TRAFFIC SAFETY COMMISSION

Report to the Legislature

HB 1125 Sec. 201 (4) (2023)

Strategies and Technologies to Prevent and Respond to Wrong-Way Driving Crashes

A Review of State Practices

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Publication and Contact Information

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Executive Summary

Wrong-way driving crashes are identified in state crash databases as a vehicle action of 'Going Wrong Way on Divided Highway', 'Going Wrong Way on Ramp', and 'Going Wrong Way on One-Way Street or Road'. It does not refer to someone who veers across a center line of traffic.

In Washington, wrong-way driving crashes account for eight percent of total traffic deaths and for 1.2 percent of total fatal and serious injury crashes.

While wrong-way driving crashes are much less common than other crash types, these crashes are much more likely to result in death or serious injury when they do occur. Studies have shown that the fatality rate for wrong-way driving collisions on controlled-access highways is 12 to 27 times greater than that of other types of crashes (NTSB, 2012).

Wrong-way driving is highly correlated with impaired driving. Nearly 60 percent of drivers traveling the wrong-way were determined to be impaired. Incidences of impaired driving are under-reported. The law only requires testing of the driver if they are deceased. Otherwise, toxicology tests are done pursuant to a warrant to compel a blood test based upon reasonable suspicion. Over the last 10 years, 47 percent of drivers involved in fatal crashes were *not* tested for drugs and alcohol.

Fatalities most often occur on highways with higher posted and travel speeds. The Washington routes with the highest number of wrong-way crashes resulting in serious or fatal injuries include Interstates 5, 82, 90 and 182, and State Routes 18, 99, 167, 2, and 512. Nearly 70 percent of wrong-way driving serious crashes occurred in just six counties: King (51), Snohomish (24), Pierce (18), Clark (14), Yakima (13), and Spokane (10). These are also the counties that account for the highest number of traffic fatalities generally. Nearly two-thirds of wrong-way driving serious crashes also occur during hours of darkness.

States have implemented engineering, signage, painting, and technological measures to prevent wrong-way driving and to alert drivers and authorities when wrong-way driving has occurred. Many of these are discussed in this report. According to the Washington State Department of Transportation (WSDOT, 2023), the most advanced wrong-way driving detection systems apply the following components:

- Detecting vehicles on ramps using technologies like radar or video cameras.
- Communication with nearby devices when wrong-way drivers are detected, such as activating red flashing lights in the pavement or surrounding wrong-way signage or triggering a message on a variable message sign.
- Broadcasting communications to other travelers, traffic management centers, and/or law enforcement.

In Washington, wrong-way driving occurs most often on limited- and non-limited-access highways, but not often in the same locations. Systems in Arizona, Florida, and other states have been found to be highly effective in alerting drivers and getting them to self-correct. They are described briefly in this report. The report also includes lower cost "low tech" measures that can also be effective in alerting and deterring wrong-way drivers.

Preventing wrong-way driving may also require addressing the risk factors presented by drivers who are most at risk. Reducing drug- and alcohol-impaired driving is likely to have the broadest impact, and it can have an impact on all crash types at any location in the state. For more information, please refer to the report from the Washington Traffic Safety Commission on "Alcohol and Drug Impaired Driving" (2023) for more information about countermeasures that are used nationally and internationally and have been found to be effective in reducing impaired driving, such as:

- Consistent enforcement of DUI laws, including well-publicized, high visibility enforcement campaigns
- Reducing the per se blood alcohol concentration (BAC) limit from 0.08 to 0.05 for DUI
- Increasing installations and compliance with ignition interlock for people found to be impaired while driving
- Using publicized sobriety checkpoints
- Effective screening and treatment for impaired drivers with substance use disorders

Introduction

In the Washington state 2023 legislative session, the Transportation budget (HB 1125) included this direction in the budget for the Washington Traffic Safety Commission:

> *Within existing resources, the commission must review and report to the transportation committees of the legislature, by December 15, 2023, on strategies and technologies used in other states to prevent and respond to wrong-way driving crashes.* [Sec. 201 (4)]

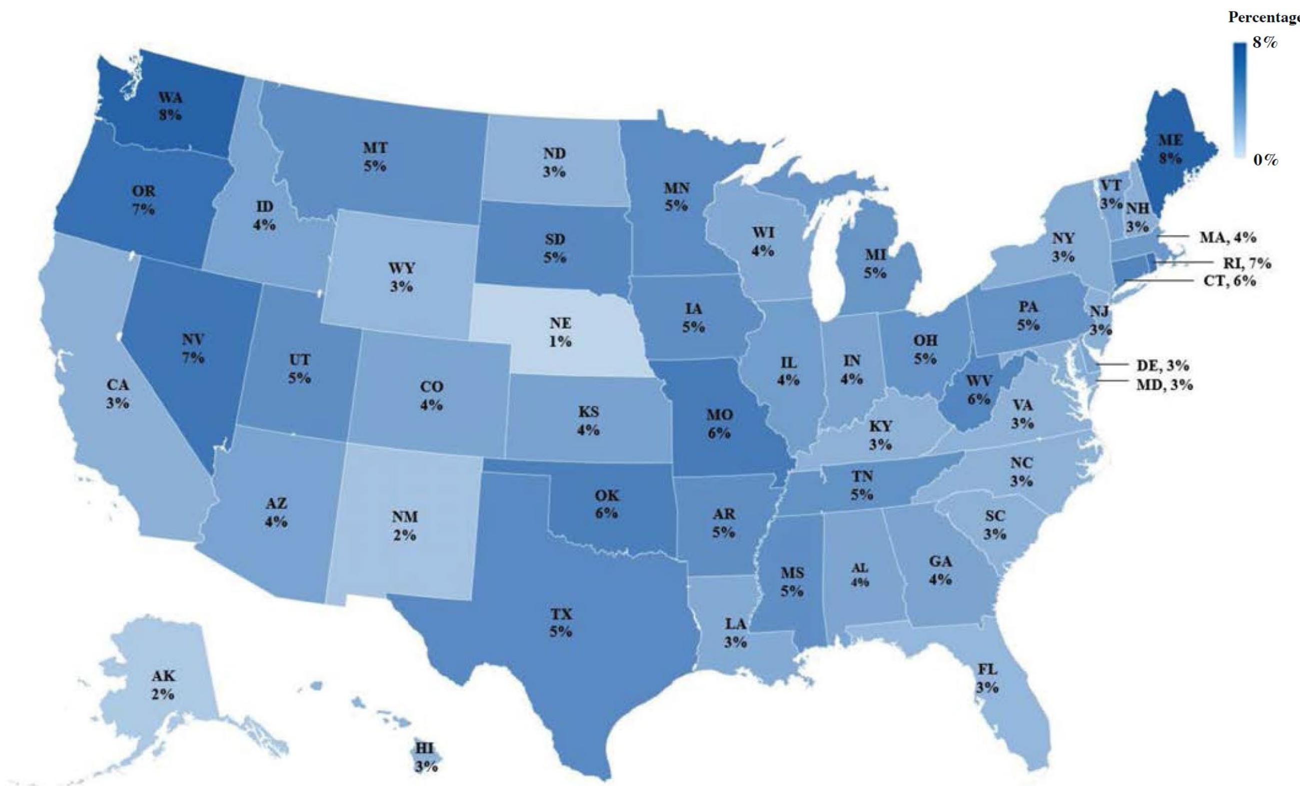
Wrong-way driving crashes are defined as involving a driver driving against the legal traffic flow and colliding with one or more road users or fixed objects (NASEM, 2023). Wrong-way driving crashes are relatively rare, however, they are very severe when they do occur and more likely to result in fatal and serious injury compared with other crash types.

