



# Systemic Approach to Wrong Way Driving Safety: Effective Practices Brief

## MICHIGAN DOT

***Wrong way driving crashes occur randomly and less frequently than other crash types; however, they often involve multiple vehicles and result in multiple fatalities and/or serious injuries.***

Many transportation agencies currently implement wrong way driver detection and deterrence tools and practices, but the variety of potential tools and practices vary, are often expensive, and are, in some cases, adopted as “spot treatments,” typically at the corridor scale. The wide variety of tools and price factors are significant barriers to adoption, and disconnected implementation has a high potential for limited results.

Recent research has found that risk factors for wrong way driving do not limit themselves to high-volume corridors. A AAA Foundation for Traffic Safety’s analysis of National Highway Traffic Safety Administration Fatality Analysis Reporting System (FARS) data for divided highways found that the following risk factors were associated to a greater degree with wrong way drivers than their right way driver counterparts:

- Imputed Blood Alcohol Content (BAC) – risk increases with BAC
- License status – risk increases for drivers with suspended or revoked licenses
- Driver’s age – risk increases for those ages 70 and over
- Vehicle age (based on model year) – risk increases with the age of the vehicle

On average there are **432 deaths annually** from wrong way driving crashes on controlled-access highways (2010–2018).<sup>1</sup>

This is a **20% increase** over previously reported data from 2004–2009.<sup>2</sup>

<sup>1</sup> AAA Foundation for Traffic Safety

<sup>2</sup> National Transportation Safety Board

Further, wrong way driving is not limited to divided highways or freeways and should be considered along prioritized arterials where wrong way driving crashes occur more frequently (though with a lower risk of fatality due to slower travel speeds).

### THE SYSTEMIC APPROACH

A systemic approach to wrong way driving considers an agency’s entire roadway system. The approach holistically applies proven methods, physical improvements, and technologies to mitigate wrong way driving. These countermeasures can integrate into existing approaches and programs for safety and help achieve agency safety objectives.

Recent agency experience among four states (California, Florida, Iowa, and Michigan) highlights a range of proven and emerging countermeasures that respond to different roadway characteristics (such as interchange type) as well as demographic and land use factors. Many of these treatments are low-cost countermeasures, and readily implemented without substantial investment in technology.

Though infrequent, wrong way driving crashes come at high costs from serious injuries and fatalities. Reducing these crashes through a systemic approach to wrong way driving countermeasures can yield highly cost-effective safety benefits, and agencies can learn from and adopt the practices of states leading a systemic approach to wrong way driving. This brief focuses on the effective practices of Michigan DOT.

### **Why the Focus?**

Wrong way driving was always known to result in much greater rates of fatality or serious injury than other types of freeway incidents and received significant publicity in the media. In 2010, Michigan DOT (MDOT) and the FHWA Michigan Division Office decided to investigate the characteristics of wrong way drivers and contributing factors to wrong way crashes. They sought to better understand the problem and identify improvements to design approaches that would lessen the occurrence of wrong way driving.

### **Approach Taken**

MDOT and FHWA conducted an analysis of wrong way entry onto Michigan's freeway system and identified 110 wrong way crashes from 2005 to 2009. The analysis found:

- 32% of crashes resulted in death (30) or severe injury (36) (compared to 2% of all freeway crashes with that result)
- Severity depended on crash location
  - » Crash on mainline: 42% with fatality or serious injury (for most mainline crashes, the entry ramp unknown)
  - » Crash on exit ramp: 6% with fatality or serious injury

