



Danger alert

Wrong-way driving crashes make up a very small percentage of total traffic accidents, but once they occur, they are generally fatal and pose significant safety concerns for freeways and limited-access highways.

These types of crashes typically occur at night, and causes may include confusing signs and pavement markings, low lighting conditions, and drivers who are confused and/or impaired and those who may be under the influence of alcohol or drugs.

Previous studies have shown that rectangular rapid flashing beacons (RRFBs) are effective in alerting drivers of correct driving behavior with regard to yielding to pedestrians crossing streets. However, when placed at freeway off-ramps to correct wrong-way driving, their effectiveness for deterring wrong-way driving and their effects on driver behavior in the adjacent arterial were unknown.

Florida had a significant increase in wrong-way driving-related fatalities in 2014, and the Florida Department of Transportation (FDOT) immediately took action to address this. Under the leadership of State Traffic Operations Engineer Mark Wilson and District 7 Secretary Paul Steinman, researchers at the Center for Urban Transportation Research (CUTR) at the University of South Florida in Tampa conducted a study on using red RRFBs mounted on "WRONG WAY" signs at off-ramps along I-275 in Tampa to determine their effectiveness in reducing wrong-way driving and the effects active red RRFBs have on drivers traveling on adjacent arterial roadways.

Mitigating wrong-way driving through red RRFB implementation

By Pei-Sung Lin, Ph.D. and Seckin Ozkul, Ph.D.
Contributing Authors

Six sites in Tampa (three sets of northbound and southbound off-ramps at I-275 and Bearss, Fletcher, and Fowler avenues) were selected, and after receiving authorization from the Federal Highway Administration, FDOT installed “WRONG WAY” signs with red RRFBs mounted on the top and bottom of each site. The signs were equipped with dual radar sensors capable of detecting vehicles traveling in the wrong-way direction. Upon detection of a wrong-way driving vehicle, the flashing red RRFBs are activated to notify the driver of the wrong-way driving action, and simultaneously, a message is sent to the Tampa Bay SunGuide Traffic Management Center. Law enforcement is then dispatched and other drivers on the freeway are warned through variable message signs.

The study

The first part of the study consisted of a public opinion survey conducted by CUTR to collect perceptions of the most effective and informative red RRFB combination. Survey participants were asked to choose between flashing light combinations on one or both sides of a freeway off-ramp that featured RRFBs located at the top and/or bottom of a “WRONG WAY” sign. A representative cross-section of the population offered their input by providing responses based on their review of pre-recorded field videos demonstrating various red RRFB combinations.

The field videos, filmed by CUTR and designed to simulate a driver’s point of view during a wrong-way driving scenario, were recorded at night at the driver’s level of eyesight and displayed a first-person view of a vehicle entering in the wrong direction of a freeway off-ramp. The Florida Highway Patrol (FHP) conducted corresponding off-ramp closures on I-275 during the filming of the effort.

Additional survey questions asked participant opinions on wrong-way driving, including what time it was likely to occur, how they would react if they realized they were driving in the wrong direction, driving under the influence if it was under the legal limit, and if they used smartphone functions while driving. Basic demographic information also was collected. Overall, survey participants were positive on the implementation of red RRFBs at freeway off-ramps to deter wrong-way driving.

The second part of the study included field observation and collecting video recordings of the traffic conditions of the corresponding adjacent arterial to use as baseline (before) data, illustrating normal driving behavior prior to the installation of the red RRFBs. FDOT installed video cameras to monitor the corresponding adjacent arterials and provided video footage for the CUTR research team. Recording took place from 11 p.m. to 4 a.m., when wrong-way driving incidents typically

occur. The data was evaluated and observed for three specific driving behaviors: sudden deceleration, sudden stops and sudden lane-changing. The driver behaviors were recorded at each off-ramp, both manually and through video recording. Because this data was used as a control, off-ramp closure was not needed during this effort.

Following collection of the baseline data, the red RRFBs were installed by FDOT at the six I-275 off-ramp sites. The “after” study involved two methods to trigger the RRFBs—wrong-way driving vehicle triggering and manual (button) triggering—using the preferred combination based on the results of the survey. A large majority of survey participants (69.5%) selected the combination of placing “WRONG WAY” signs on both the left and right sides of the roadway with red RRFBs activated at the top and bottom of the “WRONG WAY” sign, stating that this combination was the most informative and captured their attention the most.

The behavior observed on the adjacent arterials was recorded via video camera and manual documentation by field personnel. As with the baseline videos, the “after” red RRFB installation videos were recorded from 11 p.m. to 4 a.m. by FDOT. During the wrong-way driving vehicle-triggering process, off-ramp closure was provided by FHP to ensure safety. During the manual triggering process, the CUTR research team communicated



FDOT installed video cameras to monitor the corresponding adjacent arterials and provided video footage.

using two-way radio devices—one person monitored the adjacent arterial for oncoming traffic and notified the other person when to activate the RRFBs. For both triggering methods, once the red RRFBs were activated, driver behaviors that occurred were observed and manually documented. The video footage was compared to the manually recorded behavior to ensure accuracy.

Results

Data gathered from the “before” and “after” treatment sites were compiled, and the research team conducted a statistical analysis to compare the data on sudden deceleration, stops and lane changes. Results indicated that the implementation of red RRFBs does not have a negative impact on adjacent arterial driving behavior when compared to the before-implementation driving behavior data on the same adjacent arterial.

“Based on the results obtained from the survey and from field and statistical evaluations on the impacts of red RRFB implementation at six I-275 off-ramps on driving behavior along adjacent arterials,” said the CUTR, “we can conclude that the implementation of red RRFBs could potentially alert wrong-way drivers while not adversely impacting driver behaviors on adjacent arterials.”

Moving forward, the CUTR indicated that future studies will involve analysis by the research team of wrong-way driving citations and crash data at the selected six sites. CUTR also will evaluate the deployment of 18 microwave sensors used in the detection of wrong-way driving on I-275 main lanes stretching from Bearss Avenue to the I-4 interchange. Final conclusions will be drawn to evaluate the success of RRFBs and microwave detectors to mitigate wrong-way driving-related catastrophic accidents and needless deaths.

“Decreasing the number of wrong-way driving crashes and fatalities is a high priority for FDOT,” said the CUTR. “The use of red RRFBs appear to be a potential solution to increasing safety on Florida’s roadways.” **R&B**

Lin and Ozkul work at the Center for Urban Transportation Research (CUTR), College of Engineering, University of South Florida.

For more information about this topic, check out the Safety Channel at www.roadbridges.com.

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