This report provides a summary of current wrong-way crash prevention technologies, and highlights states that have implemented or are testing these technologies. This report also includes other, non-technology-based countermeasures recommended by state or federal organizations to prevent and mitigate wrong-way driving crashes.

Wrong-Way Driving Serious Crashes in Washington State

According to data from the National Highway Transportation Safety Administration (NHTSA) Fatality Analysis Report System (FARS) the national average of wrong-way driving fatalities is four percent of total traffic fatalities (NASEM, 2023). Washington state, along with Maine, had the highest proportion of deaths involving wrong-way driving in the nation at eight percent during 2004 to 2020 (Figure 1).

Figure 1: Wrong-way Driving Fatalities as an Annual Percentage of Overall Fatalities 2004-2020
Source: NASEM, Wrong-way Driving Solutions Handbook, 2023 (pg. 4)



Wrong-way driving crashes are identified in the state crash databases as a vehicle action of 'Going Wrong Way on Divided Highway,' 'Going Wrong Way on Ramp,' and 'Going Wrong Way on One-Way Street or Road.'

From 2017-2022 there have been 190 fatal and serious injury crashes[1] involving a wrong-way driver, 1.2 percent of total fatal and serious injury crashes. The majority of these crashes (91 percent) involved a driver 'Going Wrong Way on Divided Highway' and nearly 80 percent occurred on state routes, most commonly interstates/freeways, and two-thirds occur during hours of darkness (Figure 2). Table 1 shows routes with five or more fatal/serious injury crashes since 2017, representing 47 percent of all wrong-way driving crashes.

[1] Same as note 1.

Figure 2: Wrong-way Driving Fatal and Serious Crashes by Roadway Type and Light Conditions 2017-2022

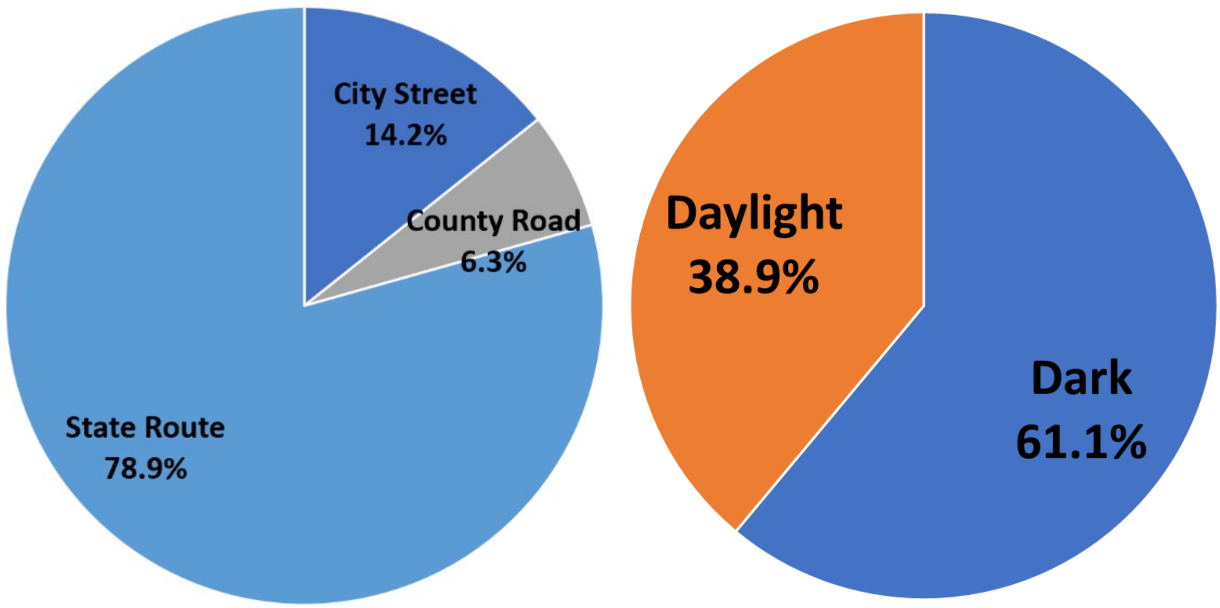


Table 1: Wrong-way Driving Fatal/Serious Injury Crash Locations 2017-2022*

Roadway	Frequency	Roadway	Frequency
I-5	30	I-182	7
I-82	10	SR-167	6
I-90	9	SR-2	6
SR-18	8	SR-512	5
SR-99	8	Other	101

The map on the following page (Figure 4) shows the locations of all wrong-way driving serious crashes 2017-2022. Nearly 70 percent of wrong-way driving serious crashes occurred in just six counties: King (51), Snohomish (24), Pierce (18), Clark (14), Yakima (13), and Spokane (10). Approximately two-thirds of wrong-way driving serious crashes occur in fair weather conditions of clear or partly cloudy, and the majority, four of every five crashes, occur on dry roadway surfaces (Figure 3).

Figure 3: Wrong-way Driving Fatal and Serious Crashes by Weather and Surface Conditions 2017-2022