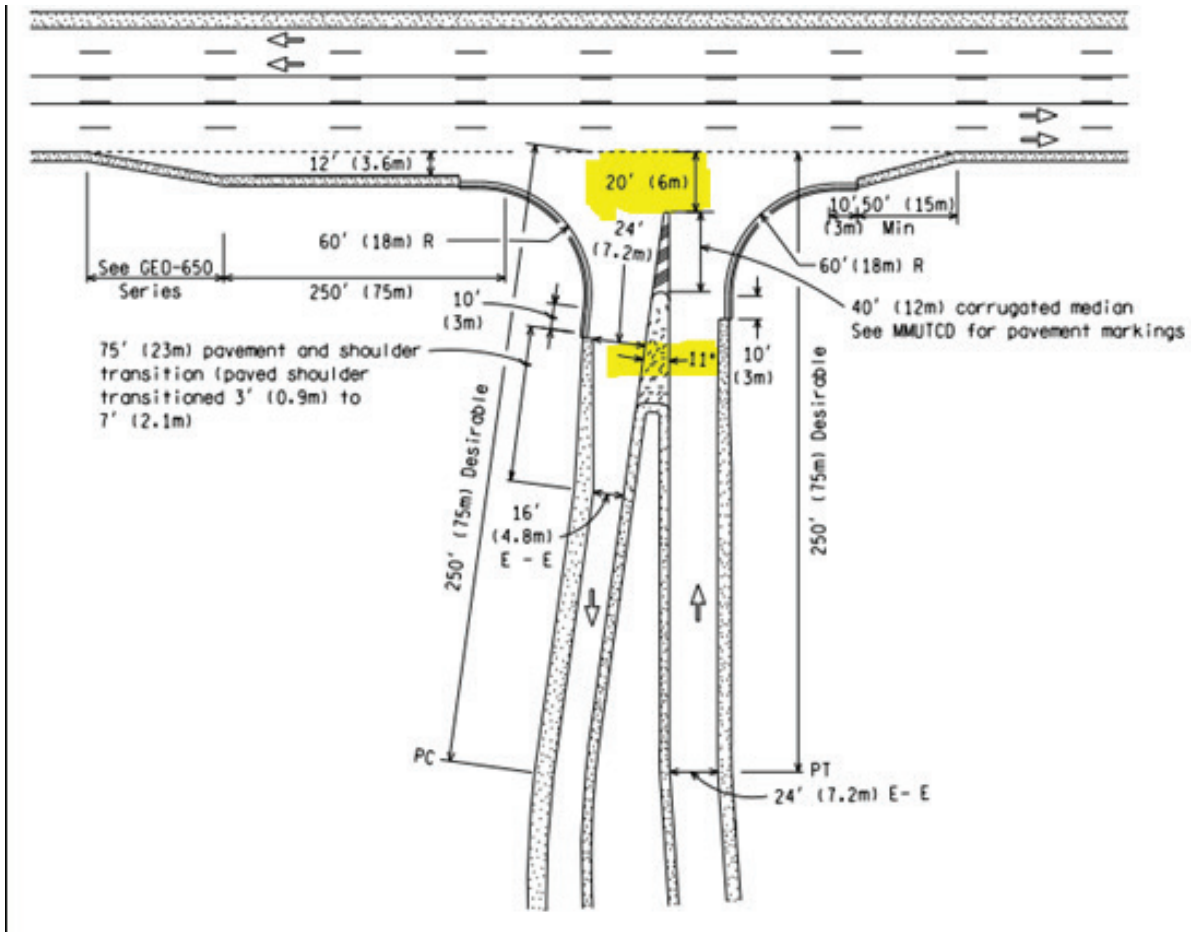
- » Crash on freeway-to-freeway ramps: 50% with fatality or serious injury

- 78% of crashes occurred during nighttime and 57% occurred between 11pm – 6am (compared to 16% of all crashes)
- 55% (60 crashes) drivers were impaired
- Partial cloverleaf and trumpet interchange ramps were the most problematic

The findings of the analysis prompted MDOT to respond quickly and strategically, focusing on partial cloverleaf interchanges with adjacent and parallel ramps extending to the crossroad. Of Michigan's 791 interchanges, 161 of them exhibited this potentially problematic configuration. MDOT applied a systemic approach of addressing all identified interchanges with low-cost countermeasures consisting of:

- Lower DO NOT ENTER/WRONG WAY sign height (4-foot bottom height)
- Reflective sheeting on signposts
- Stop bars placement at exit ramp, previously option for unsignalized intersections
- Wrong way pavement markings (off ramp wrong way arrow)
- Pavement marking extensions through intersection (turning guidelines)
- Painted islands between exit and entrance ramps
- Wrong way delineation on exit ramp (red reflectors on guardrail)
- Outcomes and Benefits

In addition, MDOT made the following adjustments to its geometric standards for partial cloverleaf ramp:



- From an 8-degree angle between ramps to 11 degrees, to better encourage access at the entry ramp relative to the exit ramp
- From a 30-foot setback to a 20-foot setback for corrugated island placement relative to the edge line of the cross street's near lane

Beginning in 2012, these countermeasures were implemented over a five-year period at a cost of about \$2 million. Going further, regionwide contracts have also addressed all ramp types systemically with application of the first two countermeasures on the list to the left.

### **Outcomes and Benefits**

The DO NOT ENTER/WRONG WAY signs, reflective signposts, and wrong way delineation have been added to Michigan's standards. Other countermeasures are optional based on site conditions. Geometric changes to partial cloverleaf ramps are also now part of the standard.

Observations at two interchanges along I-94 with a significant share of wrong way driving events revealed the following.

- Gratiot Ave. at I-94 in Detroit: installed lower signs, pavement markings, wrong way delineation, and Quick Kurb along the cross street's left turn lane – 0 wrong way crashes since June 2012.
- Sargent Rd. at I-94 in Leoni Township, 75 miles west of Detroit: installed pavement markings and new signage (TraffiCalm Wrong Way Signs with red flasher ring) – infrequent activations of the wrong way detection equipment after installation.



### **Additional Conclusions**

- Getting started requires building the case for improvements based on crash concentrations and frequency and identifying what locations lend themselves to those types of crashes.
- Funding constraints can be overcome by incorporating low-cost improvements as part of a change to standards and making their deployment part of a safety construction program.
- MDOT found it was necessary to make the case to region staff to add wrong way driver countermeasure projects as part of their safety call for projects.

## **RESOURCES**

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**Pavement Marking Standards: Partial Cloverleaf Terminal Markings (PAVE-926-B)**

**Traffic Sign Design, Placement, and Application Guidelines**