DRISI
Caltrans Division of Research, Innovation and System Information

Research Results

Microcracking for Cement Stabilized Layers: Phase 1 Lab Testing & Modeling

A literature review was conducted along with preliminary laboratory testing to understand crack mitigation mechanisms and identify criteria for modeling the effects of crack mitigation on long-term

Pavement

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Project Title:
Microcracking for Cement Stabilized Layers: Phase 1 Lab Testing & Modeling

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WHAT IS THE NEED?

The California Department of Transportation (Caltrans) has been using full-depth reclamation (FDR) as a rehabilitation strategy since 2001. Most projects to date have used a combination of foamed asphalt and portland cement as the stabilizing agent. Recently, Caltrans has become interested in developing additional strategies such as the use of portland cement, alone, as an alternative stabilizing agent, where appropriate. However, shrinkage cracking associated with the hydration and curing of the cement-stabilized layers remains a concern, especially with regard to crack reflection through asphalt concrete surfacings and the related problems caused by water ingress.

WHAT WAS OUR GOAL?

The objective of this project is to develop guidelines for mitigation measures to limit/prevent shrinkage cracking in cement-stabilized layers. This phase of the study determined what techniques have been tried and what other factors may influence crack development.

WHAT DID WE DO?

Phase 1: Literature review, laboratory testing, field project evaluations, and modeling.

1. A literature review on research related to crack mitigation in cement-treated materials.
2. Preliminary laboratory testing to understand crack mitigation mechanisms and identify criteria for modeling the effects of crack mitigation on long-term pavement performance.
3. Field evaluation of FDR projects to assess the effectiveness of crack mitigation strategies

4. Modeling of the effects of crack mitigation on long-term pavement performance.
5. A summary report with recommendations for Phase 2 testing if appropriate.

WHAT WAS THE OUTCOME?

The literature review indicated that additional research is necessary to better understand the microcracking mechanism, and to identify the key factors influencing performance. These include, but are not limited to aggregate properties, cement content, the time period before microcracking starts, layer moisture contents, roller weights and vibration settings, the number of roller passes, and the field test methods and criteria to assess the degree of microcracking. In addition the effects of early opening to traffic may be important. Early research into the use of "hybrid" stabilizers (cement with small amounts of asphalt emulsion, foamed asphalt, or synthetic polymer emulsions) indicates that these, in conjunction with appropriate mix designs, may further limit the severity of shrinkage cracks on projects that include cement-treated layers.

Field project evaluations indicated that there is broad interpretation of the current Caltrans specifications with regard to both construction procedures and microcracking. Because of the many factors that can influence the microcracking mechanism it was recommended to build a microcracking test road for phase 2 in order to identify the important factors that affect the microcracking.

WHAT IS THE BENEFIT?

The phase 1 research identified a number of factors that can influence the development of shrinkage cracks and how microcracking can be used to mitigate them. Building the test road will help determine the key factors that need to be considered in improving the microcracking specification that will prevent development of severe shrinkage cracks.

LEARN MORE

Full report:
http://www.ucprc.ucdavis.edu/PDF/UCPRC-TM-2015-02.pdf

IMAGES

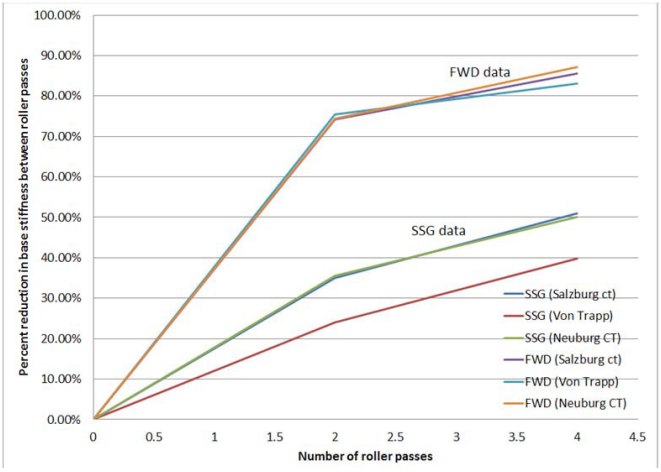

Image 1: Measured stiffness reduction with FWD and SSG during microcracking

Image 2: Light weight deflectometer

Image 3: Soil stiffness gauge