

Caltrans Sustainable Concrete Pavements

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Why Is Caltrans Interested in Sustainable Pavement practices?

▶ Legislation:

- ▶ Executive Order B-30-15
- ▶ Executive Order B-55-18
- ▶ Executive Order N-19-19
- ▶ Executive Order S-3-05
- ▶ Executive Order B-16-12
- ▶ SB 391
- ▶ California Transportation Plan 2050
- ▶ Strategic Management Plan Goal - Lead Climate Action
- ▶ Director's Policies: 30 - Climate Change and 33 - Sustainability
- ▶ CA Assembly Bill 32 (GHG Reduction), 296 (Urban Heat Island), 262 (EPDs)
- ▶ CA Senate Bill SB-1

Environmental Life Cycle Assessment (LCA)

- ▶ Quantify Environmental (GHG Emission) Impact of Pavement Operations using LCA
 - ▶ Design
 - ▶ Materials selection
 - ▶ Construction practices
 - ▶ Compare and select pavement practices with lower environmental impacts, particularly greenhouse gas emissions
- ▶ PaveM model for network level LCA analysis
- ▶ Environmental Life Cycle Assessment of Pavement (eLCAP), a web application tool for project-level LCA

What Caltrans is Doing

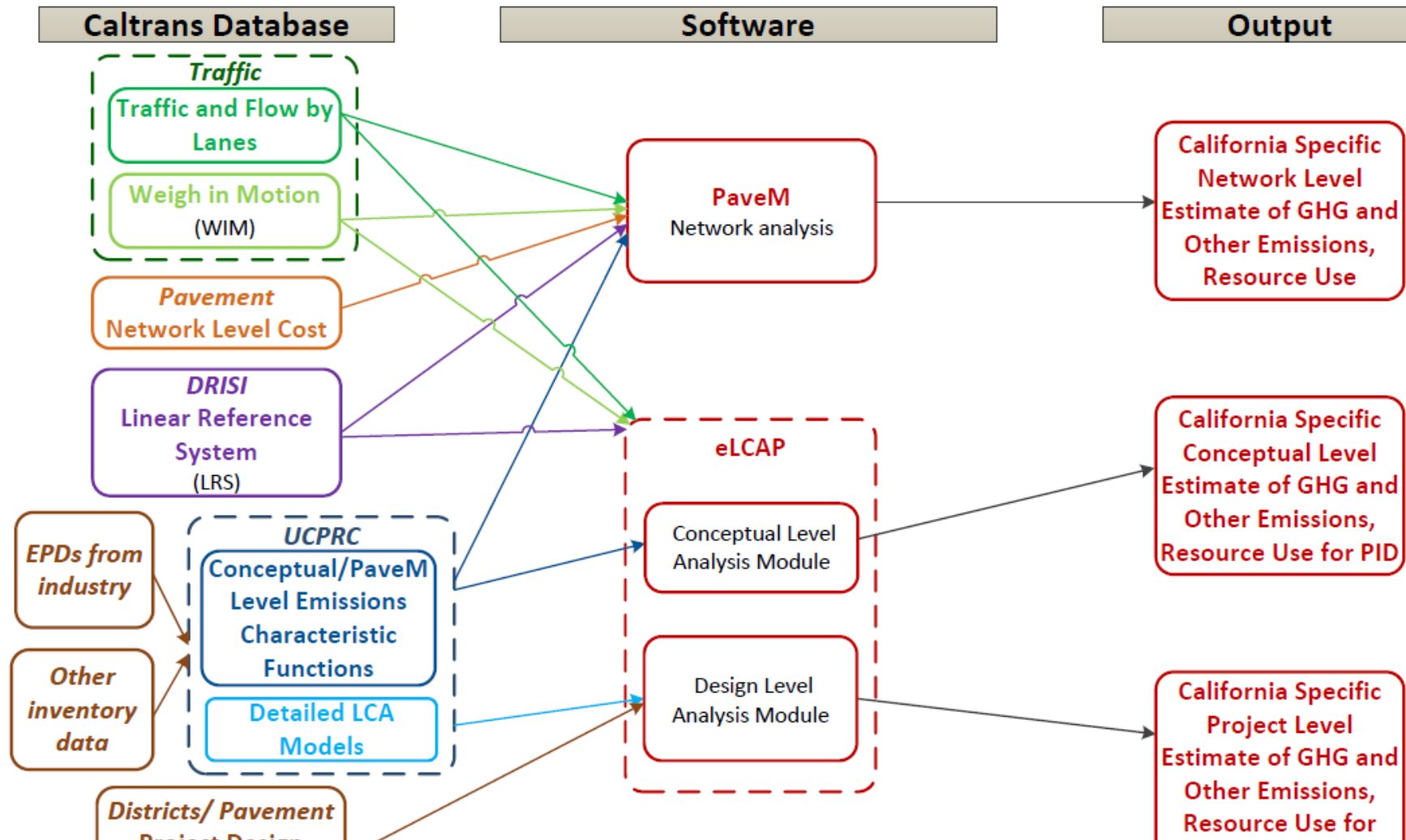
- ▶ Taking initiative to implement Environmental Life Cycle Assessment (LCA)
 - ▶ eLCAP and PaveM Model
- ▶ CA Assembly Bill 262 - The “Buy Clean California Act”
- ▶ SB 1’s Road Maintenance and Rehabilitation Program (RMRP) requires projects to consider Sustainability Provisions

