

# DRISI

CALTRANS DIVISION OF RESEARCH,  
INNOVATION AND SYSTEM INFORMATION

# Research Results

Transportation  
Safety and  
Mobility

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**Project Title:**

Phase 2: Implementation of Safety Performance Functions (SPF) for California Project

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## Phase 2: Implementation of Safety Performance Functions for California

This research will help Caltrans to more efficiently target locations that will likely benefit from safety improvements and would result in the greatest reduction in fatal and injury collisions.

### WHAT WAS THE NEED?

Identifying high crash concentration locations is a major objective of many state and local transportation agencies. In recent years, significant progress has been made with respect to crash prediction models for identifying such locations. In addition to providing valuable information related to factors that can potentially contribute to increase in the likelihood of traffic crashes, the Highway Safety Manual (HSM) explains how Safety Performance Functions (i.e., a mathematical relationship describing the crash frequency and explanatory variables) are used to estimate the expected number of crashes per year for a given location, which serve as a baseline for network screening techniques which play a major role in the transportation safety management process.

Caltrans was in the process of piloting SPF-based methodologies into the process to identify high crash concentration locations for roadway segments, intersections and ramps on the entire State Highway System. While the existing effort had value, the full benefits could not be realized until the necessary enhancements were developed and the process was fully deployed.

### WHAT WAS OUR GOAL?

The project had several goals: (i) identify performance measures and threshold values for the potential safety improvements of sites; (ii) enhance the capability of the existing MS Excel, including its functionality (Table B), users, and interface; (iii) maintain forward-compatibility with Transportation System Network Replacement (TSNR); (iv) develop advanced SPFs and evaluation types of SPFs in network screening along with integration from new SPF such as nighttime; (v) develop MS Excel tool guidelines, along with training materials and user manual.



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## WHAT DID WE DO?

Safety Performance Functions were developed for three different severity level combinations for road facilities in the State Highway System (SHS): total crashes, fatal + serious + visible injury crashes, and fatal + serious injuries. PSI based on the Empirical Bayes (EB) approach was then used for network screening processes to select the top one percent of hotspots within each facility type by injury severity level. Results indicate that including visible injuries may provide a larger sample size of crashes for SPF estimation, PSI-based prioritization, and site investigations. The analysis also revealed the differences in site demographic type and annual average daily traffic (AADT) across hotspots identified by different crash combinations. For example, the majority of low injury severity crashes in total crashes are more likely to occur in urban locations with high traffic volumes.

## WHAT WAS THE OUTCOME?

A spreadsheet-based Safety Performance Function tool has been developed for Caltrans so that staff can run more robust network screening methods aligned with best practice. This SPF-based network screening can eventually replace Table C. Future research will include calibration or re-estimation of the SPFs with newer years of crash data and additional road geometry as well as addition of wet SPFs to the tool functionality.

## WHAT IS THE BENEFIT?

The techniques and tools developed in this study will help Caltrans to more efficiently target locations that will likely benefit from safety improvements and will result in greater reductions in fatal and serious injury crashes. To accomplish this, we further developed the range and depth of the existing SPFs along with enhancements to the MS Excel tool.

## LEARN MORE

Review the complete report.

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