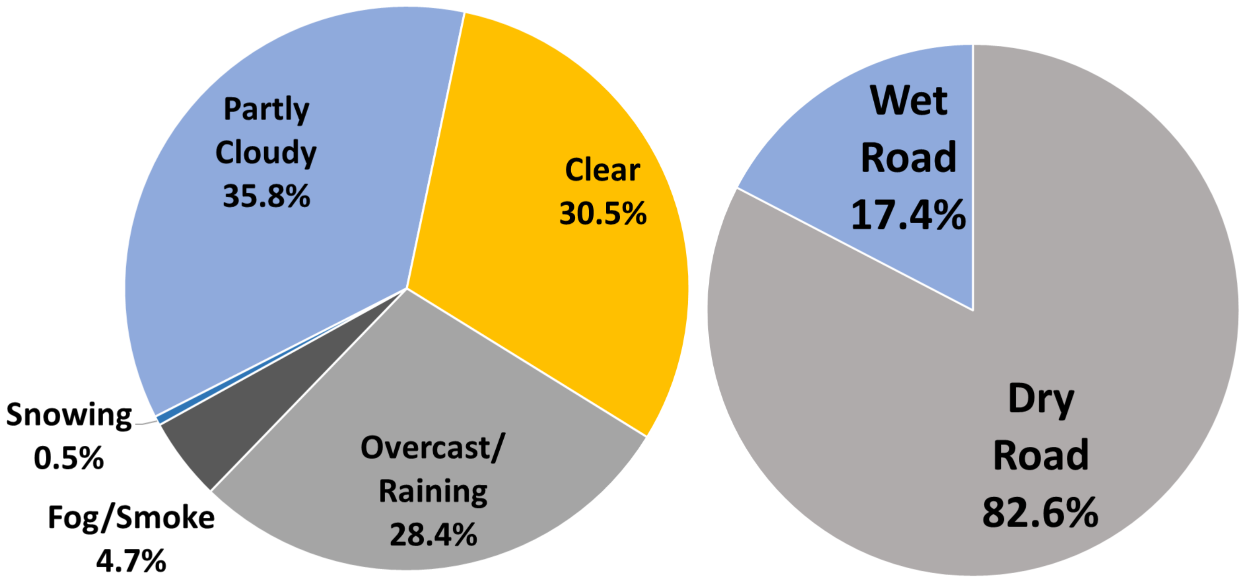
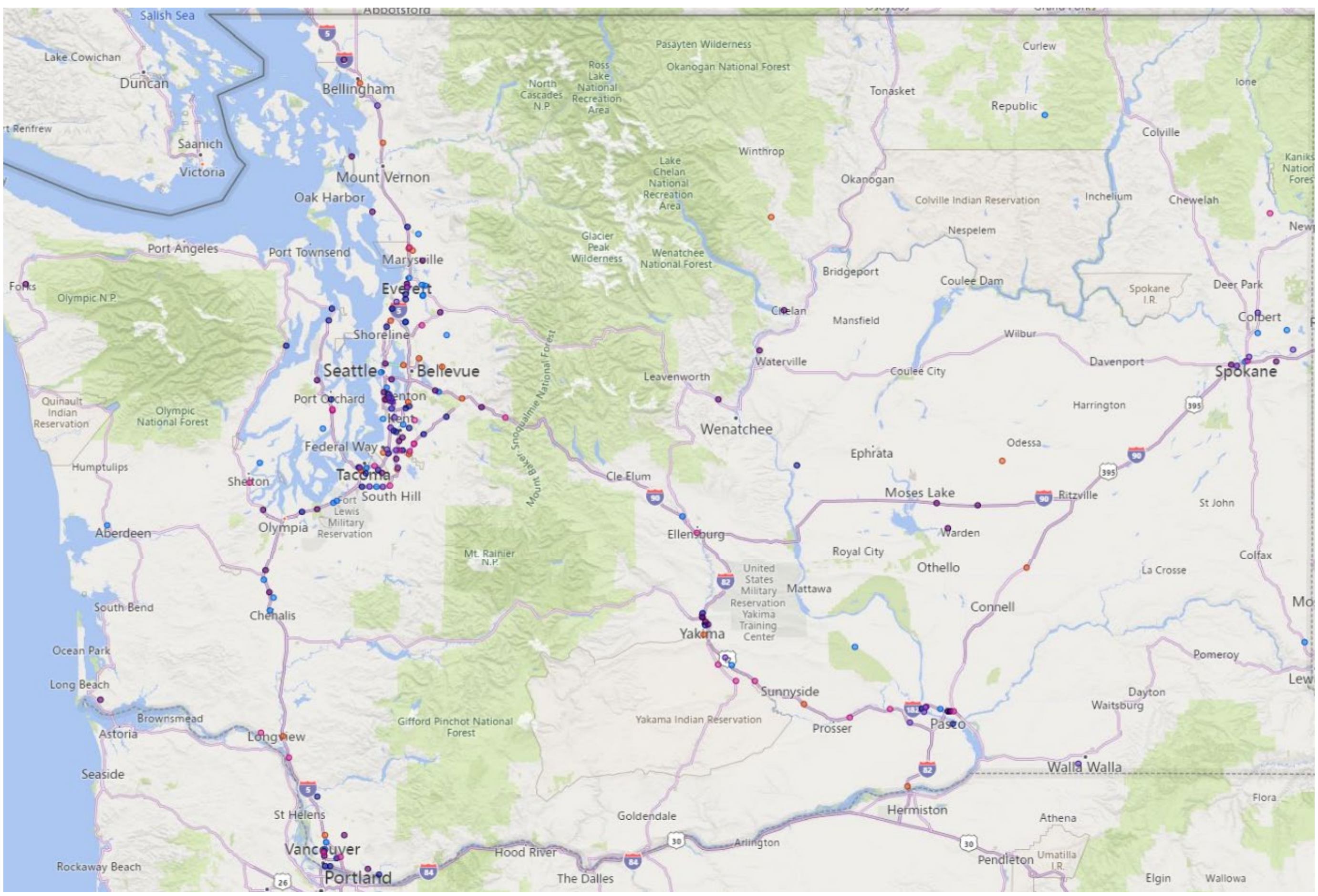
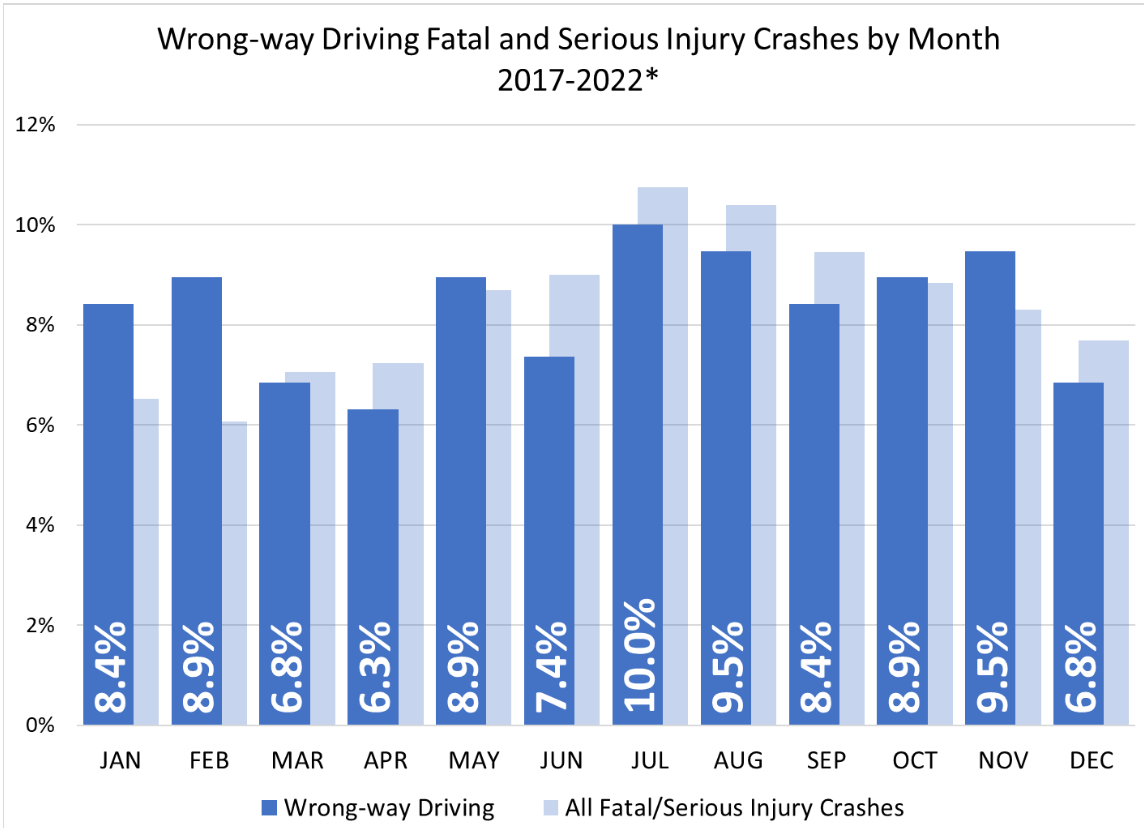


