DRISI
Caltrans Division of Research, Innovation and System Information

Research Results

Bonded Concrete Overlays on Asphalt

Develop recommendations and guidance on the use of thin BCOA as a rehabilitation alternative in California

Pavement

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Bonded Concrete Overlays on Asphalt

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WHAT IS THE NEED?

The California Department of Transportation (Caltrans) is interested in developing thin Bonded Concrete Overlays on Asphalt (BCOA) as a potential rehabilitation alternative for asphalt pavement. BCOA is defined here in as jointed plain concrete overlays placed on asphalt pavement with slab thicknesses between 0.33 and 0.58 ft (100 to 175 mm) with slabs that are half of a standard 12 ft (3.7 m) lane-width wide. The slabs are intended to function as bonded concrete overlays, with the concrete bonding to the underlying asphalt layers so that they behave as a monolithic layer.

WHAT WAS OUR GOAL?

The primary goal is to develop recommendations and guidance on the use of thin BCOA as a rehabilitation alternative in California

WHAT DID WE DO?

Fifteen bonded concrete overlay of asphalt (BCOA) sections were built at the UCPRC facility in Davis, California, from February 23 to 25, 2016. Eleven of the sections were tested with the Heavy Vehicle Simulator (HVS). In six of the fifteen sections, the response of the concrete slabs to environmental actions and cement hydration was monitored for 15 months. Additionally, an extensive laboratory testing was conducted, focused on the concrete and in the concrete-asphalt interphase.

WHAT WAS THE OUTCOME?

- The minimum flexural strength requirement was fulfilled by all mixes at the design opening time, with the exception of the Type III cement concrete which took slightly longer.
- All the portland cement–based mixes far exceeded the Caltrans 10-day flexural strength requirement, the calcium sulfoaluminate (CSA)-based concrete placed the first construction day was slightly below.
- The replacement of 50 percent of the sand of the Type II/V cement mix with pre-wetted lightweight aggregates had a decrease in flexural strength.
- The interface between concrete and new asphalt was as strong as the new asphalt itself.
- Surface texturing (milling or micromilling) did not improve concrete-asphalt bonding.
- Water had a major negative effect on bonding. Such negative effect was mainly dependent on the asphalt mix.
- Very high levels of moisture-related shrinkage were measured in all the portland cement mixes treated with curing compound. The topical use of a shrinkage-reducing admixture (SRA) reduced the shrinkage by 27 percent in certain cements.
- The peak value of differential drying shrinkage in the section with CSA cement was 53 percent lower than in the section with Type II portland cement.
- No cracking took place in any section during the standard HVS testing.
- Performance of the 6x6 sections was much better than performance of the 12x12 sections, in terms of load transfer efficiency (LTE) and in terms of slabs permanent deformation (settlement, rocking, etc.).
- LTE in the 12x12 sections showed clear weather (shrinkage) dependence and decreased during the HVS testing.
- Delamination between concrete and asphalt happened in the 12x12 sections because of the environmental effects and the cement hydration process. It happened before HVS loading was applied on the sections.
- LTE performance was excellent in most 6x6 sections. The exceptions were in the 2 inch asphalt thickness and the milled section.
- LTE performance was particularly good in the 6x6 sections on top of the new rubberized mix.

WHAT IS THE BENEFIT?

The research will lead to guidelines on appropriate applications, mix designs, asphalt pavement preparation and projected maintenance requirements for BCOA. After pilots are built and evaluated pavement engineers will have another tool for rehabilitation of older asphalt pavements.

LEARN MORE

http://www.ucprc.ucdavis.edu/PDF/UCPRC-TM-2015-01.pdf

IMAGES