

# Safety Performance on Maine's Rumble Strip Corridors

## **Background:**

On Maine's rural roads, many crashes and MOST fatalities (70% of the total) result when a vehicle leaves its designated travel lane (going either left or right) and is involved in a *Lane Departure* crash. That crash may be further described either as a Went Off Road or a Head On type crash. Although far fewer Head On crashes occur compared to the number of Went Off Road crashes, the likelihood of a serious injury or a fatality in a Head On crash are very high. In Maine, during the past 10 years, there have been over 8,000 Head On crashes and those resulted in 355 fatalities and more than 1,100 serious injuries. In recent years, there has been an average of 33 Head On fatalities occurring annually. That number spiked up in 2014 to 46, but was back down to 30 in 2015.

Vehicles leave their proper lane due to a variety of driver contributing factors: speed, alcohol/drugs, distracted driving, fatigue/falling asleep, medical episodes... also wintry or wet roads contribute to some incidents.

Preventing deadly Head On crashes has been a continuing focus for MaineDOT. Center line rumble strips have been found to be the best mitigation to prevent these crashes. Rumble strips provide immediate feedback to the driver at that point of lane deviation and are intended to alert that driver to correct course. While smart cars are coming onto the market, and some new cars feature lane departure alert systems, it will still be a long time before all vehicles become interactive with the driver or self-correcting when things go wrong. Rumble Strips have been a proven way to alert erring drivers that they are leaving their lane – regardless of any available on-board vehicle technology.

Initially, Maine was taking a reactive approach to installing centerline rumble strips. If there was a history of high frequency Head On crashes on a section of road, then rumble strips were considered. MaineDOT first installed center line rumble strips on two non-interstate corridors in 2006 – Route 1, Woolwich and Route 4, Turner.

Predicting where Head On crashes are going to occur is difficult since locations will vary based on wherever that problem driver behavior is exhibited (e.g. a driver could decide to text anywhere). Due to that random crash occurrence aspect, MaineDOT evaluated Head On crash activity based on overall road characteristics/risk factors rather than the changing perspective of where crash clusters happened to be occurring in a given review period.

One way to classify roads for performance evaluation is by road ownership – there are four categories: Toll Roads; State Highway; State Aid (shared State/Town responsibility); and Townway (local). State Highway roads represent about 17% of the state's non-Toll roadway mileage, but experience 55% of the non-interstate fatalities, and 80% of the Head On fatalities. On a fatalities/mile basis, State Highways have double the rate than that for State Aid Roads, and nearly 10 times that of the Townway rate. These higher State Highway fatality rates are a product of far higher traffic volumes and generally higher travel speeds. When analyzing State Highway fatality trends, Head On collisions from 2011 through 2015 accounted for a higher percent of fatalities than did Went Off Road crashes (35.0% of total fatalities vs. 33.2% respectively).

MaineDOT further conducted system-wide crash reviews to identify road qualities where Head On crashes are most concentrated – a systemic approach. MaineDOT also classifies roads into six levels of Highway Corridor Priority (HCP). HCP 1 for example would be a road of top importance including economic significance, such as interstate highways. HCP 6 are local roads. Crash data was screened to determine if Head On crashes were concentrated on certain Highway Corridor Priorities (HCP), speed limits, and/or AADT levels. See Table 6. for data comparisons.

Head On crashes are the most deadly crash type on non-interstate HCP 1 and 2 roads. Drilling further down, a significant portion of the HCP 1 and 2 Head On fatalities (46 of the 104 or 44.2%) were occurring on roads having traffic volumes of 6,000 AADT or more, and posted speed limits above 45 mph. These defined road sections represented about 2% of the roadway network but had 28% of the Head On Fatalities. Mitigating 2% of the road system to address 28% of the highest risk Head On corridors provided focused direction on how to prioritize and get the most benefit out of limited resources. This systemic approach to invest in rumble strips at the most crash-likely priority roads was adopted. This narrow selection of roads had the highest percentage of Head On crash type fatalities (49%) and the highest density of fatal crashes over a five year period (9.5 fatalities over a 5 year period/100 miles of roadway).

