DRISI

CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

Research Notes

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

Improving roadside safety and adherence with the National Pollution Discharge Elimination permit.

Design

May 2025

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

Task Number: 3909

Start Date: January 01, 2023

Completion Date: December 31, 2025

Task Manager:

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

WHAT IS THE NEED?

Stormwater best management practices (BMP) are in place to prevent pollution in stormwater runoff from Caltrans properties and to facilitate the stormwater discharge from road infrastructure. To comply with the National Pollution Discharge Elimination (NPDES) permit soil soil-based BMPs that can allow 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 exists with respect to the effect of soil BMPs and traffic safety.

To address this concern Caltrans conducted instigated a research project in 2018 (Task 2896), entitled "Safety of Earthen Stormwater Infiltration Best Management Practices (BMPs) 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 accident reconstruction software 3D program to simulate vehicle dynamic responses due to a roadside departure in amended and non-amended soil scenarios. The outcome of this effort 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 Coastal Regulation Zone (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;

Caltrans

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

Phase II of the aforementioned project (Task 2986) is needed.

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 changes over time to understand how sinkage potential may increase after the initial construction is completed. Researchers will then calibrate the MSMAC 3D predictions against in-field measurements to increase simulation accuracy and if necessary, conduct more roadside departure simulations and update the Integrated Roadside Design Analysis Model (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 predict better 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 in assessing 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 is safer and meets best management practices for water management near roadways.

WHAT IS THE PROGRESS TO DATE?

Field tests were conducted at six previously studied sites in California and three newly selected sites in Arizona. Field activities included in-place density and unit weight measurements, shear strength estimation and plate load testing (PLT) to assess soil modulus and pressure–sinkage behavior. Additionally, soil samples were collected for laboratory water content measurement and further characterization.