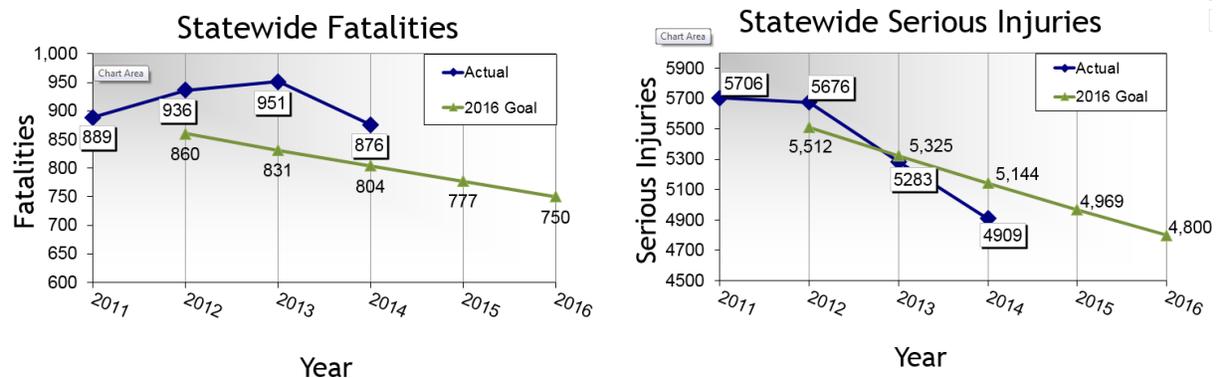


Highway Safety White Paper

The safety of Michigan’s existing transportation system remains one of the Michigan Department of Transportation’s (MDOT) highest priorities. Since the publication of the [Highway Safety Technical Report](#) in 2006, the implementation of safety-related efforts has been in alignment with the [State of Michigan Strategic Highway Safety Plan](#) (SHSP).

Simply put, the vision of SHSP is that “All roadway users arrive safely at their destinations.” The most recent version of the SHSP, published in 2012, includes updated goals for a more meaningful objective of an incremental reduction in the frequency of fatalities and serious injuries. The revised goals address both fatalities and serious injuries; the previous SHSP addressed only fatalities. The 2012 goals were to reduce traffic fatalities and serious injuries from 889 and 5,706 in 2011 to 750 and 4,800 in 2016. According to the most recently published data, Michigan is on track to meet the goal for serious injuries. Progress toward the SHSP goals of reducing statewide fatalities and serious injuries can be found in MDOT’s [Transportation System Condition Report](#). A detailed breakdown of crashes is available in the [Michigan Traffic Crash Facts](#).

Figure 1: Statewide Fatalities and Serious Injuries



Source: MDOT’s Transportation Systems Condition Report

In addition to changing the focus of the safety goals, the most recent SHSP also made a change to the emphasis areas, with Emergency Medical Services replacing Work Zone Safety as an emphasis area in response to the latest crash data.

As indicated above, MDOT uses the goals of SHSP to develop its safety efforts. To meet these safety goals, the strategy of MDOT’s Safety Program is to select cost-effective safety improvements to address state trunkline locations with fatal and serious injury crashes. Priority is given to those locations, within each MDOT region, with SHSP focus area improvements

that have the potential to deliver the highest benefits at the lowest cost to address a correctable crash pattern. Proposed improvements that do not meet this criterion, or do not address the severe injury crash pattern, are not considered. MDOT's progress of addressing fatalities and serious injuries on the state trunkline and the average cost savings (cost-benefit) from safety improvements are located in MDOT's [Transportation System Condition Report](#) and [MDOT's Scorecard](#).

MDOT's Comprehensive Safety Improvement Program continues to seek innovative solutions to address safety. To ensure equality in the identification of safety projects throughout the state, the program is part of the department's annual Five-Year Call for Projects. Safety funds are allocated based on the factors of vehicle miles traveled and total lane miles in relation to the percentage of fatalities and serious injuries experienced during the latest three years of crash data on the state trunkline in each region. Beyond the identification of proposed safety projects, each region has the opportunity to allocate up to 50 percent of their funding target for additional low-cost safety improvements. The focus is on system-wide safety improvements done by state or county work forces or through the letting process. A cost-benefit justification is not required for pre-approved system-wide safety fixes that have already proven their benefits.

In the selection of safety projects to meet SHSP goals, MDOT ensures each project addresses one or more of the focus areas identified in the SHSP. While not limited to these, the Safety Program predominately addresses the Engineering, Pedestrian and Bicycle Safety, Driver Behavior and Awareness SHSP focus areas. Although not directly impacted by the Safety Program, several of the remaining focus areas do receive an indirect benefit.

To ensure the appropriate safety fixes are incorporated into the overall design of a safety project, each MDOT region conducts a Road Safety Audit (RSA) for new proposals exceeding \$750,000 in estimated construction costs. An RSA is a formal safety performance examination of an existing or future road or intersection by an independent audit team. For selected safety projects, the RSA is conducted prior to 30 percent completion of the plans. The introduction of this proactive approach to improve transportation safety has encouraged MDOT to expand the use of RSAs on preservation-type projects.