From 2006 through 2014, Maine had installed a total of about 55 miles of centerline rumble strips. In 2015 alone, MaineDOT added another 90 miles of centerline rumble strips (bringing the state-wide total to 145 miles) and plans to systemically add about another 175 miles in 2016. The systemic corridor selection process is described further below.

MaineDOT's policy on installing centerline rumble strips includes installing them in passing zones. These sections obviously are where drivers intentionally/legally need to cross the center line. However, rumble strips are still needed on these straight portions of roadway since those driver errors noted above do occur on every type of road. Straight roadways with wide shoulders are locations where a driver may get a false sense of comfort and loosen up their attention to the driving task. MaineDOT does provide gaps in the rumble in passing zones to smooth the way for motorcycles to safely pass.

Noise concerns are considered when selecting rumble strip locations, and based on MaineDOT rumble strip guidelines noted above, most densely developed corridors would not be eligible since they are usually in lower posted speed areas. Hotels, motels and campgrounds normally should be gapped unless otherwise agreed to with the owner/operator. Rumble strip noise complaints up to this time have been very minimal. No other maintenance, plowing, or pavement condition problems have been identified related to installing centerline rumble strips. Sealer is applied immediately after rumbles are cut into the pavement. At this time, there is no programmatic plan to install edge line rumble strips - installations of these will be on a select basis.

### **Safety Performance:**

Comparing before and after safety performance has shown clear safety improvements, not only for Head On collisions, but even Went Off Road crashes experienced a noticeable decrease. National performance analysis indicates a long term 40-60% expected head on fatality reduction. Tables 2 through 4 show Crash, Fatality and Incapacitating Injury activity *Before* and *After* rumble strip installation work.

This study looked at as many as 10 corridors (Listed in Table 1) that were rumble stripped between 2006 and 2014. These corridors total about 55 miles. Since the installation years vary and the rumble strip location selection process is based on most efficient benefit per mile of roadway, the *Before* and *After* safety performance was also based on crashes/mile performance comparisons. This report reviewed *Before* and *After* results from the following perspectives:

1. **ALL Corridors having Rumble Strips installed in 2014 and earlier:** comparisons are pro-rated on Miles and *Before/After* Years of Miles Exposure (10 Corridors, 55.56 miles) Corridor miles were annualized based on the number of years of crash history was available, and no more than 10 years of *Before* history was used, and so far, the max of 9 years *After*.
2. **Corridors evaluated on 5 Years *Before/After* Crash Experience** (Only 2 Corridors had enough *Before* and *After* history for this evaluation, 8.05 miles)

3. **Corridors evaluated on 3 Years Immediately Before/After Crash Experience** (5 Corridors had adequate length of *Before/After* history - 16.54 miles)
4. **Corridors evaluated on 3 Years Immediately Before and the most recent 3 Years After** (2013 through 2015) Crash Experience (5 Corridors - 16.54 miles)

**Findings (See table 5):**

- The most significant improvement was seen in the reduction of **fatalities**, where even in the worst performing data comparison set described above, fatality rates were reduced by 90%. This is far above what national studies have shown, so Maine's results will likely moderate somewhat with time and more data development.
- **Head On Crash rates** reduced between 37.5% to 78.9%, depending on the study time frame, and **Incapacitating injury** results ranged from an increase of 100% to a reduction of 50%. These latter results obviously show a lot of variability and will need to be watched as we have more data to work with.
- **Went off Road** safety performance improved in all measured safety categories, so although Centerline Rumble Strips are largely thought of as a Head On crash mitigation, they provide additional safety benefits for other crash types as well. **Crash** rates were down between 18.8 and 36.5%; **Fatalities** rates down , but there was little data available, so that aspect will need future monitoring; and **incapacitating injury** rates were down between 50 and 75%.