Environmental Life Cycle Assessment of Pavement (eLCAP)

- ▶ A web-based software for project-level LCA
- ▶ Partnered with industry for their valuable input
- ▶ Uses California- and Caltrans-specific life cycle inventories (LCI) and processes
- ▶ LCI database has been critically reviewed by outside experts of pavement and LCA experts:
 - ▶ Arpad Horvath (UC Berkeley), Jeremy Gregory (MIT), Amlan Mukherjee (Mich Tech Univ)
- ▶ Models the life cycle history of a pavement project by allowing a user to specify any number of construction-type events, occurring at a user-specified date, followed by an automatically generated Use Stage event that begins immediately afterward and lasts until the next construction-type event or the End-of-Life (EOL) date
- ▶ The Use Stage models currently consider the effects of roughness in terms of International Roughness Index (IRI)
 - ▶ Structural response models are being prepared for future implementation
- ▶ Performs a formal mass-balancing procedure on a pavement LCA project model and then computes 18 different impact category values

eLCAP and Pavem

Functionality and Data Sources



Environmental Life Cycle Assessment of Pavement (eLCAP)

eLCAP™: environmental Life Cycle Assessment for Pavements Tool

Home Projects Input Analyze & Results Data Quality ? About [Save To PDF](#) [Save To File](#)

Useful Links

- [Caltrans](#)
- [UCPRC](#)

Login to Site

User Name

Password

or
[Forgot your Password?](#)

Please login to use eLCAP

Welcome

eLCAP is a web-based transport infrastructure life cycle assessment tool that has the capability to model the life cycle history of a pavement project by allowing a user to specify any number of construction events, occurring at a user-specified date, followed by an automatically generated Use Stage event that begins immediately afterward and lasts until the next construction event or the End-of-Life date.

eLCAP database library is developed based on the California specific extensive inventories of materials and mixes, construction equipment and activities, transportation modes, use stage impacts with consideration of pavement vehicle interaction and traffic congestion. The database is built in-house (UCPRC) to represent local conditions to the extent possible, by using California's electricity grid mix and fuels and following local practices in production, mix design, and construction.

eLCAP computes 18 different impact category values which include Primary Energy Demand used as Raw Materials (feedstock energy), Primary Energy Demand from Renewable and Non-renewable Resources (gross and net caloric value, separately), Primary Energy from Nonrenewable Resources (gross and net caloric value, separately), Primary Energy from Renewable Resources (gross and net caloric value, separately) and United States Environmental Protection Agency's Tool for Reduction and Assessment of Chemicals and Other Environmental Impacts (TRACI); Acidification, Ecotoxicity, Eutrophication, Global Warming Air (excluding and including biogenic carbon, separately), Human Health Particulate Air, Human toxicity (cancerous and non-cancerous, separately), Ozone Depletion Resources, Fossil fuels, and Smog Air.

eLCAP has two main built features:

- Specifically for Caltrans with built-in Caltrans databases (location, cross-section and traffic)
- For local agencies, researchers and academics

LCA models for various processes in **eLCAP** are available using the following button links.

Pavement Model	HMA Model	Bitumen Model	PCC Model	Portland Cement
Crushed Stone Model	Sand & Gravel Model	Electricity Model	Natural Gas (Equip) Model	Diesel (Equip) Model

A list of acronyms used throughout **eLCAP** is located in the online [help](#) system.

