EXECUTIVE SUMMARY

Instrumentation and Evaluation of District 10 Caltrans Automated Warning System (CAWS)

CALIFORNIA

PROGRAM AREA Traffic Safety	PROJECT CHARACTERISTICS Evaluation of an Advanced Fog and Traffic Warning System
TYPE OF JURISDICTION State	
TARGETED POPULATION Motorists in California Central Valley	JURISDICTION SIZE State of California

PROBLEM IDENTIFICATION

According to the National Highway Transportation Safety Administration (NHTSA) Fatality Analysis Reporting System (FARS), visibility-impairing fog was present and presumed a factor in 418 of the 38,309 fatal crashes that occurred nationwide (USA) in 2002. Although fog crashes account for a small percentage of all crashes, those crashes often involve multiple-vehicle pileups and massive losses, not revealed from the raw statistics. There is significant interest by traffic management personnel in the use of automated warning systems to provide drivers with real-time information related to fog or traffic, and thereby reduce collision risk. This study was intended to evaluate the effectiveness and operational issues related to the Caltrans Automated Warning System (CAWS), located on Interstate 5 and State Route 120 near Stockton, an area known for dense recurrent fog. This system advises drivers of appropriate speeds during fog, and warns drivers of possible traffic congestion ahead. The system includes 36 traffic speed monitoring sites, nine remote meteorological stations, and nine changeable message signs (CMS), and is controlled by three computers located in the Caltrans District 10 Transportation Management Center. This system is believed to be one of the most advanced of its kind in the world.

GOALS AND OBJECTIVES

The goal of this project was to evaluate the Caltrans Automated Warning System. This was accomplished by three primary evaluation tasks:

- Assessment of the influence of the CAWS on driver behavior

  We assessed the ability of the system to influence driver behavior as intended by the system designers by studying the characteristics of the traffic immediately before and after drivers encounter the first CMS of the CAWS.

- Technical and Operational Assessment

  Technical Assessment - Examination of engineering design and operational documentation, and inspection of facilities, to provide a sense of the soundness of the design and implementation, and effectiveness of the integration of the system and subsystem components.

  Operational Assessment - Assess the operation of the system directly by observing the actions

taken by the system and their direct effects on traffic.

- Assessment of long-term impact of CAWS on accidents

  We examined accident records over several years prior to and several years after the activation of the system. Data were normalized to travel volume and other metrics of risk exposure. Three comparison areas with similar characteristics were used. In addition to total collision statistics, secondary collisions, collisions in fog or inclement weather, specific types of collisions, effects of roadway construction, peak commute periods, and localized observations were analyzed.

STRATEGIES AND ACTIVITIES

To facilitate an accurate study of the response of drivers to the CAWS, an advanced distributed data acquisition system was designed and deployed to allow the evaluators to record the speed, separation and classification of each vehicle at five field sites located before, after and at the first CMS at the north entrance to the CAWS. The response of drivers to the CMS message was studied during both fog and non-fog conditions over a two year continuous period using a number of metrics of traffic safety, including mean speed, speed variance, and potential collision speed (a metric which considers visibility as well as vehicle separation and speed).

We studied CAWS system log files and data from our monitoring equipment to determine the actual system operational characteristics, which lead us to the need to examine the system control software.

We examined a total of 11.5 years of traffic collision, weather and construction data from TASAS and other public sources in support of a statistical analysis of the safety benefits of the system.

RESULTS

The major findings of this study are:

- Over 300,000 vehicles driving in fog, we observed an average incremental speed reduction of 1.1 mph and a small reduction in the visibility-limited safe following distance attributable to the CAWS.
- Speed variance was insignificantly affected by either visibility reduction or the CAWS warnings.
- We observed a number of unexpected responses of the CAWS system which lead us to discover a number of operational problems related to software or control algorithm design issues.
- Overall results from the analysis of collision data are inconclusive. Over the period 1997-2003 compared with 1992-1996, an average increase in travel-normalized collisions of 60% was observed in the study area, compared with an average increase of 39% in three similar control and comparison areas. Generalized linear models yielded contradictory results: one set of models predicted a possible reduction of 15% in overall collisions, while another did not find the CAWS to be associated with either a positive or negative effect on overall collisions.
- For a few targeted classes of collisions such as secondary collisions in fog, a small positive effect is evident.
- Effects of unusual roadway conditions and construction did not change these results.
- The junction of I-5 and SR-120 was clearly a problem area, while SR-120 and I-5 north of SR-120 fared better.
- Overall, we feel that the CAWS provides a safety and driver information benefit to a degree consistent with or slightly less than reasonable expectations as established by similar systems in the USA and Europe.
- With minor modifications, the potential of the CAWS may be greater than demonstrated in this study.
- The system also provides a valuable service for traffic management and driver support that may transcend its immediately measurable effects on traffic safety.

FUNDING:
Section 163 $632,419

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