**Next Steps – what's underway for 2016 and beyond:**

Maine's systemic approach described above identified roads that were at the highest serious risk for Head On crash risk – these roads met the following criteria: Highway Corridor Priority 1 & 2; Posted speed 45 mph or greater; and  $\geq 6,000$  AADT.

Once that criterion was defined, MaineDOT's road system inventory was queried and all roads that met those qualifications were identified. That select inventory was paired with a review of past and near future paving work – both identifying dates of upcoming paving work and the type of pavement treatment. That combined inventory was then toured. The review team included pavement specialists, Regional staff, Highway Design and Safety. A resulting Rumble Strip work plan was established that charts out Rumble Strip needs through 2019, with 2016 being the most aggressive year in terms of planned miles of installation.

TABLE 1: Maine Corridors Having Centerline Rumble Strips (sorted by installation year **through 2015**)

Maine's Centerline Rumble Strip Corridors				
Town(s)	Route	Total Project Length (miles)	BMP-EMP	Year Installed
Woolwich	Route 1	3.07	86.44-90.07	2006
Turner	Route 4	4.98	82.68-87.64	2006
Trenton	Route 3	0.28	87.25-87.53	2011
Trenton	Route 3	0.1	87.72-87.82	2011
Dedham	Route 1A	1.81	51.8-53.61	2011
Aurora to T25MD	Route 9	0.82	223.97-224.79	2011
Aurora to T25MD	Route 9	0.31	227.29-227.6	2011
Aurora to T25MD	Route 9	0.15	235.32-235.47	2011
Aurora to T25MD	Route 9	0.4	235.5-235.9	2011
Aurora to T25MD	Route 9	2.86	237.04-239.9	2011
Aurora to T25MD	Route 9	0.86	245.35-246.21	2011
Aurora to T25MD	Route 9	0.9	247.52-248.42	2011
Berwick-North Berwick	Route 4	4.78	1.31-6.09	2013
North Berwick to Sanford	Route 4	7.16	7.45-14.41	2013
Alfred	Route 202	1.6	14.39-15.99	2013
Alfred to Arundel	Route 111	9.23	4.29-13.34	2013
Lebanon	Route 202	10.75	0.26-11.33	2013
Winthrop	Route 202	5.5	92.55-97.52	2014
Topsham	Route 196	3.63	4.06 - 7.69	2015
Lewiston - Greene	Route 202	1.76	77.42 - 79.18	2015
Greene	Route 202	0.78	79.76 - 80.54	2015
Greene - Winthrop	Route 202	10.63	81.57 - 92.2	2015
Winthrop	Route 202	0.14	92.4 - 92.54	2015
Winthrop - Manchester	Route 202	0.62	97.79 - 98.41	2015
Holden	Route 1A	0.98	44.17 - 45.15	2015
Dedham - Ellsworth	Route 1A	8.59	53.61 - 62.2	2015
Edgecomb	Route 1	1.03	95.06 - 96.09	2015
Edgecomb-Newcastle	Route 1	7.76	96.1 - 103.86	2015
Damariscotta to Waldoboro	Route 1	6.71	104.56 - 111.27	2015
Waldoboro	Route 1	2.87	112.76 - 115.63	2015
Rockland	Route 1	0.99	124.45 - 125.44	2015
Rockport	Route 1	1.94	130.98 - 132.92	2015
Rockport	Route 1	0.62	134.25 - 134.87	2015
Belfast	Route 1	2.56	152.63 -155.19	2015
Belfast to Searsport	Route 1	3.12	156.57 - 159.69	2015
Searport to Stockton Springs	Route 1	2.8	161.99 - 164.79	2015
Stockton Springs to Verona	Route 1	5.51	165.22 - 170.73	2015
Stockton Springs to Prospect	Route 1A	3.67	14.71 - 18.38	2015
Prospect to Frankfort	Route 1A	3.39	18.9 - 22.29	2015
Frankfort	Route 1A	1.54	23.04 - 24.58	2015
Winterport	Route 1A	2.78	27.73 - 30.51	2015
Rockport 2	Route 17	1.95	3.21 - 5.16	2015
Rockport	Route 17	2.78	5.83 - 8.61	2015
Jefferson to Windsor	Route 17	3.45	28.01 - 31.46	2015
Windsor to Augusta	Route 17	6.98	32.34 - 39.32	2015
<b>TOTAL MILES</b>		<b>145.14</b>		

