National Center for Rural Road Safety

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Rural Intelligent Transportation System (ITS) Toolkit – *An Introduction*

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Overview

- Why update the Rural ITS Toolkit?
- Live Demonstration
- Questions?

Why Update the Rural ITS Toolkit?

- First created in 1997
- Technology is rapidly advancing
  - Update, expand, relevant, useful
- Updated examples
- Tools that may have been cost-prohibitive 5 to 10 years ago may now be financially feasible

Live Demonstration

Questions?

https://ruralsafetycenter.org/resources/rural-its-toolkit/

Categories

1) Crash Countermeasures (CC)
2) Traffic Management (TM)
3) Operations & Maintenance (OM)
4) Emergency Services (ES)
5) Surface Transportation & Weather (STW)
6) Rural Transit & Mobility (RTM)
7) Tourism & Travel Information (TTI)

Each tool has a relevant photo of the tool

Wrong Way Driver Detection & Warning System

CC 5

Photo: Courtesy of Arizona Department of Transportation

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 #TM5), 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.

The description has links to other relevant tool sheets

Multiple critical needs categories may be identified

Rural Transportation Critical Needs	Issues Addressed	Strategies Achieved
☑ Crash Countermeasures	☐ Road Geometry Warning	☑ Road User
☑ Emergency Services	☐ Highway-Rail Crossing Warning	☑ Road
☑ Operations & Maintenance	☑ Intersection Collision Warning	☐ Vehicle
☐ Rural Transit & Mobility	☑ Pedestrian Safety	☑ Safety Culture
☐ Surface Transportation & Weather	☑ Bicycle Warning	☑ Engineering
☐ Tourism & Travel Information	☐ Animal Warning	☑ Emergency Response
☑ Traffic Management	☑ Collision Avoidance	☑ Enforcement
	☑ Collision Notification	☑ Education
	☐ Weather Warning	

Issues Addressed and Strategies Achieved changed for each category (i.e. CC vs. TM)

When one might want to consider the tool

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

Components that the tool consists of

Short description of examples along with links to further information

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)	Implementation Considerations (Pro)	Implementation Considerations (Con)
•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.	•Can help to address crashes that are often severe. •LED signs were found to reduce incidents of wrong-way driving by 38%.	•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.

General considerations for implementation as well as positives and negatives that may have been found with the tool

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

How this tool may be combined with other tools or opportunities for the future

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.ntsb.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/

If the user finds the overview of the tool to be useful and wants to learn more about that tool

Ideas on how the tool's usefulness can be maximized

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.)

Visual aids convey the ranges of capital and operations costs that were found in literature

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 $14,510[1]. 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 signs[2]. 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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