Figure 4: Map of Wrong-way Driving Fatal and Serious Injury Crashes 2017-2022



The highest number of wrong-way serious crashes occur during summer and fall months, which is a similar pattern for all serious crashes. They also occur in months of longer darkness. The proportion of wrong-way driving serious crashes in January and February are higher than the proportion of those months for all serious crashes (Figure 5).

Figure 5: Wrong-way Driving Serious Crashes by Month



Compared to all serious crashes, wrong-way driving serious crashes occur most commonly on weekends; more than 40 percent of these crashes occurred on a Saturday or Sunday (Figure 6). Wrong-way driving is highly correlated with impaired driving, which are also serious crashes that occur more frequently on weekends. Nearly 60 percent of drivers traveling the wrong-way were impaired, and this proportion was nearly identical for male (57.8 percent) and female (59.3 percent) wrong-way drivers, although 70 percent of all wrong-way drivers were male. One-quarter of impaired wrong-way drivers were ages 16-25, another quarter were ages 26-35, and another quarter were ages 36-45, representing 75 percent of all impaired wrong-way drivers in these three age groups (Figure 7). Older drivers have also been identified as a group with increased odds of being a wrong-way driver (Villavicencio, Anorve, & Arnold, 2021). In Washington, drivers older than age 76 are slightly overrepresented in wrong-way driving serious crashes (Figure 7).

Figure 6: Wrong-way Driving Serious Crashes by Day of Week

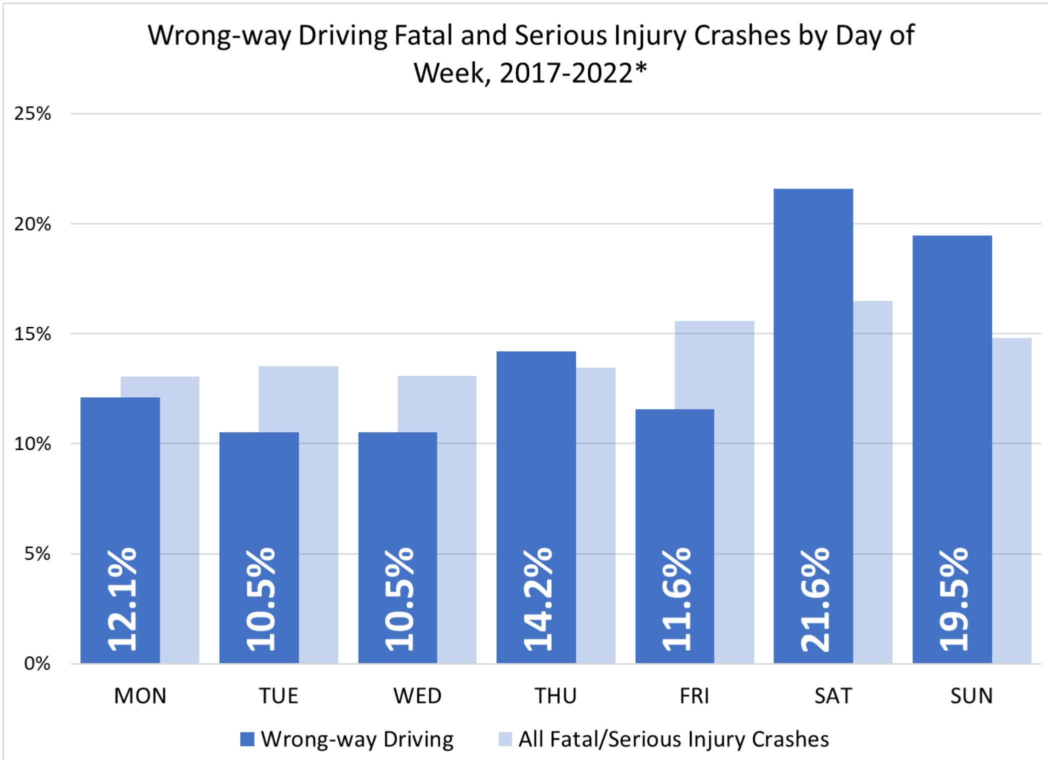
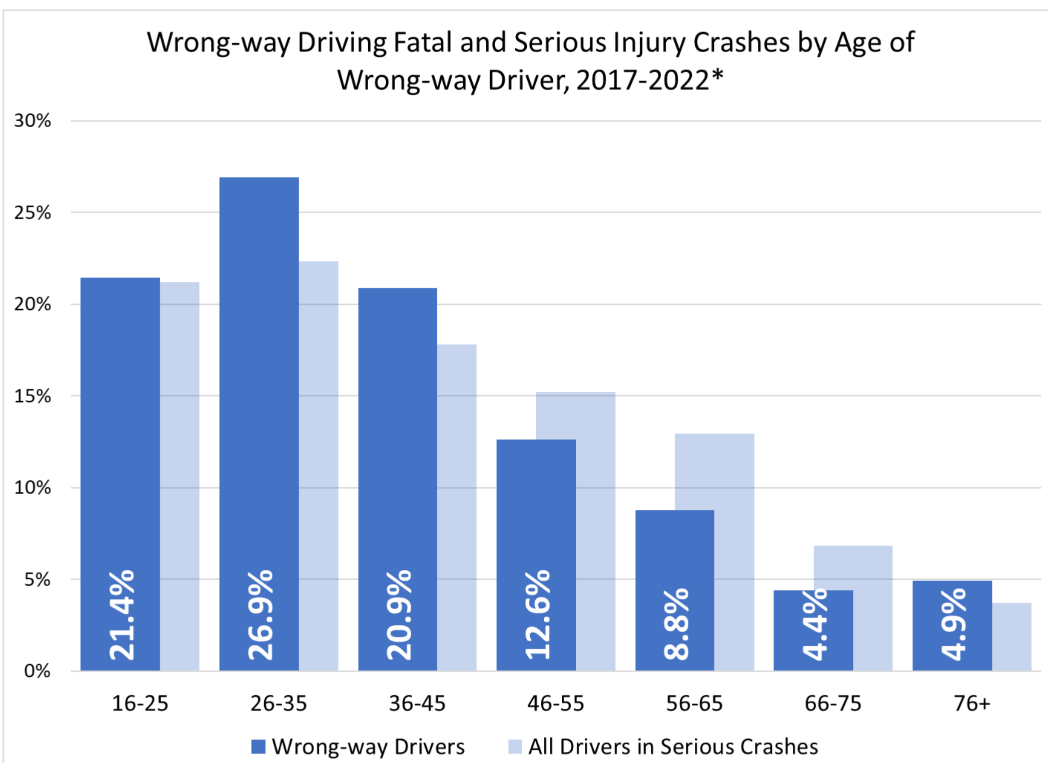