TABLE 2: Head On and Went Off Road Crashes on Maine Rumble Strip Corridors during Before and After Installation Years

Town(s)	Route	BMP-EMP	Type of Crash	Before RS Installation is left of the shaded box																
				2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Woolwich	Route 1	86.44-90.07	Head-on	0	0	1	3	3	2	0	0	1	0	1	1	1	1	1		
Woolwich	Route 1	86.44-90.07	Went-off-Road	3	2	3	2	2	9	6	3	5	4	3	3	9	5	6		
Turner	Route 4	82.68-87.64	Head-on	3	3	1	2	3	0	1	0	0	1	4	0	2	1	0		
Turner	Route 4	82.68-87.64	Went-off-Road	3	7	8	8	11	9	5	8	5	6	1	2	7	3	5		
Trenton	Route 3	87.25-87.53	Head-on				0	0	0	1	0	0	0	0	0	0	1	0		
Trenton	Route 3	87.25-87.53	Went-off-Road				0	0	0	0	0	0	0	0	1	0	0	0		
Trenton	Route 3	87.72-87.82	Head-on				0	0	0	0	0	0	0	0	0	0	0	0		
Trenton	Route 3	87.72-87.82	Went-off-Road				0	0	0	1	0	1	0	1	0	0	0	0		
Dedham	Route 1A	51.8-53.61	Head-on				0	1	0	0	1	1	3	0	0	0	0	0		
Dedham	Route 1A	51.8-53.61	Went-off-Road				2	5	9	2	3	4	4	5	1	2	1	1		
Aurora to T25MD	Route 9	223.97-224.79	Head-on				0	0	0	0	0	0	0	0	1	0	0	0		
Aurora to T25MD	Route 9	223.97-224.79	Went-off-Road				1	0	0	0	2	0	1	1	1	0	0	0		
Aurora to T25MD	Route 9	227.29-227.6	Head-on				0	0	1	0	0	0	0	0	0	0	0	0		
Aurora to T25MD	Route 9	227.29-227.6	Went-off-Road				0	0	0	1	0	0	0	2	0	0	0	0		
Aurora to T25MD	Route 9	235.32-235.47	Head-on				0	0	0	0	0	0	0	0	0	0	0	0		
Aurora to T25MD	Route 9	235.32-235.47	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0		
Aurora to T25MD	Route 9	235.5-235.9	Head-on				0	0	0	0	0	0	1	0	0	0	0	0		
Aurora to T25MD	Route 9	235.5-235.9	Went-off-Road				0	0	0	1	0	0	0	0	0	0	1	1		
Aurora to T25MD	Route 9	237.04-239.9	Head-on				0	0	0	0	0	0	0	0	0	0	0	0		
Aurora to T25MD	Route 9	237.04-239.9	Went-off-Road				2	2	1	0	0	1	0	2	0	0	0	0		
Aurora to T25MD	Route 9	245.35-246.21	Head-on				1	0	0	0	0	0	0	0	0	0	0	0		
Aurora to T25MD	Route 9	245.35-246.21	Went-off-Road				1	0	0	0	0	0	0	0	1	0	0	0		
Aurora to T25MD	Route 9	247.52-248.42	Head-on				0	0	0	0	0	0	0	0	0	0	0	0		
Aurora to T25MD	Route 9	247.52-248.42	Went-off-Road				0	2	0	0	0	0	0	0	0	0	0	0		
Berwick-North Berwick	Route 4	1.31-6.09	Head-on				0	0	0	1	2	2	2	0	0	0	0	0		
Berwick-North Berwick	Route 4	1.31-6.09	Went-off-Road				2	9	3	6	6	2	7	2	4	5	6	6		
North Berwick to Sanford	Route 4	7.45-14.41	Head-on				1	1	2	2	4	2	2	1	1	1	0	0		
North Berwick to Sanford	Route 4	7.45-14.41	Went-off-Road				5	8	11	5	10	5	7	8	4	5	4	4		
Alfred	Route 202	14.39-15.99	Head-on				1	0	0	1	1	0	0	1	1	0	0	0		
Alfred	Route 202	14.39-15.99	Went-off-Road				0	1	2	6	4	3	1	2	4	2	2	1		
Alfred to Arundel	Route 111	4.29-13.34	Head-on				1	4	5	1	3	2	4	8	2	3	5	5		
Alfred to Arundel	Route 111	4.29-13.34	Went-off-Road				18	15	18	8	9	19	12	17	16	19	13	10		
Lebanon	Route 202	0.26-11.33	Head-on				3	3	2	5	1	2	4	2	1	4	5	1		
Lebanon	Route 202	0.26-11.33	Went-off-Road				20	11	5	12	10	6	13	7	14	11	10	11		
Winthrop	Route 202	92.55-97.52	Head-on				1	1	2	1	2	1	2	3	2	3	1	1		
Winthrop	Route 202	92.55-97.52	Went-off-Road				5	9	4	2	6	7	4	7	8	7	4	4		