Since the [Highway Safety Technical Report](#) was published in 2006, the department has undertaken two system-wide initiatives: the installation of non-freeway rumble strips and the installation of cable median barriers. Both initiatives address crashes associated with lane departure, which is an emphasis in the Engineering focus area in the SHSP. Lane departure-related crashes accounted for 396 fatalities statewide in 2014 (45 percent of all fatalities).

One of the primary objectives for this focus area is to identify cost-effective strategies that help reduce unintentional lane departures, as well as alert the driver should a lane departure occur.

The secondary objective is to assist the driver in returning to the travel lane safely and minimize departure consequences by creating roadside clear zones.

Rumble Strips

Rumble strips are a proven and cost-effective countermeasure to lane departure crashes brought on by driver drowsiness, distraction, and/or inattention. To date, 5,700 miles of centerline and 1,700 miles of shoulder rumble strips have been placed.



To determine the overall effectiveness of rumble strips, Wayne State University completed the "Evaluation of Non-Freeway Rumble Strip - Phase II" for the department. The goal was to determine a cost-to-benefit ratio, estimate crash reduction factors, assess public acceptance, and create an implementation guide for local agencies. The safety performance analysis indicated statistically significant reductions, in the range of 50 percent, in all types of target crashes after centerline rumble strips were installed. Researchers identified 2,488 target crashes in the three years before installation of centerline rumble strips and 1,306 in the three years after installation. They noted a 43 percent to 55 percent reduction in head-on, sideswipe opposite and single vehicle run-off-the-road crashes. Overall fatal and injury crashes were cut in half, with a 51 percent reduction in fatal crashes and a 47 percent reduction in injury crashes.

Table 1: “Before and After” Safety Performance

CRASH TYPE OR SEVERITY	THREE-YEAR TARGET CRASH FREQUENCY		PERCENT REDUCTION IN TARGET CRASHES
	"BEFORE" PERIOD	"AFTER" PERIOD	
Angle	13	3	76.92%
Head-On	240	118	50.83%
Sideswipe Opposite	365	161	55.89%
Sideswipe Same	121	68	43.80%
Single Vehicle Run-Off-the-Road	1,729	928	46.33%
Fatal	83	40	51.81%
A (Serious Injury)	237	139	41.35%
B (Minor Injury)	353	177	49.86%
C (Possible Injury)	381	206	45.93%
PDO (Property Damage Only)	1,434	744	48.12%

Source: Wayne State University

Rumble strips are proving to be a cost-effective countermeasure to lane departure crashes on Michigan's state highways. MDOT is reaching out to local agencies to increase their understanding of the benefits of rumble strips and to encourage interest in installing them on county, city and township roads, either system-wide or at specific sites. To support this effort, MDOT has developed concise, user-friendly design and installation guidelines for use by local agencies.

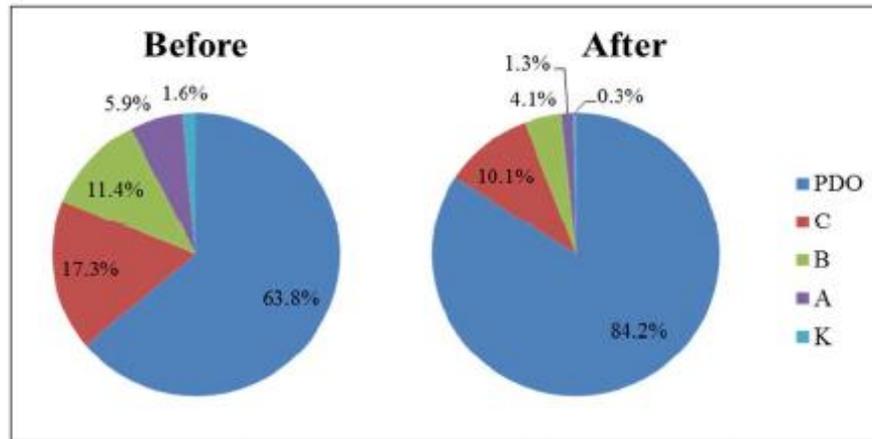
Cable Median Barrier

The second statewide initiative, cable median barrier, addresses both primary and secondary objectives of the engineering focus area. Cross-median crashes are three times more deadly than other freeway crashes. Cable guardrail is expected to reduce cross-median crashes by an estimated 90 percent, and is a very cost-effective safety measure when compared to other barriers. In 2007, MDOT evaluated the state trunkline system to project how many lives could be saved in Michigan, and at what cost, by installing cable median barriers on divided roadways where median barriers do not currently exist. The result was the identification of 340 miles of roadway that would benefit from this improvement. Construction of this statewide initiative began in 2008. As of 2014, 333 miles of cable have been installed.



