



Caltrans Division of Research,  
Innovation and System Information

# Research



# Results

Pavement

## JANUARY 2016

**Project Title:**

Recycling of Rubberized Hot Mix Asphalt in Reclaimed Asphalt Pavement and Full-Depth Reclamation Projects and with Warm Mix Technologies

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## Recycling Strategies for Rubberized Hot Mix Asphalt

New guidelines help determine when to use partial- or full-depth reclamation techniques for pavements

### WHAT IS THE NEED?

Caltrans has used full-depth reclamation (FDR), which recycles the pavement surfacing and base materials, as a rehabilitation strategy since 2001. Recycling only the upper layers of the surfacing—partial-depth reclamation (PDR) and cold in-place recycling—has been used on a limited scale as of 2009. However, comparative studies between the recycling strategies do not exist. Long-term field performance of FDR-asphalt emulsion and FDR-portland cement or any type of PDR projects have not been documented. Nor have the different types of PDR construction procedures been compared. More information is also needed regarding the influence of recycled rubberized asphalt on FDR or PDR performance. Engineers need comprehensive guidelines to determine which technique to choose for a particular project and the most appropriate stabilizer.

### WHAT WAS OUR GOAL?

The goal was to develop project selection and mechanistic-empirical (ME) design guidelines describing the differences between PDR and FDR and when to use each technique.

### WHAT DID WE DO?

Caltrans, in partnership with the University of California Pavement Research Center at Davis, constructed a test track to compare FDR with no stabilization and with cement, foamed asphalt, and asphalt emulsion stabilization. The researchers performed initial laboratory testing to refine the mix-design procedures and identify suitable criteria for ME design procedures and performance models. The first phase of the study, consisting of dry condition tests, was completed. The second phase of testing under wet conditions is in progress and will be completed in Task 2707.



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## WHAT WAS THE OUTCOME?

The first phase of testing under dry conditions showed the following:

- FDR can be an appropriate rehabilitation alternative to mill and overlay. All in-place materials are reused. Consequently, no old materials need to be trucked out, and only the new asphalt surfacing is trucked in. No detours are required, and traffic disruption is minimal.
- Using FDR with no stabilizer is appropriate only for low-volume roads.
- FDR with foamed asphalt and FDR with cement provide similar performance, and both are appropriate for high traffic volumes. Projects can be opened to traffic on the same day as construction.
- FDR with an asphalt emulsion has potential, but has limited use in pavements with relatively high in situ moisture contents and on projects that need to be opened to traffic on the same day as construction.
- Preliminary mechanistic analyses indicate that FDR with an appropriate stabilizer is a cost-effective rehabilitation strategy.

The results from the two phases will be used to finalize the guidelines and CalME design parameters and revise mix design and construction specifications if considered necessary.

## WHAT IS THE BENEFIT?

Having comprehensive guidelines on reclamation techniques supports sustainable pavement rehabilitation and maintenance. FDR can be a cost-effective alternative to traditional mill and overlay or base reconstruction. All in-place materials are reused, and roads can often be reopened to traffic on the same day as construction, minimizing disruption and congestion.

## LEARN MORE

To view the complete report:  
[www.ucprc.ucdavis.edu/PDF/UCPRC-RR-2014-03.pdf](http://www.ucprc.ucdavis.edu/PDF/UCPRC-RR-2014-03.pdf)

## IMAGES



Figure 1: FDR with cement on a test track at UC Davis