TABLE 3: Head On and Went Off Road Fatalities on Maine Rumble Strip Corridors during Before and After Installation Years

Town(s)	Route	BMP-EMP	Type of Crash	After RS installation is to the right of the shaded box														
				2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Woolwich	Route 1	86.44-90.07	Head-on	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Woolwich	Route 1	86.44-90.07	Went-off-Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Turner	Route 4	82.68-87.64	Head-on	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0
Turner	Route 4	82.68-87.64	Went-off-Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trenton	Route 3	87.25-87.53	Head-on				0	0	0	0	0	0	0	0	0	0	0	0
Trenton	Route 3	87.25-87.53	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Trenton	Route 3	87.72-87.82	Head-on				0	0	0	0	0	0	0	0	0	0	0	0
Trenton	Route 3	87.72-87.82	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Dedham	Route 1A	51.8-53.61	Head-on				0	1	0	0	0	0	0	0	0	0	0	0
Dedham	Route 1A	51.8-53.61	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	223.97-224.79	Head-on				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	223.97-224.79	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	227.29-227.6	Head-on				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	227.29-227.6	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	235.32-235.47	Head-on				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	235.32-235.47	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	235.5-235.9	Head-on				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	235.5-235.9	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	237.04-239.9	Head-on				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	237.04-239.9	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	245.35-246.21	Head-on				2	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	245.35-246.21	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	247.52-248.42	Head-on				0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	247.52-248.42	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Berwick-North Berwick	Route 4	1.31-6.09	Head-on				0	0	0	0	0	0	0	0	0	0	0	0
Berwick-North Berwick	Route 4	1.31-6.09	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
North Berwick to Sanford	Route 4	7.45-14.41	Head-on				0	0	1	0	0	0	0	0	0	0	0	0
North Berwick to Sanford	Route 4	7.45-14.41	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Alfred	Route 202	14.39-15.99	Head-on				1	0	0	0	1	0	0	0	0	0	0	0
Alfred	Route 202	14.39-15.99	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Alfred to Arundel	Route 111	4.29-13.34	Head-on				2	0	1	0	0	0	0	0	0	0	0	0
Alfred to Arundel	Route 111	4.29-13.34	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Lebanon	Route 202	0.26-11.33	Head-on				0	2	1	0	0	0	0	0	0	0	0	0
Lebanon	Route 202	0.26-11.33	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0
Winthrop	Route 202	92.55-97.52	Head-on					0	0	1	0	0	0	0	0	0	0	0
Winthrop	Route 202	92.55-97.52	Went-off-Road					0	0	0	0	0	0	0	0	0	0	0