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CA Assembly Bill 262 - The “Buy Clean California Act”

- ▶ Mandated Facility-specified EPDs:
 - ▶ Carbon Steel Rebar
 - ▶ Structural Steel
 - ▶ Flat Glass
 - ▶ Mineral Wool Board Insulation
- ▶ Piloting of EPDs by Caltrans and industry since 2019
- ▶ Full implementation from June 1, 2022

Caltrans Additional EPD Initiative

- ▶ Initiate EPDs since 2019 for:
 - ▶ Concrete
 - ▶ Asphalt
 - ▶ Aggregates
- ▶ Report only at this time, baseline values have not been set for GHG
- ▶ Piloted for Data collection, Refine Methodology, and Outreach



Caltrans Planned Use of Type III Environmental Product Declarations (EPD)



Require EPDs to collect high-quality, regionally-acceptable, standardized data for environmental impacts to support better decision-making, create market incentives for improvement, and reduce GHG emissions and potential climate change impacts from projects



Scope
EPDS in a larger system of use of Life-Cycle Assessment (LCA)

Starting Points:

Policies and Directives:

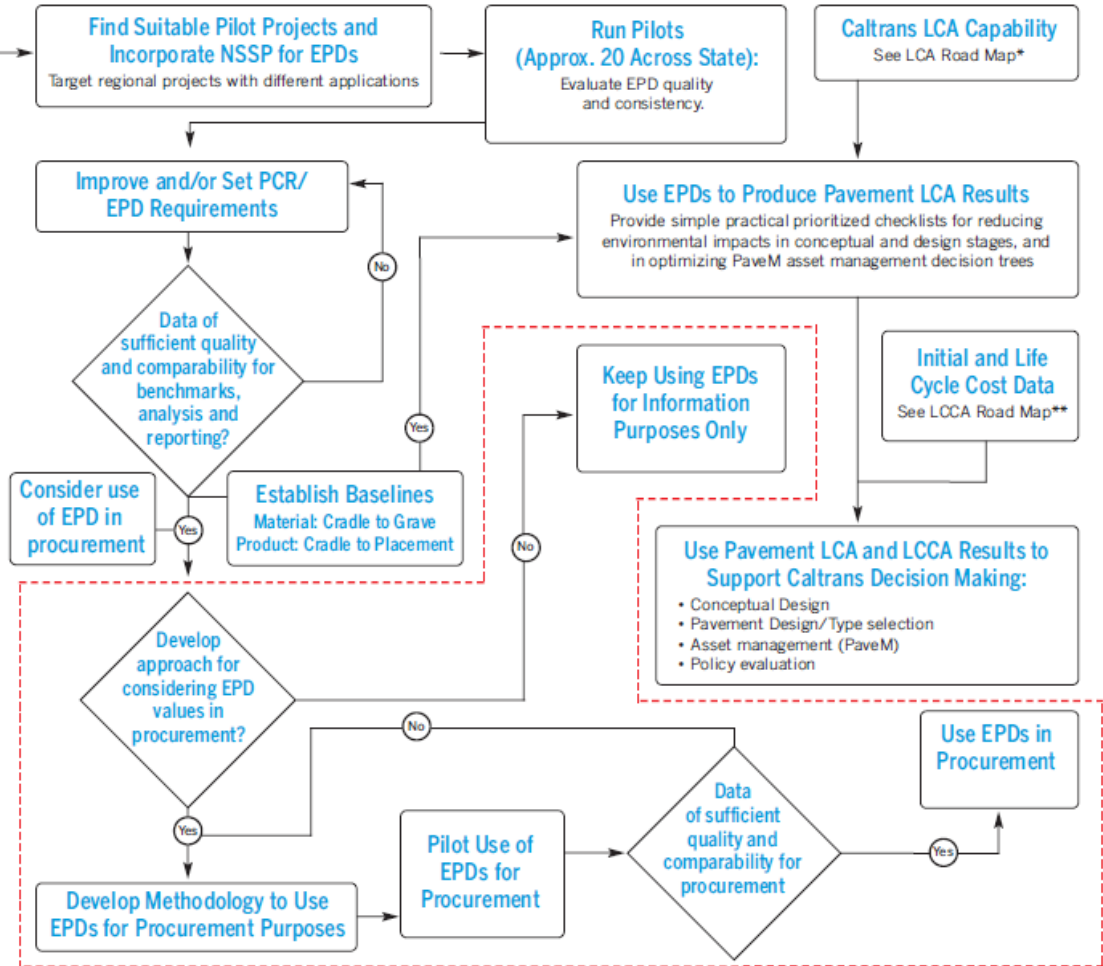
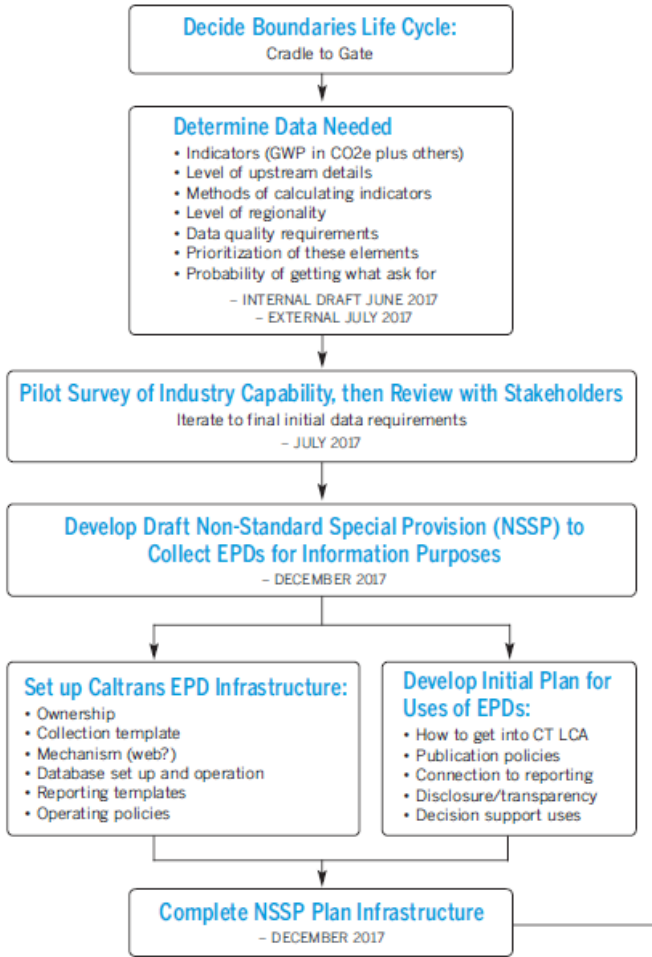
- Governor's Executive Order B-30-15
- California Transportation Plan 2040
- Strategic Management Plan, Goal 3 – Sustainability, Livability, Economy
- Director's Policy-30 Climate change
- Director's Policy-33 Sustainability

