DRISI

CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

Research Notes

Partnered Pavement Research Center (PPRC) 23: Mechanistic-Empirical Design

Improving, refining, and updating CalME for Mechanistic-Empirical (ME) design of flexible pavements

Pavement

MAY 2024

Project Title:
Partnered Pavement Research Center (PPRC) 23: Mechanistic-Empirical Design

Task Number: 4201

Start Date: November 7, 2023

Completion Date: September 30, 2026

Task Manager:
Junxia Wu
Transportation Engineer
junxia.wu@dot.ca.gov

WHAT IS THE NEED?

Caltrans is transitioning from using empirical method to ME method for pavement design so that local conditions such as material, climate and traffic can be effectively accounted for. ME design method needs to be continuously improved by conducting research to better understand various physical processes affecting pavement deterioration and implementing the findings. Additionally, there is a need to develop new, consistent tools and a flexible design catalog for local governments, replacing retired desktop programs, and aligning with the ME method adopted by Caltrans.

WHAT ARE WE DOING?

This task order involves improving the models within CalME to explain larger portions of observed performance, thus reducing uncertainties in predicted outcomes. This includes updating existing models for better accuracy, adding new models to account for more processes that affect pavement performance, updating climate and traffic databases where necessary, and periodically re-calibrating the empirical part of the ME design to reflect updated performance data.

This task includes the following subtasks:

- Improve CalME user interface and functionality
- Update models and databases in CalME
- Update calibration of CalME performance models
- Develop flexible pavement design catalog for local government

Caltrans

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

WHAT IS OUR GOAL?

The primary goal of this task is to advance the CalME program by improving design workflow efficiency, incorporating advanced features, and expanding design functionalities. The most significant objective is to make pavement designs more cost-effective by refining models to explain a larger portion of observed performance, thereby reducing uncertainties and allowing for the use of smaller safety factors without compromising design reliability. Additionally, the task order aims to fulfill the needs of local governments by developing a new set of simple tools consistent with CalME, ensuring a smooth transition from retired desktop programs.

WHAT IS THE BENEFIT?

By advancing the CalME program, the efficiency of pavement design workflows for Caltrans engineers will be significantly improved through the incorporation of advanced features and expanded functionalities. The refinement of models within CalME will not only enhance design accuracy but also make pavement designs more cost-effective. M-E methods account for local conditions such as climate, traffic, and material and can therefore optimize pavement designs for the specific conditions rather than having to cover the worst-case scenario. This reduces the uncertainties in predicted performance and as a result allows the use of smaller safety factors for the same design reliability. Additionally, local governments stand to benefit from the development of a new set of tools consistent with CalME, ensuring a smooth transition and alignment with state-of-the-art design methodologies.

WHAT IS THE PROGRESS TO DATE?

As of May 2024, the research team has made the following progress:

- Reviewing modern programing frameworks and develop an approach for migrating CalME onto modern frameworks.
- Reviewing model for predicting field aging
- Reviewing improvements needed for the first version of the design tables.