KANSAS DEPARTMENT OF TRANSPORTATION

ACCELERATED TESTING FOR STUDYING PAVEMENT DESIGN AND PERFORMANCE (FY 2004): THIN BONDED RIGID OVERLAY ON PCCP AND HMA (CISL EXPERIMENT NO. 13)

RESEARCH

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Introduction

The thirteenth full-scale Accelerated Pavement Test (APT) experiment at the Civil Infrastructure Laboratory (CISL) of Kansas State University aimed to determine the response and the failure mode of thin concrete overlays.

Project Objective

The purpose of this project was to continue the study of Accelerated Pavement Testing to determine the response and failure mode of thin concrete overlays.

Project Description

Four pavement structures were built and tested in this experiment: two Thin Concrete Overlays (TCO) pavements, with 4-inch and 6-inch thick overlays constructed on a 5-inch thick PCCP and two Thin Whitetopping (TWT) pavements, with 4-inch and 6-inch thick PCC overlays constructed on a 5-inch hot-mix asphalt layer.

The pavements were instrumented to measure the strains at selected locations in each PCC overlay. Each of the four pavements was loaded with approximately two million passes of the CISL APT machine, under in-door ambient temperature condition. No moisture was added to the pavements. Response measurements and performance evaluations were performed at about every 100,000 passes.

Project Results

The TCO overlays failed due to the loss of support underneath the concrete slab which caused transverse cracks to develop in both 4 and 6-inch PCC overlays. No loss of bond between the PCC overlay and the supporting slab was observed. The 4-inch TWT exhibited a transverse crack at the middle of the slab, while the 6-inch TWT exhibited no cracks at the end of testing.

The theoretical strains in the concrete overlays at the locations where instrumentation was installed were computed with the ANSYS Finite Element Method (FEM) software. It was found that the magnitude and shape of computed strains matched well with those of the strains measured before any APT loads were applied. It was, therefore, concluded that the three-dimensional finite element model built and the assumption made (linear elastic materials, fully bonded overlays) can accurately estimate the response of TWT and TCO pavements under wheel loading. In addition, the FEM can be used to estimate the evolution of lineal extent of the loss of support under the joints by comparing the measured strains with the corresponding computed strains.

Report Information

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