

Pavement

MAY 2026

Project Title: Partnered Pavement Research Center (PPRC) 23: Recycling

Task Number: 4205

Start Date: November 17, 2023

Completion Date: September 30, 2026

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

Continued Development of Guidance and Specifications for Cold Recycling

Enhancing cold recycling mix designs, materials, and pavement applications.

WHAT IS THE NEED?

The California Department of Transportation (Caltrans) uses various strategies and materials to maintain and rehabilitate pavements, addressing the diverse characteristics of its highway system. Interest in in-place pavement recycling methods like full-depth reclamation (FDR), cold central plant recycling (CCPR), and partial-depth reclamation (PDR) continues to grow in California and nationally. Since 2001, Caltrans has used FDR and is working to develop updated guidance on mix designs, pavement designs, specifications, and procedures for cold recycling. Revised specifications are needed to reflect new findings on material performance, construction practices, and emerging materials like rejuvenators and geosynthetics, supporting the goal of expanding cold recycling in pavement projects.

WHAT ARE WE DOING?

This study continues Caltrans' program of accelerated pavement testing (APT), lab testing, and field monitoring to improve cold recycling practices. Focus areas include:

- Literature reviews of recent national and international research.
- Long-term field monitoring of cold recycling projects.
- Lab and APT testing of material performance, structural improvements, and construction techniques.
- Developing procedures and specifications for specialized applications, including incorporating supplemental fines; using subgrade stabilization or geogrids with CCPR; recycling pavements containing Gaped-graded Rubberized Hot Mix Asphalt (RHMA-G) and geosynthetics; applying tack coats or spray pavers in PDR; using

rejuvenators to mobilize in-place binders; and refining mix designs and procedures for FDR with cement.

WHAT IS OUR GOAL?

To deliver updated cold recycling guidance, specifications, and test methods based on recent research, field observations, and lab testing. The project aims to optimize California's cold recycling practices by addressing material performance, constructability, and long-term pavement performance. Guidance will cover rejuvenator use and improved stabilization techniques.

WHAT IS THE BENEFIT?

Updated guidance will help Caltrans designers, contractors, and engineers select optimal pavement recycling strategies. It will promote cost-effective, durable pavements by extending service life and improving performance. Results will inform updates to standards, plans, specifications, and project selection criteria in Caltrans' pavement management system, supporting sustainable practices and innovative construction methods.

WHAT IS THE PROGRESS TO DATE?

The research team has made the following progress in each of the subtask:

- Monitored literature for latest published research
- Continued identifying Cold Recycled (CR) projects in Pavem that are considered to be performing poorly and selecting representative projects for forensic investigation. Completed visual assessments on previously constructed pilot studies including Gle-162 (supplemental aggregates [2021]), SB-135 (recycling train comparison, emulsified and foamed asphalt comparison [2021], supplemental fines [2024]), SBd-2 (recycling train comparison [2021]), Imp-78 (high RHMA-G content [2023]), and SBd-18 (CCPR, [2023]). Coring and falling weight deflectometer (FWD) testing on these sections is

being scheduled. Started preparing Tech Memo on pilot study monitoring. Completed initial cost and environmental analysis comparisons of cold recycling and other strategies using field testing, Pavement Management System (PMS), California Mechanistic-Empirical Design (CalME), Life-Cycle Cost Assessment (RealCost-CA), and Environmental Life-Cycle Assessment (eLCAP).

- Completed testing and analyses for the supplemental fines study. Continued interim report on using supplemental fines on projects with 100% Recycled Asphalt Pavement (RAP) recycling. Started Heavy Vehicle Simulator (HVS) testing on first supplemental fines test.
- Continued laboratory testing on materials sampled during test track construction. Continued CalME analyses of inverted pavement options using Full-Depth Reclamation with Cement (FDR-C) and CCPR in combination. Continued HVS testing on inverted pavement CCPR- Foamed Asphalt (FA) section.
- Continued laboratory testing of additional RHMA-G samples with various gradation modifications. Continued report on cold recycling of high RHMA-G content projects.
- Continued literature review specific to rejuvenation of old asphalt during cold recycling and met with potential rejuvenator developers. Obtained data from a county road experiment in Iowa.
- Continued post-construction FWD testing and instrument monitoring on test track to assess stiffness change over time. Continued laboratory testing on materials sampled during test track construction to assess shrinkage properties and impacts of delayed compaction on strength, stiffness, and pavement life. Continues preparation of test sections for HVS testing.
- Published CCPR material stockpiling report. Submitted cold recycling guideline to Caltrans for review. Continued technical memorandum on cost and environmental analysis comparisons. Continued test track construction



report. Continued supplemental fines report.
Continued high RHMA-G content report.