Figure 7: Wrong-way Drivers in Serious Crashes by Age Group



While wrong-way driving serious crashes are relatively rare, these crashes are much more likely to result in death or serious injury when they do occur. Studies have shown that the fatality rate for wrong-way driving collisions on controlled-access highways is 12-27 times greater than that of other types of crashes (NTSB, 2012). The American Association of State Highway and Transportation Officials (AASHTO) has outlined a range of proven and emerging effective countermeasures for different roadway characteristics, demographics, and land use factors (AASHTO, 2023a). Wrong-way driving countermeasures may include the following:

- Improved signage, pavement markings, and physical improvements to interchange elements, such as median configurations.
- The use of Intelligent Transportation System treatments to warn and alert wrong-way drivers to self-correct.
- Using technology to monitor wrong-way drivers that don't self-correct, communicate with law enforcement, and alert other drivers in the vicinity of wrong-way drivers.

The following section of this report will highlight various wrong-way driver technologies that states have tested or implemented.

Wrong-Way Driver Detection Technologies

According to the American Association of State Highway and Transportation Officials (AASHTO, 2023b), wrong-way driving detection systems technologies are available as a customizable set of tools that may be applied as part of a systemic approach to detection and deterrence of wrong-way driving incidents. The systemic approach involves a holistic view of the entire roadway system by identifying methods, physical improvements, and technologies integrated with existing approaches and programs for safety. AASHTO (2023b) summarizes wrong-way driving technologies as:

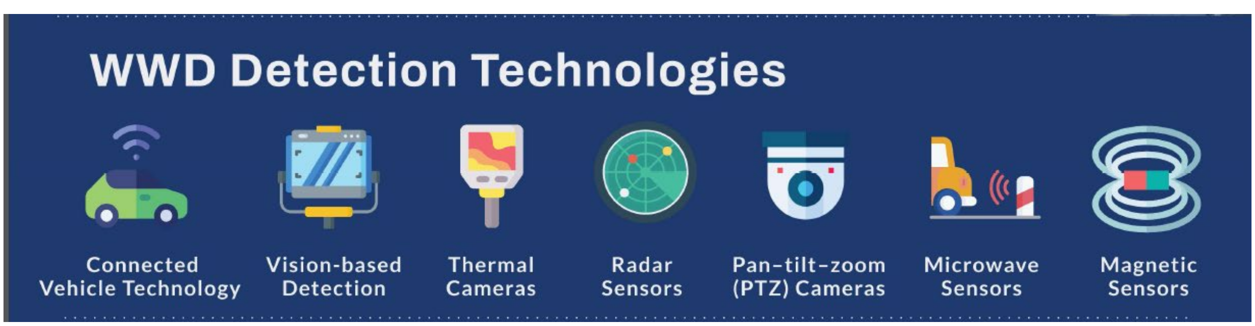
- Detection and Tracking cameras (thermal, radar, infrared)
- Communications interfaces with Traffic Operations/Management Centers and law enforcement
- Dynamic Message Systems or other signage for driver alerts
- Specialized, illuminated, and reflective signage and striping treatments
- Integration with ramp sensors and traffic signals

According to the Washington State Department of Transportation (WSDOT), the most advanced wrong-way driving detection systems apply the following components (2023):

- Detecting wrong-way vehicles on ramps using technologies like radar or video cameras
- Communication with nearby devices when wrong-way drivers are detected, such as activating red flashing lights in the pavement or surrounding wrong-way signage or triggering a message on a variable message sign
- Broadcasting communications to other travelers, traffic management centers, and law enforcement

The U.S. Department of Transportation is also monitoring emerging wrong-way driver detection technologies such as Connected Vehicle (CV) technology. CV refers to peer-to-peer communications that allow road users and their vehicles to communicate directly with one another within the immediate vicinity. This is not yet widely used in passenger vehicle applications. In 1999, the FCC allocated a broadcast spectrum to transportation communications. One channel is designated for crash avoidance (USDOT, 2020).

Figure 8: Wrong-way Driving Detection Technologies



Source: U.S. DOT Wrong-way Driving Systems Infographic, 2022

For the purposes of this report, the remainder of this section will highlight other states' efforts to test and implement various wrong-way driving detection system technologies.

