



CALTRANS DIVISION OF RESEARCH,
INNOVATION AND SYSTEM INFORMATION

Research Results



Pavement

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Project Title:

Partnered Pavement Research Center (PPRC) 17: Sustainability

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Environmental Life Cycle Assessment (LCA) for Project Level Use

Developed eLCAPTM, an easy to use, comprehensive, and practical tool using California data for life cycle assessment for pavements.

WHAT WAS THE NEED?

Caltrans needs to quantify greenhouse gas (GHG) emissions and other environmental impacts from pavement operations. This requirement extends to pavement management, conceptual design, project level design, materials selection, and construction project delivery decisions. To achieve this, Caltrans has used Life Cycle Assessment (LCA) tools, including: (1) Pavem asset management software to model International Roughness Index (IRI) and calculate GHG emissions for different planned scenarios versus doing nothing, and (2) Federal Highway Administration's (FHWA) Infrastructure Carbon Estimator (ICE) to obtain early-stage GHG estimates. However, these tools had limitations in project-level assessments and California-specific conditions.

To address these limitations, a web based LCA tool called eLCAPTM was developed. This tool is designed to provide detailed environmental impact assessments for construction and maintenance stages of pavement projects, using data and models specific to California. eLCAPTM aims to enhance project-level evaluations with California-specific data, supporting more informed decision-making in pavement management and project design.

WHAT WAS OUR GOAL?

The goal of this project was to develop and refine eLCAPTM using California specific data to provide an easy to use, comprehensive, practical tool for life cycle assessment for pavements in California.



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WHAT DID WE DO?

To help Caltrans quantify and manage the environmental impacts of pavement operations, the University of California Pavement Research Center (UCPRC) developed the eLCAPTM tool. eLCAPTM uses California-specific data to model the life cycle impacts of pavement projects, incorporating construction events and use stages. It computes 18 impact category values, such as Global Warming Potential, and generates detailed Excel report file to display graphs and tables.

WHAT WAS THE OUTCOME?

The eLCAPTM tool streamlines the LCA process for pavement projects by providing detailed and comprehensive environmental impact reports. eLCAPTM simplifies LCA modeling and generates Excel spreadsheets with visual bar and pie charts for 18 impact categories, categorized by Material Production, Transport, Construction Equipment, and Construction. eLCAPTM generates detailed process-level results, including input and output flows, characterization factors, and flow potential amounts for various impact methods. Additionally, for the use stage, eLCAPTM provides detailed reports on truck lane distribution, traffic volumes, equivalent single axle loads (ESALs), IRI, performance model parameters, and GHG emissions. This enables Caltrans to effectively integrate environmental considerations into their pavement management and project design processes.

WHAT IS THE BENEFIT?

The eLCAPTM tool has simplified the complex LCA process for pavement projects, using California-specific data, to generate detailed reports. It allows Caltrans to quantify GHG emissions and other environmental impacts across different stages of pavement management, from design to construction and maintenance. By providing specific, easy-to-understand results, eLCAPTM supports informed decision-making, helping Caltrans integrate environmental considerations into policy development, project planning, and materials selection.

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<https://escholarship.org/uc/item/9f5181j1>

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