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Poster Presentation
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Effect of Matched and Mismatched Joints on Airfield Unbonded Concrete Overlay Performance

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The Innovative Pavement Research Foundation (IPRF) has an objective of improving the current design methodology and understanding of the influence of design parameters for airfield unbonded concrete overlays. The prime contractor has been Quality Engineering Solutions Inc. (QES); the Baseline Experiment was initiated in September 2005 and the SCI Validation Study began in 2007. All testing has been conducted in the FAA's National Airfield Pavement Test Facility. While there are many important parameters for unbonded concrete overlay design, this portion of the study is focused on one parameter--whether the joint should be matched or mismatched according to the data collected from Baseline and SCI Validation experiments.

The objective of this poster is to identify the effect of matched and mismatched joints on the performance of airfield unbonded concrete overlays through analysis of the distress patterns and HWD (heavy weight deflectometer) data collected from both the Baseline and SCI Validation experiments. The effect of joint types on airfield unbonded concrete overlay is first compared via intact slab life, basin area, load transfer efficiency and normalized D0, separately. Then a regression model is used to examine whether or not the behavior of airfield unbonded concrete overlays is influenced by the joint type.

A. Intact Slab Life – Number of passes prior to the first crack normalized to Normalized number of passes prior to SCI = 80; SCI = Structural Condition Index

When the PCC underlay is intact, there is no statistical evidence showing that matched joints and mismatched joints have different effects on the intact slab life. When the PCC underlay is damaged, which is a more typical condition for application of unbonded concrete overlays, slabs with mismatched joints demonstrated significantly extended intact slab life, as compared to that of slabs with matched joints, only among the first two test items.

B. Basin Area – Area of the HWD deflection basin computed with four sensors

The basin areas of intact underlay test items are smaller than those for test items with damaged underlays, and decreases with increase of thickness and SCI value of underlay. Unbonded concrete overlays with matched joints generally have better structural capacity than those with mismatched joints (smaller basin areas).

C. Normalized (37250lbf) D0 and Load Transfer Efficiency

Load transfer efficiency is proportional to the thickness of PCC overlay; the thicker the PCC overlay, the higher the load transfer efficiency. Normalized D0 increases after the PCC underlay is damaged. There is no significant improvement in load transfer efficiency with mismatched joint.

D. Selection of Regression Model

Intact Slab Life (pass) = 438837 - 8412 D0 - 13400 EH ratio - 3244 LTE

Although different joint types somewhat affect the mechanical behavior of airfield unbonded concrete overlay, the regression model indicates that the number of passes prior to the first crack is affected more by other structure parameters such as D0, EH ratio and LTE than joint type in this study.