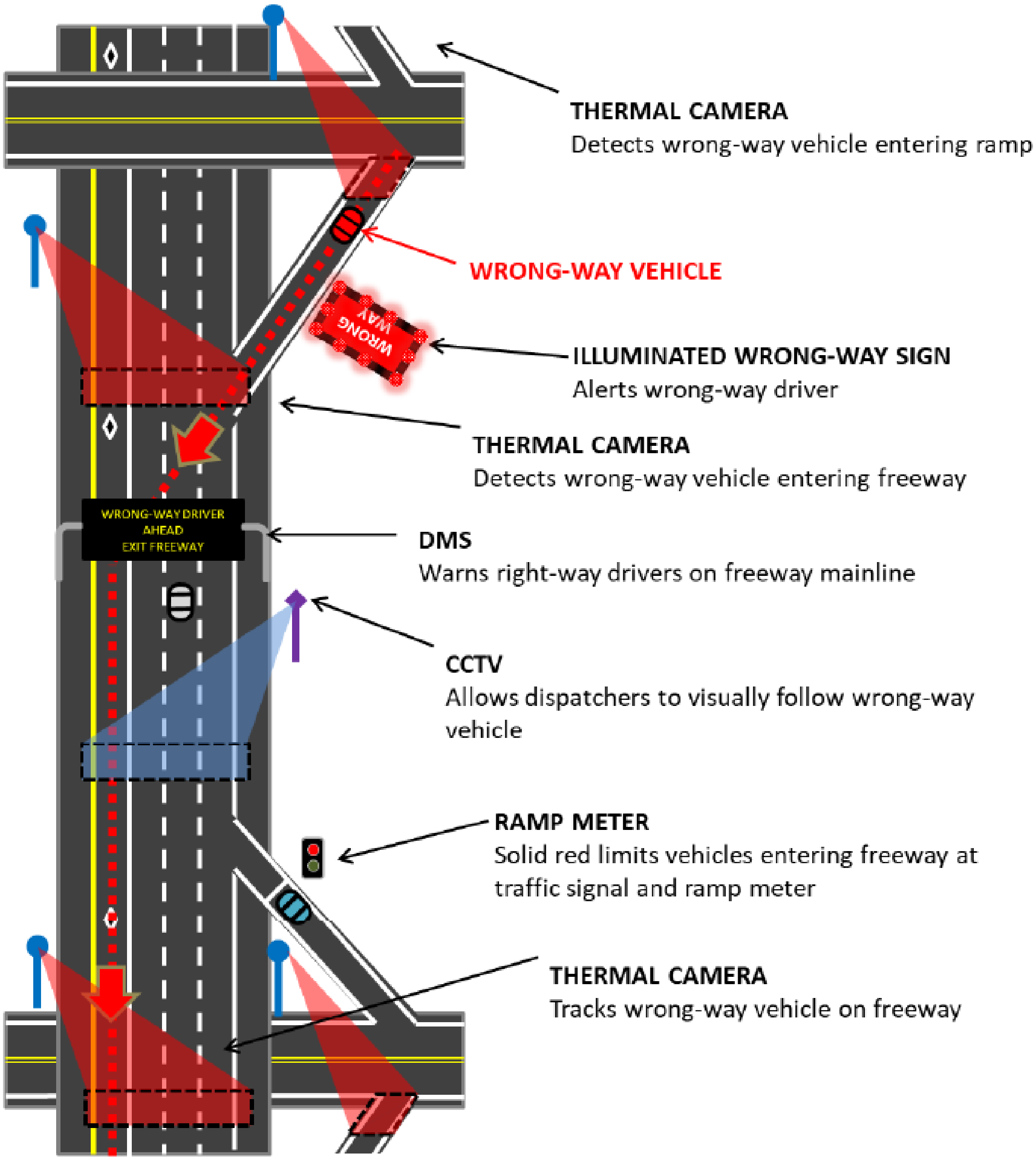
Arizona Department of Transportation Wrong-Way Vehicle Detection Pilot Program

In January 2018, the Arizona Department of Transportation (ADOT) implemented the first in the nation wrong-way driver detection system to include notifying law enforcement/traffic operation centers (TOC) and warning both wrong-way and right-way drivers. This pilot program was implemented on a 15-mile stretch of Interstate 17 and was the first pilot in the nation to detect and track wrong-way drivers in real-time. The ADOT pilot used thermal cameras for detection of wrong-way drivers, enhanced illuminated LED signage, and existing ADOT TOC cameras for visual verification and tracking of the wrong-way drivers.

ADOT also employs a custom-built decision support software package to manage tracking and notifications. When a wrong-way driver is detected by the thermal cameras, a TOC dispatcher verifies the detection, and verification triggers automatic deployment of law enforcement notification, repositioning of traffic cameras for tracking the wrong-way vehicle, activation of warning messages for other drivers, and holding signals on upstream ramp meters at red to discourage additional traffic from entering the freeway. Figure 9 on the following page shows how all these systems work in tandem with the decision support software package (ADOT, 2020).

Evaluation of the ADOT detection system showed that an overwhelming majority (88 percent) of would-be wrong-way drivers made self-correcting turns and did not continue on as a wrong-way driver (LED-illuminated signage triggered by thermal detection of a driver entering wrong-way). Of the remaining 12 percent of drivers that continued wrong-way, only one resulted in a crash (tracking and apprehension of wrong-way drivers). ADOT also compared the time lapse between the first thermal detection notifications and 911 calls received reporting a wrong-way driver. With the thermal detection notifications, law enforcement was notified of the wrong-way driver an average of 1 minute and 38 seconds sooner than when the first 911 call was received. Furthermore, the study found that only 28 percent of wrong-way driving even resulted in any 911 call by other motorists, resulting in a three-fold increase of wrong-way driving incident notifications (ADOT, 2020).

Figure 9: Arizona's Pilot System Device Layout

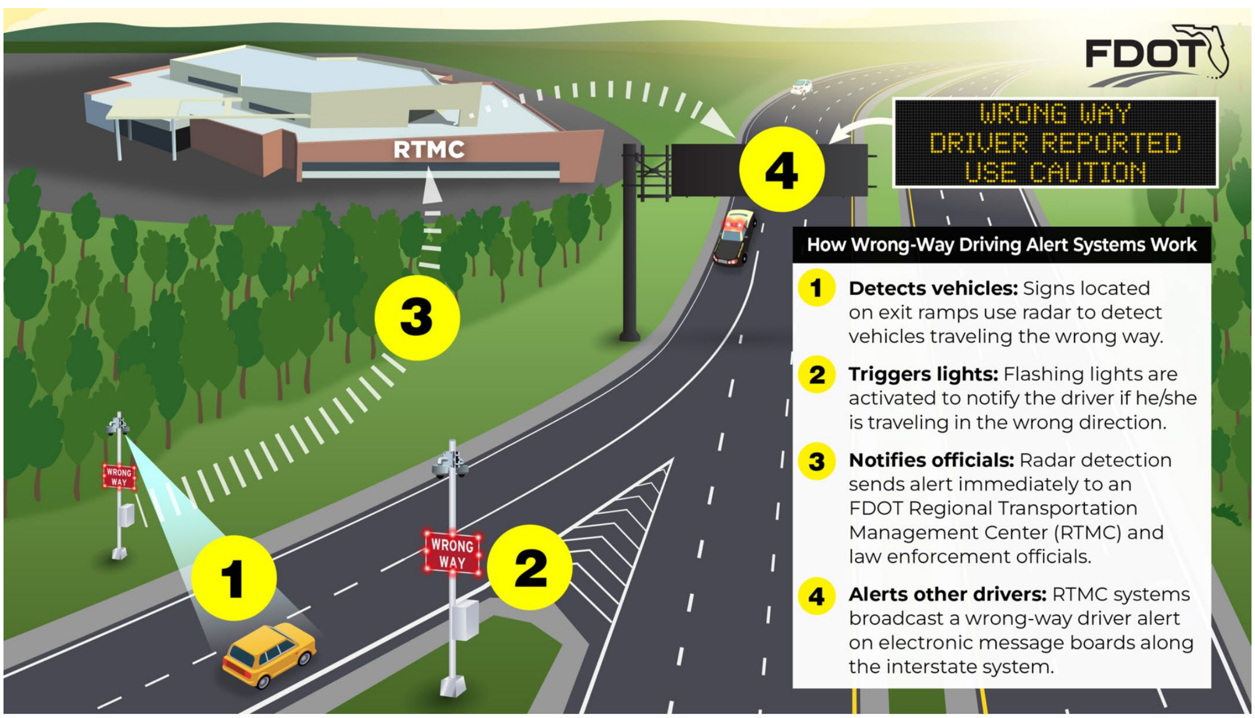


Source: ADOT (2023). Interstate 17 Wrong-Way Vehicle Detection Pilot Program: Final Report

Florida Department of Transportation Wrong-way Driving Initiative

The Florida Department of Transportation (FDOT) began installing wrong-way vehicle detection systems in 2019 and new systems are added each year. FDOT has been increasing the amount of wrong-way signage and these signs are equipped with radar to detect vehicles traveling the wrong way. Once this radar is triggered, lights begin to flash to notify the wrong-way driver. If the motorist continues wrong-way driving, the radar detection sends alerts to FDOT traffic managers and law enforcement and triggers wrong-way driver alert messages on surrounding electronic messaging boards to alert other drivers (FDOT, 2023a). Figure 9 below shows a complete example of this detection and alert system (FDOT, 2023b). FDOT has conducted extensive review and testing of the accuracy of several wrong-way driver systems vendor products (Lin, Chen, Ozkul, & Rajalingola, 2018) and have developed vendor specifications and other documents useful to states like Washington exploring different technological options. The FDOT system deployed boasts a 95 percent detection accuracy.