TABLE 4: Head On and Went Off Road Incapacitating Injuries on Maine Rumble Strip Corridors during Before and After Installation Years

Town(s)	Route	BMP-EMP	Type of Crash	After RS installation is to the right of the shaded box																			
				2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015				
Woolwich	Route 1	86.44-90.07	Head-on	0	0	1	1	1	1	1	0	0	0	0	0	2	0	1	0	0	0	0	
Woolwich	Route 1	86.44-90.07	Went-off-Road	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Turner	Route 4	82.68-87.64	Head-on	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	1	0	1	
Turner	Route 4	82.68-87.64	Went-off-Road	0	0	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Trenton	Route 3	87.25-87.53	Head-on				0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Trenton	Route 3	87.25-87.53	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trenton	Route 3	87.72-87.82	Head-on				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trenton	Route 3	87.72-87.82	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dedham	Route 1A	51.8-53.61	Head-on				0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Dedham	Route 1A	51.8-53.61	Went-off-Road				0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Aurora to T25MD	Route 9	223.97-224.79	Head-on				0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Aurora to T25MD	Route 9	223.97-224.79	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	227.29-227.6	Head-on				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	227.29-227.6	Went-off-Road				0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Aurora to T25MD	Route 9	235.32-235.47	Head-on				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	235.32-235.47	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	235.5-235.9	Head-on				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	235.5-235.9	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	237.04-239.9	Head-on				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	237.04-239.9	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	245.35-246.21	Head-on				2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	245.35-246.21	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	247.52-248.42	Head-on				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora to T25MD	Route 9	247.52-248.42	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benwick-North Berwick	Route 4	1.31-6.09	Head-on				0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Benwick-North Berwick	Route 4	1.31-6.09	Went-off-Road				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
North Berwick to Sanford	Route 4	7.45-14.41	Head-on				2	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0
North Berwick to Sanford	Route 4	7.45-14.41	Went-off-Road				0	0	1	0	0	0	2	0	0	1	0	0	0	0	0	0	0
Alfred	Route 202	14.39-15.99	Head-on				1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Alfred	Route 202	14.39-15.99	Went-off-Road				0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Alfred to Arundel	Route 111	4.29-13.34	Head-on				0	1	1	0	2	0	3	4	1	2	0	0	0	0	0	0	0
Alfred to Arundel	Route 111	4.29-13.34	Went-off-Road				3	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Lebanon	Route 202	0.26-11.33	Head-on				0	1	1	4	0	0	0	0	0	0	0	0	0	0	0	4	0
Lebanon	Route 202	0.26-11.33	Went-off-Road				1	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0	1
Winthrop	Route 202	92.55-97.52	Head-on				0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Winthrop	Route 202	92.55-97.52	Went-off-Road				2	0	0	0	0	0	0	0	0	0	0	1	1	1	3	0	0

**TABLE 5: SUMMARY COMPARISONS - Head On and Went Off Road Crashes, Fatalities and Incapacitating Injuries on Maine Rumble Strip Corridors during Before and After Installation Years**

**1. ALL Corridors: pro-rated on Miles and Before/After Years of Exposure (10 Corridors, 55.56 miles)**

OVERALL Lane Departure	Crashes		Fatalities		Incapacitating Injuries	
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
Number	727	199	31	1	71	21
*Rate(/100 miles)	143.56	111.20	6.12	0.56	14.02	11.74
Percent improvement (RATE)		22.5%		90.9%		16.3%
<b>HEAD ON</b>						
Number	145	32	28	1	42	16
*Rate(/100 miles)	28.63	17.88	5.53	0.56	8.29	8.94
Percent improvement (RATE)		37.5%		89.9%		-7.8%
<b>WENT OFF ROAD</b>						
Number	582	167	3	0	29	5
*Rate(/100 miles)	114.92	93.32	0.59	0.00	5.73	2.79
Percent improvement (RATE)		18.8%		100.0%		51.2%

