

**Pavement****MARCH 2025****Project Title:** Partnered Pavement Research Center (PPRC) 20: Sustainability**Task Number:** 3820**Start Date:** June 30, 2020**Completion Date:** September 30, 2023**Task Manager:**Simon Bisrat  
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## Environmental Life Cycle Assessment Updates and Applications

Collect and validate data to improve the life cycle inventories database.

### WHAT WAS THE NEED?

This research was conducted to address critical issues in the management and maintenance of pavement projects in California. Historically, there has been a lack of detailed, region-specific life cycle inventories (LCIs) for pavement materials, which are essential for making sustainable decisions. Existing methods for evaluating the sustainability and environmental footprint of pavements have been inadequate, lacking comprehensive data and standardized procedures. Additionally, federal and state mandates, such as the California Renewables Portfolio Standard, along with guidelines from the Federal Highway Administration (FHWA) and the United States Environmental Protection Agency (U.S. EPA), require improved tools for assessing the environmental impacts of pavement projects.

### WHAT WAS OUR GOAL?

The goal of this project was to develop a comprehensive life cycle inventory database for pavement materials, mixtures, surface treatments, material transportation, and construction activities used by the California Department of Transportation (Caltrans) to build new roads, maintain and rehabilitate existing structures, and manage pavements at the end of their service life.

### WHAT DID WE DO?

This research focused on the ongoing development of the pavement Life Cycle Assessment (pLCA) and environmental Life Cycle Assessment for Pavement (eLCAP) tools to analyze the environmental impacts of pavement surface treatments. Data were collected from national and local



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sources, metadata fields in eLCAP were updated, and a data quality assessment matrix based on the U.S. EPA's pedigree matrix was enhanced. Validation processes were conducted through quality assessments and comparisons with accepted sources. Collaborative efforts included working with institutions such as Lawrence Berkeley National Laboratory and aligning the tools with federal and state standards. Critical reviews in 2016 and 2021 ensured the validity and reliability of the database and tools.

## WHAT WAS THE OUTCOME?

This research significantly advanced the development of the eLCAP and pLCA tools, providing comprehensive platforms for evaluating the environmental impacts of pavement materials and processes. Data quality and reliability were enhanced through rigorous assessments, leading to improved accuracy and localization of environmental impact data for California-specific conditions. These tools enabled better decision-making in pavement design and maintenance, provided a framework for regional LCIs, and identified areas for future research, including continuous database updates and further validation.

## WHAT IS THE BENEFIT?

This research facilitates the decision-making process, leading to more sustainable and environmentally friendly pavement solutions; reduced greenhouse gas emissions; and improved air quality. Economically, this research contributes to potential cost savings through optimized pavement strategies and better resource allocation. Additionally, it serves as a model for other Departments of Transportation (DOTs) and both private and public sectors, providing standardized and reliable data to support nationwide improvements in pavement management and environmental impact reduction.

## LEARN MORE

<https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/final-reports/3820-pavement-life-cycle-inventories-for-california-a11y.pdf>