Figure 9: Florida's Wrong-way Driving Alert System



Source: FDOT Wrong-way Driving webpage [*https://www.fdot.gov/traffic/teo-divisions.shtm/cav-ml-stamp/Wrong-Way-driving#Research*](https://www.fdot.gov/traffic/teo-divisions.shtm/cav-ml-stamp/Wrong-Way-driving#Research)

Similar to Arizona, FDOT reports that more than 80 percent of would-be wrong-way drivers self-correct and has also identified LED-flashing signage triggered by detection systems as the most effective countermeasure for preventing the wrong-way driving event (Alluri, Wu, Nafis, & Hagen, 2018).

Rhode Island Department of Transportation Wrong-way Crash Avoidance

Beginning in 2015, the Rhode Island Department of Transportation (RIDOT) began upgrading and road striping at more than 200 ramps throughout the state. In addition, RIDOT installed wrong-way driver detection systems at 24 high-risk locations. These detection systems alert the would-be wrong-way driver by activating lights on wrong-way signs. The system also takes a picture of the vehicle and transmits it to the Traffic Management Center (TMC). If a driver does not self-correct, then a radar system further up the ramp detects that vehicle and alerts the TMC. The TMC officials will then notify law enforcement and other motorists of a potential wrong-way driver (RIDOT, 2023). RIDOT reports that the system sometimes detects false positives, so the picture is sent to TMC to verify the event prior to contacting law enforcement. Since the detection systems were installed in 2015 and through 2022, over 600 wrong-way events were identified, and only one driver continued on as a wrong-way driver and caused a crash, which was non-fatal (Roads & Bridges, 2023).

Connecticut Department of Transportation Wrong-way Detection Program

The Connecticut Department of Transportation (CTDOT) began installing wrong-way driving alert systems on exit ramps in 2020. CTDOT uses cameras to detect wrong-way drivers and activate wrong-way signage equipped with flashing beacons. In 2023, the Governor signed legislation to install these driver alert systems on at least 120 additional exit ramps identified as high-risk by CTDOT by the end of 2024. Figure 10 shows the type of lighted signage activated by the CTDOT wrong-way driver detection system.

Figure 10: CTDOT Flashing-beacon Wrong-way Alert Signs

Source: CTDOT Wrong-way Countermeasures. https://portal.ct.gov/DOT/Traffic-Engineering/Wrong-Way-Countermeasures

Current installations include only wrong-way driver alerts (detection triggering lights installed on signs); future installations will also include real-time law enforcement notifications and activation of variable message signs. The new legislation directs pilot testing of directional rumble strips (discussed later in this report) and the use of variable message signs to alert other drivers.

Nevada Department of Transportation Wrong-way Detection Program

Like CTDOT, the Nevada Department of Transportation (NDOT) began installing wrong-way driving alert systems on exit ramps that activate lights installed on wrong-way signs. CTDOT uses radar and closed-circuit cameras to detect wrong-way drivers and activate lights on wrong-way signage (NDOT, 2023a). The first set of lights on the sign are four feet above the ground, intentionally designed to be more visible to would-be wrong-way drivers that are impaired or drowsy. Figure 11 shows the type of signage lights activated by the wrong-way driving detection systems.

Figure 11: NDOT Wrong-way Driver Alert Signs

Source: NDOT Wrong-way Driver System. https://www.dot.nv.gov/safety/wrong-way-driver-system

NDOT conducted an evaluation of 37 wrong-way driver detection and alert systems installed throughout the state. Like previous research, NDOT reports that the detection-activated lighted signs resulted in 84 percent of would-be wrong-way drivers self-correcting before entering the freeway (NDOT, 2023b).

Other Strategies to Prevent Wrong Way Driving Crashes

In addition to the emerging technologies described earlier in this report, there are a range of more traditional and lower-cost effective countermeasures for preventing wrong-way driving. According to AASHTO (2023a), some transportation agencies adopt wrong-way driving technologies as “spot treatments” at the corridor scale. A systemic approach takes into consideration that wrong-way driving events are not limited to divided highways and freeways, although wrong-way driving events on lower speed roads come with a lower risk of a fatality. A systemic approach holistically applies proven methods, physical improvements, and technologies to mitigate wrong-way driving integrated with existing approaches and programs for safety. This section highlights additional countermeasures included in the Wrong-way Driving Solutions Handbook (NASEM, 2023), released this year from the National Cooperative Highway Research Program. These countermeasures have also been recommended by the National Transportation Safety Board (NTSB, 2012).

Signs, Pavement Markings, and Traffic Signals

Improving signs intended to prevent wrong-way driving can result in fewer wrong-way driving events and higher rates of driver self-correction. Signs should be directly oriented toward the intended road users and clearly visible, including the application of retroreflective materials to the sign and post. Larger signs may improve visibility for older drivers, and repeating signs longitudinally along the roadway provides redundancy. Signs may also be lowered, depending on possible obstructions, to be more directly illuminated by vehicle headlights and easier to see for impaired, drowsy, and older drivers who look for visual cues near the pavement surface. Finally, as reviewed earlier, LED-enhanced lighting on wrong-way signage may be activated dynamically through wrong-way driver detection systems.

Pavement markings used to address wrong-way driving include lane use arrows, longitudinal lines, stop bars, and delineation. Pavement markings may be made more visible using red retroreflective raised pavement markers. Beginning in 2015, the California Department of Transportation (Caltrans) began implementing a number of countermeasures to decrease wrong-way driving, including installing two-way red/clear retroreflective raised pavement markers (Figure 12). This countermeasure resulted in a 44 percent reduction in wrong-way driving events reported by California Highway Patrol. Since that time, Caltrans has installed these pavement markings on over 1,000 exit ramps in the state (AASHTO, 2023c).

Figure 12: Two-way Retroreflective Raised Pavement Markers

Source: AASHTO Effective Practices Brief: Caltrans

Caltrans also installed directional rumble strips at some locations to alert wrong-way drivers with vibration and noise. Connecticut enacted a bill in 2023 that requires the Department of Transportation to implement multiple wrong-way driving prevention countermeasures, including rumble strips on exit ramps (NCSL, 2023). Lastly, where applicable, traffic signals may be upgraded to green arrows rather than the traditional circle to indicate travel direction more clearly. An example would be to use a straight green arrow to indicate that the driver should continue driving straight and should not turn left onto an exit ramp.

