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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

Research Notes

PPRC 20 REC-A: Improved Guidance and Specifications for Full-Depth Reclamation 4.78

Caltrans currently has a cold in-place asphalt recycling program that uses large machines to remove 3 to 6 inches of roadway surface and grind up the asphalt while mixing it with a foamed binding agent made of bitumen, a leftover sludge from oil refining. With this traditional technique, the recycled material used only is durable enough to serve as the roadway base. Trucks need to deliver hot-mix asphalt from an offsite production plant and place a final layer over the base.

Pavement

NOVEMBER 2023

Project Title:
Updated Guidance and specifications for in-Place Recycling

Task Number: 3817

Start Date: June 30, 2022

Completion Date: September 30, 2023

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WHAT IS THE NEED?

This project is a continuation of a study to develop project selection and design guidelines and specifications for different full-depth reclamation (FDR) strategies. This phase of the project will assess performance of different asphalt emulsion strategies with and without active fillers, as well as promising new stabilization strategies in a series of laboratory tests. Project design guidance with special focus on in-situ moisture content, optimal mixing and compaction moisture contents, and implications for early opening to traffic will be developed. This phase will also continues long-term monitoring of field performance on projects constructed in the 2014-2017 contract as well as new FDR projects. This is a continuation of research task ID# 2707.

WHAT ARE WE DOING?

- Mechanistic-empirical parameters for in-place recycling (IPR) projects need to be finalized.
- Consistent mix design procedures for all IPR strategies need to be developed and laboratory performance testing needs to be done to refine mechanistic-empirical design and performance modeling parameters. Mix design procedures should include raveling tests, given that recycled layers are exposed to traffic for up to 15 days before the asphalt surfacing is placed.
- Partial-depth recycling (PDR) and cold central plant recycling (CCPR) materials produced with only recycled asphalt pavement typically have coarse gradations, which leads to compacted layers having relatively high air-void contents. The use of supplemental fines to improve gradations needs to be investigated. Use of fines derived from forest waste biomass

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materials should also be considered.
- Time limits for stockpiling of CCPR materials need to be established.
- The effects on construction and performance of rubberized hot mix asphalt and fabrics in the recycled layer are not fully understood and need to be further evaluated.
- Current PDR construction techniques are not conducive to the application of tack coats between the recycled and underlying layers. Consequently, debonding of these two layers is often observed in cores removed from the pavement. Recent developments in spray pavers need to be assessed to see if this equipment can be effectively used in PDR applications to improve long-term performance.
- The long-term performance of deep-lift full-depth recycling (FDR-C) projects has not been quantified. Although this strategy is being used on city and county roads with reported success, to date there are no published studies documenting longer-term performance on roads carrying traffic volumes typical of those on Caltrans roads where FDR-C may be considered. Concerns regarding the compaction of thicker layers on weak/moist subgrades, the potential for cracking resulting from drying shrinkage and/or differential compaction over the thickness of the layer, and the applicability of shrinkage crack mitigation of these thicker layers need to be investigated.

WHAT IS OUR GOAL?

Prepare a revised full-depth reclamation design guide.

WHAT IS THE BENEFIT?

Some of the benefits associated with pavement recycling include less user delay for the traveling public, contributes to conservation of energy, provides a source for the preservation of environment, shows reduced cost of construction, provides conservation of aggregate still in the ground which hasn't been mined yet, and preservation of existing pavement geometrics.

WHAT IS THE PROGRESS TO DATE?

Completed a site investigation for an FDR-C pilot project on Mer-165. The site investigation report was submitted. Completed HVS testing on the CCPR test sections. Continued preparation of first-level analysis report. Continued laboratory testing on method standardization, specification strength limits, MDD, raveling resistance, and supplemental fines sub-tasks. Continued dynamic modulus and four beam fatigue tests on specimens cut from the test track to assess changes in material properties/stiffness over time. Started monotonic testing to measure friction angle and cohesion on CCPR materials to better understand mechanistic properties. Continued preparation of laboratory testing reports. Continued preparations for shrinkage testing of FDR-C mixes. Waiting for installation of the new environmental chamber before testing can begin. Continued to liaise with industry to identify deep-lift FDR-C projects that can be monitored (no projects were identified in this quarter). Continued calibration of and improvements to CalME cold recycling models. Continued preparation of reports on completed laboratory and field testing. Continued routine maintenance on HVS-2 and HVS-3.
The deliverables for next quarter are as follows:
- Continue monitoring of long-term sections according to workplan.
- Continues HVS testing according to workplan. Continue preparation of HVS testing report.
- Continue laboratory testing according to workplan.
- Continue working with industry to identify potential deep-lift FDR-C projects that can be evaluated. Continue laboratory testing according to workplan.
- Continue preparation of Phase 3 laboratory testing reports.
- Continue HVS maintenance and repairs as required.