



Caltrans Division of Research,
Innovation and System Information

Research

Notes

Transportation
Safety and
Mobility

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Project Title:
Wrong-Way Driver Off Ramp
Enhancement Evaluation

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Vision-based Sensor System for Site Monitoring: Wrong-Way Driving, Phase 1

Evaluating wrong way driver mitigation enhancements on off ramps and comparing wrong way driver behavior between enhanced and control ramps.”

WHAT IS THE NEED?

Wrong way driving is a serious hazard. As noted in pending Assembly Bill AB 162, wrong way driving on state highways kills or injures numerous Californians each year, and accidents caused by wrong way driving on highways are more likely to result in fatal or serious injuries than other types of accidents. Wrong way accident rates in the first half of 2015 appear unusually high, particularly in California Department of Transportation (Caltrans) Districts 3 (Sacramento) and 11 (San Diego). These wrong way accidents have been, as usual, deadly, e.g. a recent incident in San Diego which led to the death of two medical school students. From a recent article in the Sacramento Bee, as of May 12, 2015, 14 people have been killed in 2015 in wrong way head-on collisions in the Sacramento area. There is a need to assess the magnitude of wrong way driving in California and to evaluate the efficacy of enhancements and technologies with the potential to reduce the number of instances of wrong way driving on state highways.

With this in mind, Caltrans has proposed pilot projects in Districts 3 and 11 to install enhancements on several off ramps to warn drivers, and notify authorities, when vehicles enter from the wrong direction. Active monitoring systems capable of identifying wrong way drivers, transmitting information to a central location, and activating local flashing beacons will be installed in a subset of the off ramps. Existing white and yellow one-way retro-reflective pavement markers in the lane lines, channelizing lines, and gore areas will be replaced by two-way white/red (W/R) and yellow/red (Y/R) markers in all off ramps.

The district pilot projects are supposed to have a mitigating effect on wrong way driver behavior, however there is a need to study and attempt to quantify the effects of the district enhancements in order to determine if similar treatments are warranted on more ramps.



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WHAT ARE WE DOING?

DRISI is working with its research contractor, The Advanced Highway Maintenance and Construction Technology Research Center (AHMCT), at the University of California at Davis, to develop and install zone-triggered video image processing systems (VIPS) at the subset of district off ramps scheduled for active monitoring system installation. These systems will also be installed on five control off ramps not receiving the district enhancements. Zone-triggered video segments will be collected and initially buffered locally for off-peak hour wireless transmission to AHMCT for subsequent off-line (non-real-time) post-processing and analysis. The researchers will then develop statistics to quantify wrong-way drivers, the effectiveness of the district enhancements, and the accuracy of the district installed active monitoring and warning systems. The AHMCT developed VIPS detectors will be unmarked and inconspicuous, so they should have no effect on driver behavior.

The VIPS to be developed, installed, and monitored in this research are strictly for before and after studies to assess the impact and effectiveness of the off ramp marking enhancements and the active wrong way monitoring and warning systems. This research is not intended to perform any real-time wrong way driving detection, and will not provide alerts to Caltrans, the California Highway Patrol (CHP), or any other entity. Collected video will not be stored in the long term. The researchers currently anticipate needing to retain collected video for a rolling window of approximately one week before the data is extracted and the video overwritten.

In analyzing the collected video, the researchers will look to determine the number of triggered video collections that are generated each day, which will be an indication of the amount of traffic on the ramp. Within this data set, they will determine the number of wrong-way events, as observed during post-processing. This post-processing will be performed manually for at least a portion of the research project, although means for non-real-time automation of post-processing will be considered. The researchers will also look to determine how well the district-installed active wrong way monitoring and warning systems perform. They will independently validate the performance of these systems by determining false positives, i.e. warnings for non-wrong-way events, and false negatives, i.e. no warnings for actual wrong-way events. They will also independently verify and quantify true positives, i.e. times when the detection system issues a warning for an actual wrong-way event. When possible, the researchers will also try to qualitatively determine the causes for any verified wrong-way events, e.g. talking on a cell phone, other distractions, or visibly identifiable driver impairment.

WHAT IS OUR GOAL?

The objective of this research is to determine three things:

- 1.) the number of wrong way drivers by counting the instances of vehicles entering the off ramps in the wrong direction;
- 2.) the effectiveness of the district enhancements by comparing the number and behavior of wrong way vehicles before and after they are installed, as well as the number and behavior of wrong way vehicles entering control off ramps that do not receive enhancements; and
- 3.) the accuracy of the active wrong way monitoring and warning systems installed by the districts in a subset of off ramps.

WHAT IS THE BENEFIT?

The proposed research will provide substantial benefits to Caltrans and the traveling public. Assessing the baseline magnitude and frequency of wrong-way driving is essential in evaluating any future improvement in this important traffic safety area. In addition, the scientific, measurement-based approach taken in the proposed research will allow Caltrans to make informed, data-driven decisions regarding future detection and/or mitigation strategies based on their known effectiveness as demonstrated by this research. This study and resulting data set will make a substantial contribution to wrong-way driving research, thus enhancing the safety and stewardship of the transportation system.

WHAT IS THE PROGRESS TO DATE?

The researchers have designed, and procured equipment for, the VIPS under a previous task. They have prepared a proposal for the study described in this task, which DRISI has reviewed and sent to its customer, Traffic Operations, for approval.