Geometric Design Elements

The Wrong-Way Driving Solutions Handbook identifies geometric design elements that are susceptible to wrong-way driving (and should therefore be avoided) and offers minor geometric changes that discourage wrong-way driving maneuvers. The handbook offers design solutions for five interchange types most susceptible to wrong-way driving events. Figure 13 from the handbook summarizes these geometric design elements.

Figure 13: Guidelines for Geometric Design Elements to Discourage Wrong-Way Driving

Box 5-1. Guidelines for Geometric Design Elements

On-/Off-Ramps

- **Less susceptible to WWD:**
  - Use acute angles to connect off-ramps to one-way streets and right angles to connect off-ramps to two-way roadways to better convey the direction of travel (Atiquzzaman and Zhou 2022; Washington State DOT 2013; AASHTO 2011).
  - Use sweeping connections to cross streets (such as outer connections, loops, and some diamond ramps) (AASHTO 2011).
  - Reduce the width of off-ramp throats where on- and off-ramps are closely spaced and increase the width of on-ramp throats by removing islands or using large radii (Zhou and Pour-Rouholamin 2014; Washington State DOT 2013).
- **More susceptible to WWD:**
  - Adjacent on- and off-ramps intersecting a crossroad (e.g., parclo interchanges) (Cooner et al. 2004),
  - Parclo B interchange terminals (see Section 5.2.1),
  - Isolated off-ramps (Caltrans 2012),
  - Left-side off-ramps (Cooner et al. 2004),
  - One-way off-ramps connected as unchanneled T-intersections (AASHTO 2011),
  - Off-ramps that intersect with two-way frontage roads (Illinois DOT 2010),
  - Less common arrangements of off-ramps (e.g., buttonhook or J-shaped ramp connected to a parallel or diagonal street or frontage road) (AASHTO 2011),
  - Acute angle connection between off-ramp and two-way crossroad (Zhou and Atiquzzaman 2018),
  - Temporary ramp terminals at work zones (Zhou and Pour-Rouholamin 2014),
  - Freeway feeders (Illinois DOT 2010), and
  - Side streets adjacent to off-ramps (AASHTO 2011).

Frontage Road

- **More susceptible to WWD:**
  - Two-way frontage roads (AASHTO 2011),
  - Multilane frontage roads with numerous driveways or side streets (AASHTO 2011), and
  - Acute angles between off-ramps and two-way frontage roads (AASHTO 2011).

Raised Median

- **Less susceptible to WWD:**
  - Use nontraversable medians to discourage left-turn WW entry onto off-ramps (AASHTO 2011).
  - Use longitudinal channelizers to prohibit left-turn WW entry when no raised medians are present (Morena and Ault 2013).
  - Use narrow median openings on arterial highways to prevent left-turn WW movements (AASHTO 2011).
  - Install raised medians or median barriers between ramps of trumpet interchanges (Moler 2002).
- **More susceptible to WWD:** Do not use raised medians to separate vehicles traveling in the same direction on off-ramps (Zhou and Pour-Rouholamin 2014; AASHTO 2011).

Channelizing Island

- **Less susceptible to WWD:**
  - Use raised channelizing islands to reduce WWD, especially for older drivers (AASHTO 2011).
  - Use channelizing islands to reduce the width of off-ramps (Washington State DOT 2013).
  - Use a height of at least 4 in. where the island is intended to prohibit or prevent traffic movements such as WWD (Illinois DOT 2010).
- **More susceptible to WWD:**
  - Do not use scissors channelization because it can confuse motorists and result in WWD (AASHTO 2011).
  - A painted channelizing island may be used by intentional WW drivers for a shortcut.

Control/Corner Radius

- **Less susceptible to WWD:**
  - Use a short-radius curve or angular break at the intersection of the left edge of off-ramps and the right edge of crossroads to discourage WW right turns from crossroads (AASHTO 2011).
  - Ensure that the control radius is tangent to the crossroad centerline, not tangent to the edge line (AASHTO 2011).

Sight Distance

- **Less susceptible to WWD:**
  - Provide an open sight distance throughout the entire length of ramps, especially at the ramp terminal on crossroads where WW entries start (AASHTO 2011).
  - Provide uniform lighting levels for ramps (Zhou et al. 2012).
  - At the intersection of two-way ramps and crossroads (parclo interchanges), move stop lines for left turns from crossroads forward so motorists have a better view of the entrance ramp and a better turning radius (Washington State DOT 2013).
- **More susceptible to WWD:** Where the entrance ramp and off-ramp are adjacent, do not extend median barriers to block left-turn drivers' view of the entrance ramp (Morena and Leix 2012).

Nearby Access Point

- **More susceptible to WWD:** Access points (e.g., driveways, side streets, or nearby businesses) located less than 500 ft from ramp terminals can increase the risk for WWD (Jalayer et al. 2016; Pour-Rouholamin et al. 2015a; Illinois DOT 2010; Zhou et al. 2008).

Source: NASEM, 2023. The Wrong-way Driving Solutions Handbook

Enforcement and Education

In addition to engineering countermeasures and wrong-way driving mitigation technologies, enforcement and education are key components of a holistic approach to preventing wrong-way driving. Even the most sophisticated technologies available may not help drivers self-correct on their own, especially in the case of a severely impaired driver (NASEM, 2023). Technologies can result in quick detection and notification to law enforcement who may deploy various techniques, most of which are high-risk (NTSB, 2012), to stop the wrong-way driver. But law enforcement have a much bigger preventative role to play than just responding to the wrong-way driving event once it occurs. Sixty percent of wrong-way driving fatal and serious crashes in Washington involve driver impairment. Proactive traffic safety enforcement, especially to prevent or apprehend impaired drivers, will reduce wrong-way driving crashes. In addition to improving impaired driving enforcement, both NTSB (2012) and the Handbook point to strong ignition interlock programs (high installation and compliance rates) as a proven effective countermeasure for reducing impaired driving and driving under the influence recidivism.

Education campaigns to reduce wrong-way driving may include a focus on understanding street signs, pavement markings, and interchange movements; how to self-correct if you are a wrong-way driver; what to do if you see a wrong-way driver; and impaired driving awareness and prevention.

As mentioned above, alcohol and drug impairment are the most common risk factors involved in wrong-way serious and fatal crashes, just as it is in fatal crashes generally. Education aimed at preventing impaired driving and encouraging safe behaviors is also an evidence-based countermeasure used across the U.S. Education campaigns target both high-risk drivers and those who influence them (parents, spouses, friends, employers) to encourage people who use alcohol, cannabis, or other impairing substances to travel safely by arranging sober drivers; using rideshare, taxis, or transit; or by delaying travel.

Appendix A: References

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