Initial Scope of Pavement Materials PCR/EPDs:

- Asphalt-bound paving materials
- Concrete and cement-bound paving materials
- Steel products used in pavement

References:

- ISO standard 14025
- Upcoming update to ISO standard 21930
- European standard EN 15804
- FHWA pavement LCA framework



For more information:

For information on past research projects, visit Caltrans www.dot.ca.gov/research/researchreports/index.htm and UCPRC www.ucprc.ucdavis.edu. For additional information on Caltrans Pavement Research Program, email Nick Burmas, Office Chief of Materials and Infrastructure, nick@burmas@dot.ca.gov.

* Life Cycle Assessment (LCA) Road Map (maybe include url)
 ** Life Cycle Cost Assessment (LCCA) Road Map (maybe include url)
 Pavement Research Roadmap, Caltrans Environmental Product Declaration, version date May 9, 2017

SB 1's Road Maintenance and Rehabilitation Program (RMRP)

- ▶ Mandate to Use New Technology and Materials Recycling Techniques for GHG emission reduction
- ▶ Promoting to use recycled materials
 - ▶ Recycled Asphalt Pavement (RAP)
 - ▶ Recycled Concrete Aggregate (RCA)
 - ▶ In-place recycling
 - ▶ Full-depth
 - ▶ Partial-depth

Partnering With Industry

- ▶ Pavement and Materials Partnering Committee (PMPC)
- ▶ Implemented Portland Lime Cement (PLC) with a maximum Limestone content of 15 % in Concrete Pavement and Bases
- ▶ Use of Returned Plastic Concrete in Minor Concrete
- ▶ Working on use of Recycled Concrete Aggregate (RCA) in Concrete Pavements

Thank You, Questions?