MDOT contracted with Wayne State University to also conduct a research study to determine the effectiveness of cable median barrier. The "Study of High Tension Cable Barrier on Michigan Roadways" research project was to determine the effectiveness of MDOT's high-tension cable barrier installations in reducing the frequency of cross-median crashes and resulting injuries and fatalities. The results of the research show that cable median barriers have been highly effective at reducing crossover crashes in Michigan. After the barriers were installed, crossover crash rates on those highway segments fell by 87 percent, and the barriers successfully contained 97 percent of the vehicles that hit them. The research team concluded that cable barriers have improved overall safety at the locations where they have been installed. The most serious crash types (fatal and severe injury crashes) decreased by 33 percent after cable median barriers were installed, according to rigorous statistical analysis. Since their installation, cable barriers are estimated to have saved 20 lives and prevented more than 100 serious injuries in Michigan. As expected, low-severity crashes increased following the cable barrier installation. Crashes involving only property damage or minor injuries increased by 155 percent. Researchers' analysis showed that placing the cable barrier farther from the roadway (toward the center of the median) would result in fewer low-severity crashes, but this can be impractical because of soil conditions, slope grade, drainage characteristics, or increased installation and maintenance costs. The results of the research study are shown in the charts on the next page.

Figure 2: Percent of Target Crashes by Crash Severity and Analysis Period

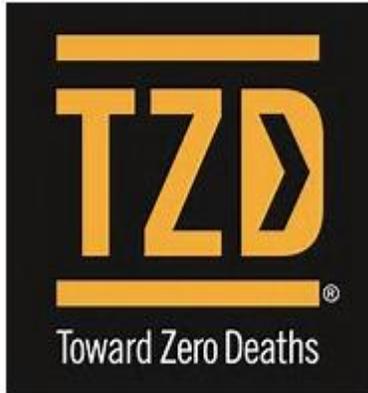


Source: Wayne State University

The latest information on non-freeway rumble strips, cable median barriers and other current MDOT safety programs may be found in MDOT’s [Safety Goals and Plans](#) and the department’s [Driven By Excellence: A Report on MDOT Accomplishments](#).

A new initiative in MDOT’s effort to address serious crashes is low-cost countermeasures to deter wrong-way movements onto freeways. An MDOT study of crash data revealed that 32 percent of freeway wrong-way movement crashes resulted in a fatality or serious injury. Most of these serious crashes occurred on the freeway mainline after the driver was able to maneuver down the ramp going the wrong way. To address this behavior, MDOT is implementing a package of low-cost safety improvements over the next five years at interchange types where this behavior is more frequently observed. These improvements include lowering the height of Do Not Enter/Wrong Way signs, placement of a reflective strip on the sign posts of these signs, wrong-way pavement marking arrows, left-turn pavement marking turning guides, and increased two-sided delineation along the exit ramp. This effort supports the department’s efforts to reduce crashes identified in the Engineering and Driver Behavior and Awareness SHSP focus areas.

Through its [Local Safety Initiative](#) (LSI), MDOT continues to help local agencies identify safety issues and improve the safety of local roads. MDOT’s involvement begins with a complete crash analysis of the selected local road system. Based on the analysis, a list of select intersections and roadway segments is compiled for department staff to investigate in the field, with a local agency representative. An engineering study (or other types of analysis, as needed) is conducted to determine potential improvements, many of which are low-cost fixes. Projects identified may be eligible for federal funding through MDOT’s [Local Agency Programs](#). These approaches are part of MDOT’s effort to address the 60 percent of fatalities and serious injuries



that occur annually on the local roadway system.

MDOT has fully embraced implementation of Toward Zero Deaths (TZD) as a Safety program, and has developed several related action plans. MDOT's North Region analyzed recently implemented safety projects and compared crash trends for the region. In an effort to more closely align the problem with the goal, they developed a Region TZD Implementation Plan that heavily emphasizes strategies focused on reducing lane departure and stop-controlled intersection fatal and serious injury crashes. Other regions across the state are also developing plans for their areas. The MDOT Traffic and Safety area created, and is actively

tracking, a TZD Strategic Plan for the purpose of increasing "Awareness of MDOT's TZD efforts within the State of Michigan by 1) identifying effective strategies to distribute the TZD logo and create logo recognition, and 2) gaining TZD partnerships." This Strategic Plan is designed to capture a widespread audience, including: MDOT employees, state agencies and employees, local agencies (county, city, village, township, etc.), private organizations, and the general public.

Communication is a key aspect of implementing TZD. In addition to the action plans, MDOT has developed a number of TZD-focused tools and resources, including a website; rest area posters; internal and external newsletter articles; a crash statistics postcard; a safety fact sheet with actionable items for pedestrians, bicyclists, motorcyclists and drivers; and a safety programs brochure. MDOT also communicates the year-to-date fatalities across a number of different media, including a weekly e-mailing list, messaging on digital messaging signs, and social media outlets. This effort has led to numerous related news stories by media outlets across the state.