Rates based on Crashes/Road miles per Year exposure in each corridor's available Before and After review period. Example: If a 10 mile rumble strip corridor had 8 years of Before history and 4 years of After, crash rate would be based on 80 miles ( 8 yrs X 10 miles) BEFORE, and 40 miles (4 yrs X 10 miles) AFTER). Exposures bases in annual miles of corridors reviewed: **BEFORE** = 506.42 miles; **AFTER** = 178.95 miles

**2. Corridors with 5 Years Before/After Crash Experience (2 Corridors, 8.05 miles)**

OVERALL Lane Departure	Crashes		Fatalities		Incapacitating Injuries	
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
Number	79	54	7	0	7	9
*Rate(/100 miles)	196.27	134.16	17.39	0.00	17.39	22.36
Percent improvement		31.6%		100.0%		-28.6%
<b>HEAD ON</b>						
Number	18	8	7	0	4	8
*Rate(/100 miles)	44.72	19.88	17.39	0.00	9.94	19.88
Percent improvement		55.6%		100.0%		-100.0%
<b>WENT OFF ROAD</b>						
Number	61	46	0	0	3	1
*Rate(/100 miles)	151.55	114.29	0.00	0.00	7.45	2.48
Percent improvement		24.6%		N/A		66.7%

**3. Corridors with 3 Years Immediately Before/After Crash Experience (5 Corridors - 16.54 miles)**

OVERALL Lane Departure	Crashes		Fatalities		Incapacitating Injuries	
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
Number	82	44	9	0	8	4
*Rate(/100 miles)	165.26	88.67	18.14	0.00	16.12	8.06
Percent improvement		46.3%		100.0%		50.0%
<b>HEAD ON</b>						
Number	19	4	9	0	4	3
*Rate(/100 miles)	38.29	8.06	18.14	0.00	8.06	6.05
Percent improvement		78.9%		100.0%		25.0%
<b>WENT OFF ROAD</b>						
Number	63	40	0	0	4	1
*Rate(/100 miles)	126.96	80.61	0.00	0.00	8.06	2.02
Percent improvement		36.5%		N/A		75.0%

**4. Corridors with 3 Years Immediately Before and most recent 3 Years After (2013 through 2015) Crash Experience (5 Corridors - 16.54 miles)**

OVERALL Lane Departure	Crashes		Fatalities		Incapacitating Injuries	
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
Number	82	49	9	0	8	2
*Rate(/100 miles)	165.26	98.75	18.14	0.00	16.12	4.03
Percent improvement		40.2%		100.0%		75.0%
<b>HEAD ON</b>						
Number	19	7	9	0	4	2
*Rate(/100 miles)	38.29	14.11	18.14	0.00	8.06	4.03
Percent improvement		63.2%		100.0%		50.0%



# Systemic Data Drilldown

## Based on 2011 to 2015 Fatalities (Head On/Total) TIDE DATA

Road Description	Head On/Total Fatalities	HO % of Total Category	% of ALL Head-On Fatalities	HO Fatalities (5 YR)/100 Mile Rate	Road Miles	% of Roadway Miles
ALL Roads	174/711	24.50%		<b>0.76</b>	≈22,900	100%
HCP 1 & 2 Non-Interstate	104/258	40.30%	59.80%	<b>5.70</b>	1827.51	7.97%
Non-interstate with 6,000+ AADT and 45+mph posted speed limit	53/121	43.80%	30.50%	<b>8.69</b>	609.77	2.66%
HCP 1 & 2, Non-interstate with 6,000+ AADT and 45+mph posted speed limit	46/94	<b>49%</b>	28.20%	<b>9.50</b>	483.87	2.11%

## Improving Safety on Maine's Roads



MaineDOT developed a Rumble Strip brochure (left) to inform the public about the benefits of Rumble Strips. (Below) Center line rumble strip installation on Route 1A, Dedham.

## Understanding Rumble Strips

**MaineDOT**



To learn more about rumble strips, a brochure is available at <http://www.maine.gov/mdot/safety/docs/rumblestrip-brochure-general.pdf>