



CALTRANS DIVISION OF RESEARCH,  
INNOVATION AND SYSTEM INFORMATION

# Research Results

Design

MAY 2024

**Project Title:**

Cost-Benefit Analysis for Concrete vs Metal Guardrails and Wood vs Metal Posts for Signs and Guardrails

**Task Number:** 3848

**Start Date:** December 1, 2021

**Completion Date:** November 30, 2023

**Task Manager:**

Hamid Ikram  
Transportation Engineer, Electrical  
hamid.ikram@dot.ca.gov

## Cost-Benefit Analysis for Concrete vs Metal Guardrails and Wood vs Metal Posts for Signs and Guardrails

This project performed cost-benefit analysis study to develop methodology for choosing between concrete vs metal beam guardrail barriers and developed guidelines to support the decision for replacement of wooden posts with metal posts for signs and guardrails.

### WHAT WAS THE NEED?

Findings from previous research project (Task ID 2761) had revealed that the maintenance work on guardrails, barriers, and end-treatments incurs the highest average cost per work order compared to the maintenance cost of other roadside features considered. Additionally, in certain situations, these maintenance operations expose highway workers to live traffic for an extended duration, increasing safety risks. Therefore, there was a need for both safety and efficiency considerations in developing a lifecycle cost analysis and cost-benefit evaluation, which could assist in decision-making regarding best practices to reduce both safety risks and the cost of such operations.

### WHAT WAS OUR GOAL?

The goal of this project was to analyze the lifecycle costs of concrete barriers vs. steel guardrails, as well as wooden vs. steel posts for signs and guardrails, to help in the decision-making process when choosing between these different roadside features and their replacements.

### WHAT DID WE DO?

In this project, a lifecycle cost analysis and cost-benefit evaluation framework was developed that can be used to facilitate decision-making processes to mitigate safety risks and reduce overall operational expenses. Researchers reviewed the practices of other Departments of Transportation (DOTs) in selecting roadside barriers, conducted interviews with Caltrans maintenance personnel, and used available analytical models and data extracted from Caltrans databases to conduct



DRISI provides solutions and knowledge that improves California's transportation system



the cost-benefit analysis. The methodology incorporated several factors, such as construction and maintenance costs, exposure risks during maintenance operations, and the cost imposed on public in terms of traffic delays and accidents outcome. This research also developed an algorithm named "CalBarrier" designed to calculate and compare the life-cycle costs of concrete barriers and steel guardrails.

## WHAT WAS THE OUTCOME?

The results of this research showed that selecting the most cost-effective barrier requires the inclusion of many factors, such as maintenance resources required to maintain the barrier, exposure risks to Caltrans workers, and public costs, while carefully considering factors such as traffic mixture, economic factors, and road geometry. CalBarrier tool was developed to incorporate these factors in computing and comparing the lifetime cost of concrete barriers versus steel guardrails. This research also revealed that the wooden guardrail posts and signposts, despite their lower initial costs, incur elevated maintenance and disposal expenses, which makes them less cost-effective over their lifetime.

## WHAT IS THE BENEFIT?

The benefits of this research include improved safety for maintenance/construction workers and cost savings in certain high-cost maintenance operations associated with barriers, guardrails, and signposts.

## LEARN MORE

<https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/final-reports/final-report-task-3848-a11y.pdf>