

Modal

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Project Title:
Rail Crossing Safety Improvements**Project Number:** P79

This project consists of four tasks commissioned by Caltrans and conducted by University of California, Berkeley researchers between 2002 and 2012 to study the factors contributing to rail crossing collisions and examine affordable, practical solutions that provide drivers with a sufficient level of warning and motivate them to comply with the safety cues.

Project Manager:
Bradley Mizuno,
Transportation Engineer
bradley.mizuno@dot.ca.gov

Rail Crossing Safety Improvements

New methodologies and technologies to reduce collisions and increase safety at rail crossings

WHAT WAS THE NEED?

Grade crossings are an integral part of the railway and highway network. California has 6,433 public at-grade rail-highway crossings. Between 2001 and 2010, 1,033 train-vehicle collisions occurred at these crossings, resulting in 157 deaths and 458 injuries. While the majority of the crossings had only one collision, 29% had multiple incidents in this period, including a few with up to 10.

Many highway-railway crossing sites have rarely or never experienced a collision. Upgrading all grade crossings to a uniform standard is expensive and impractical. Therefore, ranking crossings is necessary to identify where the risk of collision is high and safety measures are most warranted.

To employ cost-effective measures to reduce the number of collisions, Caltrans wanted to identify which factors contribute or predispose a site to collisions and to propose appropriate solutions. Choosing the correct safety treatment for a specific rail-highway crossing requires accurate, up-to-date details about the physical site, traffic, and incidents.

WHAT WAS OUR GOAL?

The project's objective was to develop a model of rail-crossing violations and the contributing factors to better predict sites that are predisposed to collisions and examine cost-effective methods to increase crossing safety.

WHAT DID WE DO?

- Formulated a database to compile information on site location and classification, railroad and highway information, traffic control devices, physical characteristics, and incidents.
- Merged two databases from different government agencies to consolidate information on railroad crossings in the San Joaquin Rail Corridor.
- Demonstrated the practicality of using video data gathered from an existing Locomotive Video Data Acquisition System (LVDAS) to capture crossing violations to populate a database to track near-misses and help identify crossings that might be more susceptible or prone to collisions.
- Analyzed driver behavior and other factors that contribute to rail collisions and measures that make it difficult to ignore safety warnings.
- Examined ways to improve commercial off-the-shelf in-pavement warning signals and their suitability for use at grade crossings, and demonstrated a new in-pavement crossing signal based on LED technology.



WHAT WAS THE OUTCOME?

Increasing rail crossing safety is highly dependent on the accuracy of the state's inventory database, so bringing the database up to date and putting it into a readily accessible format is important. Properly evaluating crossings is then possible by looking for commonalities at sites where incidents have occurred. Tools such as Google Maps are effective in verifying and updating information in the inventory database.

Although collisions are relatively rare, near-misses are frequent. Therefore, it is important to collect data on crossing violations, because these near-misses offer useful statistical information to identify risk factors for collisions and devise appropriate solutions.

Some type of warning device is present at all public crossings, so most collisions are caused by people violating the signs, signals, or gates and misperceiving an approaching train's distance and speed. Their concern is determining the speed and proximity of the train rather than its presence. However, the interplay of perception, expectation, and human information processing required can easily lead to failures in judging train location and speed. The group of drivers who are not deterred by lowered gates are primarily male and mostly under 40 years old.

One effective solution to rail crossing collisions is to discourage drivers from making faulty decisions. At existing gated locations, median separators and long-arm gates are two low-cost, low-technology, and low-maintenance methods that have been deployed in many locations nationwide. Their efficacy of preventing deaths and injuries has been documented and estimated to reduce collisions by 75%, compared to standard flashing lights and gates.

Gate arms typically extend to the centerline of the road. But when covering at least three-quarters of the roadway, long-arm gates are effective at discouraging gate drive-arounds. Long-arm gates cost less than median separators per crossing, but might not be appropriate for locations with significant truck or bus traffic, wide crossings, multiple rails, or high winds.

Median separators can be applied directly to the existing roadway or part of an island. They present drivers a visual cue and impede crossing to the opposing traffic lane. The curbs are no more than 6 inches in height, usually less than 12 inches in width. The reflectorized delineators, typically 24-36 inches high, can bounce back after being hit or run over and are designed to allow emergency vehicles to cross over into opposing lanes. A system can usually be placed on existing roads without the need to widen them.

WHAT IS THE BENEFIT?

Caltrans and its partners can use this research to plan for the reduction of injuries, fatalities, and property damage and lessen travel delays resulting from rail and highway shutdowns. Having consolidated detailed information about violations and collisions for each rail crossing is important for identifying on-going dangerous conditions and the type of warnings and obstacles to employ for a particular site, allowing for scarce funds to be used most effectively. This research produced a decision support tool that helps to employ safety measures that are site-appropriate and effective at deterring those drivers who tend to ignore warnings, thereby reducing collisions and saving lives.



Street-mounted
channelization

LEARN MORE

To view the complete Caltrans reports, visit:

- Applying Safety Treatment to Rail-Highway At-Grade Crossings
www.dot.ca.gov/research/researchreports/reports/2012/2012-05_task_1732-modal.pdf
- Driver Behavior at Rail Crossings: Cost-Effective Improvements to Increase Driver Safety at Public At-Grade Rail-Highway Crossings in California
www.dot.ca.gov/research/researchreports/reports/2012/2012-05_task_0747-modal.pdf
- San Joaquin Rail Corridor Crossing Survey Task
www.dot.ca.gov/research/researchreports/reports/2012/2012-05_task_0990-modal.pdf
- Improved Grade Crossing Safety with In-Pavement Warning Lights
www.dot.ca.gov/research/researchreports/reports/2012/2012-05_task_0159-modal.pdf