



CALTRANS DIVISION OF RESEARCH,  
INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

# Research



# Notes



Design

OCTOBER 2023

Project Title:  
Safety of Earthen Stormwater  
Infiltration Best Management  
Practices (BMP) Adjacent to  
Highways – Phase II

Task Number: 3909

Start Date: January 1, 2023

Completion Date: December 31,  
2025

Task Manager:  
Akber Ali  
Transportation Engineer (Civil)  
akber.ali@dot.ca.gov

## Safety of Earthen Stormwater Infiltration Best Management Practices (BMP) Adjacent to Highways – Phase II

A research focused on improving roadside safety and adherence with the National Pollution Discharge Elimination permit.

### WHAT IS THE NEED?

Stormwater best management practices (BMP) are in place to prevent pollution in stormwater runoff from Caltrans properties and also to facilitate the stormwater discharge from road infrastructure. To comply with the National Pollution Discharge Elimination (NPDES) permit soil based BMPs that are capable of allowing infiltration of the 85th percentile of a 24-hour stormwater event may need to be installed in roadway clear recovery zones. Thus, compliance with the NPDES must also come with adherence to traffic safety design requirements. Little to no national guidance or guidance from other states currently exist with respect to the effect of soil BMPs and traffic safety.

To address this concern Caltrans conducted a research project in 2018 (Task 2896), entitled "Safety of Earthen Stormwater Infiltration Best Management Practices (BMP's) Adjacent to Highways". As part of that study, experiments were performed on non-amended and amended soils and the results were used as input to the Msmac 3D program to simulate vehicle dynamic responses due to a roadside departure in amended and non-amended soil scenarios. The outcome of this efforts was a library of simulations that provided quantifiable data on the effect that soft soils have on the safety and rollover potential of a vehicle traversing the CRZ. This library of results was used to create logit models to predict the probability of overturns, spinouts, and sinkage from roadside departures. The models were compiled into a user-friendly design analysis tool, known as the Integrated Roadside Design Analysis Model (IRDAM), which was implemented into the Microsoft Excel Platform. Research is now needed to enable widespread use and implementation of these findings, a Phase II of the aforementioned project (Task 2986) is needed.



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

## WHAT ARE WE DOING?

This project will review the relevant literature on the topic for any new findings since Phase I was completed, perform sinkage and hydraulic conductivity experiments on amended and non-amended soils, and evaluate how the density of the roadside soils change over time to understand how sinkage potential may increase after the initial construction is completed. Researches will then calibrate the Msmac 3D predictions against in-field measurements in order to increase simulation accuracy and if necessary, conduct more roadside departure simulations and update the IRDAM tool from Phase I.

## WHAT IS OUR GOAL?

The goals of this Phase II project are to: 1) enhance the Phase I product to better predict behaviors on the broad range of soils that may be encountered; 2) verify the soil sinkage predictions with in-situ measurements; 3) better consider the effect of changes in the density of the roadside soil over time and how this interacts with the use of soil amendments; and 4) incorporate the findings to update the Phase I IRDAM tool.

## WHAT IS THE BENEFIT?

Caltrans and the public will benefit from this research because designers will be able to use the tool and design tables that will result to assess soil amendments on a case-by-case basis. By making site-specific decisions, the designers will more effectively use available resources (thus saving money and time). The public will also benefit from a roadside that is safer and meets best management practices for water management near roadways.

## WHAT IS THE PROGRESS TO DATE?

The work in this quarter has been focused on the literature review. To this end, the elements of the literature evaluated in the previous project (Task 2896) are being revisited to complement and expand where needed, the state of knowledge that is pertaining to the project tasks..