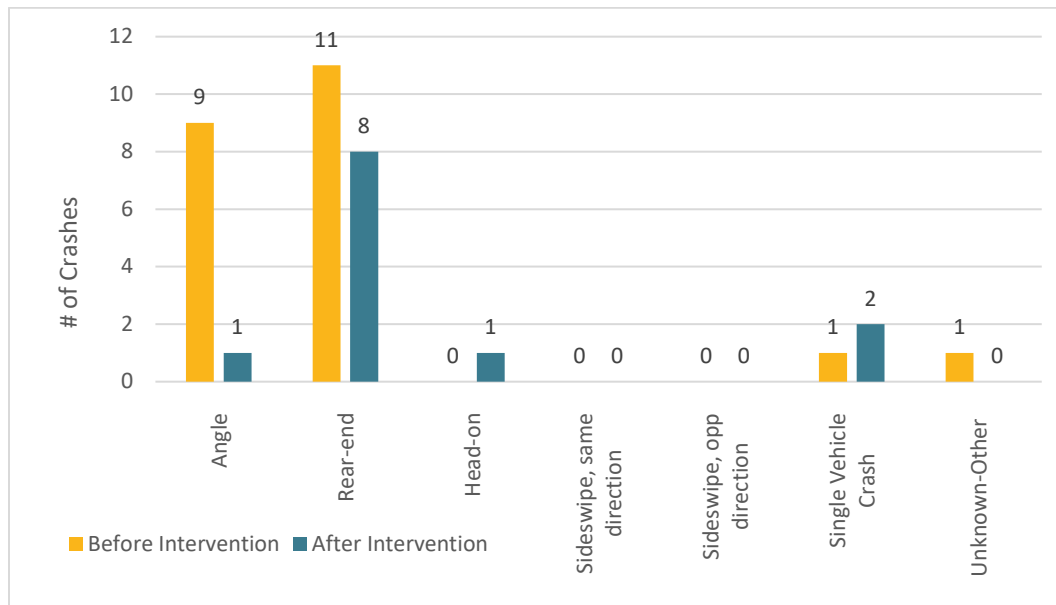
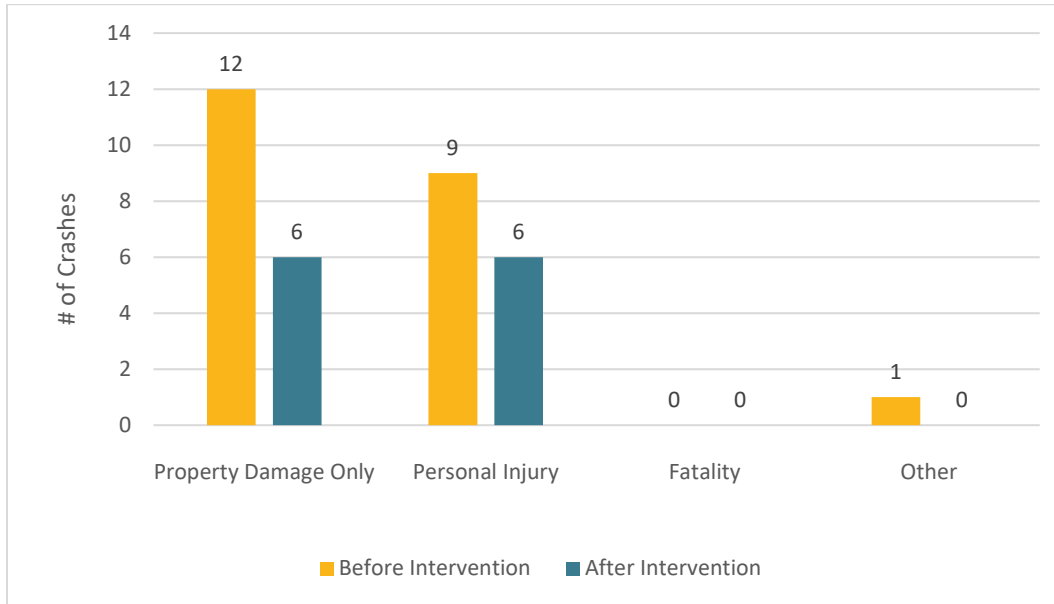


Figure 12: Crashes by Crash Severity, Before Interventions & After Interventions



## Conclusion

Based on the crash analysis performed in this report, the intersection improvement projects at the six study area locations likely improved overall safety by either decreasing the number of crashes and/or decreasing the severity of crashes occurring at the intersection. These positive outcomes show that targeted interventions improve safety at high-crash locations. While crashes may not be eliminated entirely, it is hopeful that the number and severity of crashes will be significantly reduced in alignment with a Vision Zero strategy that envisions no serious injuries or fatalities.

Roundabout intersections saw the most dramatic decrease in the total number of crashes and a significant decrease in the number of crashes that resulted in an injury. Due to their design and layout, roundabouts require vehicles to navigate the intersection at a slower speed, reducing the likelihood of injury-related crashes and improving non-motorist safety. This intersection is a prime example of the benefits associated with a roundabout. Modest reductions in crash numbers were also observed at signalized intersections.

Cape Cod MPO staff will continue to use the information gained in this report to inform future infrastructure safety improvements in the region. As a next step, Cape Cod MPO Staff recommend performing this analysis every 3-5 years with a new slate of recently improved intersection projects. Additionally, next year Staff will focus on safety reviews involving crashes with non-motorists within the region.