



Wrong Way Driver Detection & Warning System

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Description: Approximately sixty percent of wrong-way driving is caused by impaired drivers. However, older drivers were also found to be overrepresented in wrong-way driving crashes. Wrong-way driver detection and warning systems alert both the driver and a traffic management center (see [#TM9](#)) of a wrong-way driving entry. Wrong-way driver detection and warning systems are composed of three components: 1) the detection element (see [#TMS](#)), 2) the notification element, and 3) the warning element. The detection element detects a vehicle that is traveling on a roadway in the wrong direction. The notification element of a system notifies the traffic management center and law enforcement authorities of the infraction. The warning element informs both the wrong-way driver and right-way drivers.

Rural Transportation Critical Needs

- Crash Countermeasures
- Emergency Services
- Operations & Maintenance
- Rural Transit & Mobility
- Surface Transportation & Weather
- Tourism & Travel Information
- Traffic Management

Issues Addressed

- Road Geometry Warning
- Highway-Rail Crossing Warning
- Intersection Collision Warning
- Pedestrian Safety
- Bicycle Warning
- Animal Warning
- Collision Avoidance
- Collision Notification
- Weather Warning

Strategies Achieved

- Road User
- Road
- Vehicle
- Safety Culture
- Engineering
- Emergency Response
- Enforcement
- Education





Applicability

- If a collision occurs between a wrong-way and right-way driver, the consequences can be fatal. Several states have reported success in reducing wrong-way driving by installing wrong-way driving detection and notification systems. It may be possible to deploy a notification system in rural areas if the detection system can send a notification to law enforcement authorities or traffic management center (if applicable).

Partnerships

- Applications benefit from collaboration among numerous agencies, which may include:
 - Departments of transportation (local, state, federal)
 - Law enforcement
 - Emergency response
 - Vehicle manufacturers

Key Components

- Detection element
 - Intrusive: loop detectors
 - Non-Intrusive: radar, microwave, video, thermal and magnetic detection
- Notification element
 - Visual and audio signal notification for operators at Traffic Management Center
 - Closed circuit television
- Warning element
 - Wrong-way driver: Light Emitting Diode (LED) lighting, in-pavement lights
 - Right-way drivers: dynamic message signs with automated messages

Examples of Implementation

- **Doppler-Radar-Enhanced LED**

New York State's Thruway Authority has installed [Doppler-radar-enhanced LED](#) signs at the I-190 interchange in Buffalo, NY, at the I-87/I-287 interchange in Nyack, NY, at the I-87 interchange in Catskill, NY, and at the I-90 interchange in Canastota, NY.

- **Lonestar Software**

The Texas Department of Transportation (TXDOT) is experimenting with its [Lonestar software](#) to send notifications of wrong-way detections.

- **SunGuide Software**

The Florida Department of Transportation is experimenting with its [SunGuide](#) software to send notifications on wrong-way detections.

- **Arizona, Wrong-Way Detection with Radar and LED Warning Systems**

In 2014, the [Arizona](#) Department of Transportation (AZDOT) installed two permanent, wrong-way detection stations using radar to detect wrong-way driving. In 2015, the ADOT installed three wrong-way LED warning systems.

- **San Antonio, Radar & LED Warning Lights**

[San Antonio](#), Texas utilized radar detection and LED warning lights to reduce wrong-way driving incidents by up to 30 percent.

- **Rhode Island, Wrong-Way Detection & Warning System**

The Rhode Island Department of Transportation (RIDOT) indicated that since installing a wrong-way detection and warning system, wrong-way crashes have been reduced to zero. Find out more about this project [here](#) and [here](#).





Implementation Considerations (General)

- Solar panels must be checked/cleaned periodically.
- See the Manual on Uniform Traffic Control Devices (MUTCD) for more information on LEDs.
- LEDs should flash at a rate of more than 50 but less than 60 times per minute.

Implementation Considerations (Pro)

- Can help to address crashes that are often severe.
- LED signs were found to reduce incidents of wrong-way driving by 38%.

Implementation Considerations (Con)

- Systems, like Texas DOT's Lonestar, Florida DOT's SunGuide, and Iowa DOT, still have a lot of false-positives, which is restricting deployment to the user-level.
- One state reported problems with powering wrong-way detectors by solar panels because they became dirty.
- Studies suggest that enhancing the visibility of wrong-way signs using LED lights will not address intoxicated drivers traveling the wrong-way; these signs were reported to be more effective for older drivers who may not have understood the configuration.

Opportunities for Future Expansion

- Wrong-way detection and warning systems that track, in real time, a wrong-way vehicle are under development, but currently have not been deployed.
- With connected vehicles, alerts can be provided to a driver traveling the wrong-way on a roadway using internal data. They could also warn right-way drivers of the presence of a wrong-way driver. Such a system has reportedly been piloted in Japan, and Mercedes-Benz has been working to

Additional Resources

- *Detection and Warning Systems for Wrong-Way Driving* (Arizona), found here: https://apps.azdot.gov/ADOTLibrary/publications/project_reports/PDF/az741.pdf
- *Guidelines for Reducing Wrong-Way Crashes on Freeways* (Illinois), found here: <https://apps.ict.illinois.edu/projects/getfile.asp?id=3118>
- *Wrong-Way Driving Prevention Methods* (California), found here: http://www.dot.ca.gov/newtech/researchreports/preliminary_investigations/docs/wrong-way_driving_preliminary_investigation_10-02-15_-_with_appendices_final.pdf
- *Highway Special Investigation Report: Wrong-Way Driving* (National Transportation Safety Board), found here: <http://www.nts.gov/safety/safety-studies/Documents/SIR1201.pdf>
- Federal Highway Administration, Office of Safety, *Wrong-Way Driving*, found here: http://safety.fhwa.dot.gov/intersection/other_topics/wwd/





Useful Tip

If dynamic message signs are installed on a corridor where a wrong-way driver is known to have entered, they can be used to suggest to right-way drivers that they should pull off to the side of the roadway until the wrong-way driver has been apprehended.

Cost Range

(Cost/financial information, where noted, is based on 2016 dollars (unless otherwise specified). Cost/financial information is estimated, and will vary based on size and scope of project, number of units, etc. In general, capital costs include initial purchase costs of hardware, software, and other required equipment. Maintenance and operations costs include staff time to operate, monitor and maintain systems; data collection; system upgrades; evaluation; etc.)



Capital Costs: The total capital costs for this tool were reported as low (Less than \$50,000). However, the full costs depend upon the number of locations where wrong-way systems are implemented. The TXDOT installed LED wrong-way signs with solar panels on exit ramps to increase conspicuity of the wrong-way signs. The cost was \$2,060 for a sign with a solar panel mounted to an existing signpost. The price increased to \$5,540 when radar was added. The total for an exit ramp is therefore approximately \$14,510¹. RIDOT installed a wrong-way detection and warning system, at a cost of \$25,000 per location. They did appear to make use of some existing infrastructure, like dynamic message signs². TXDOT reported a cost of \$41,455 to install a wrong-way driving notification system on the mainline of a highway (includes two wrong-way LED signs, two blank out signs, one radar detector, one radio link, and additional electrical components)¹.



Operations Costs: The operations and maintenance costs for this tool are estimated as low (Less than \$50,000) to medium (\$50,000 to \$100,000). They are highly dependent upon the complexity of the wrong-way detection system and what are included as costs. Traffic management center personnel and law enforcement officers may be needed to confirm wrong-way drivers and respond and apprehend them. There may be costs for powering the dynamic message signs if they are used to warn right-way drivers. The frequency of responses to wrong-way driving and the level of automation will all influence the costs.

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