PILOT INSTRUMENTATION OF A SUPERPAVE TEST SECTION AT THE KANSAS ACCELERATED TESTING LABORATORY

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RESEARCH

Introduction

Performance evaluation of a pavement structure incorporating the new Superpave volumetric asphalt concrete mixture design method implemented by the Kansas Department of Transportation is necessary to determine the critical stress/strain and the rutting and fatigue performance. Under accelerated load testing this new pavement design can be tested with controlled traffic loadings that can accumulate faster than the anticipated growth of traffic or changes in vehicle technology. Non-traffic load parameters such as material and environmental variation can also be controlled to reduce variability in the experiment.

Project Objective

The objective of this study was to instrument two test sections of Superpave asphalt mixtures with varying percentages of river sand to measure tensile strain at the bottom of the asphalt, vertical compressive stress at the top of the subgrade and temperature at four depths. This data was correlated with the amount of fatigue damage, rutting performance and the mix composition.

Project Description

Test sections were constructed at the Kansas Accelerated Testing Laboratory (K-ATL) with two Superpave mixtures (SM-2A) with different sand percentages. A 150 Kn (34 kip) tandem axle was used for 10,000 repetitions before six different tandem and single axle loads were applied for more than 30 repetitions each. The test sections were each instrumented at three locations with transverse strain gages, pressure cells, and temperature gages. Data was collected during load applications by the K-ATL tandem axle and a Falling Weight Deflectometer (FWD). The theoretical pavement responses were also calculated and compared to the test results. Fatigue tests were conducted on beams fabricated in the laboratory and on beams sawed from the test section. Rutting damage analyses were also conducted on the beams from the test section.

Project Results

Testing was terminated when severe rutting was observed on both test sections after 80,000 repetitions. The measured vertical stresses on the top of the subgrade and tensile strains at the bottom of the SM-2A layer due to FWD loads are generally very close to those calculated by a multi-layer elastic analysis program, ELSYM5. However, measured tensile strains and vertical stresses on both sections were higher than those calculated by ELSYM5. In general, the measured tensile strains under the K-ATL wheel loads were found to increase with increasing number of wheel load repetitions, but the measured vertical stresses remained relatively constant. The rutting and fatigue results were consistent with observed and predicted damage. The AASHTO load equivalency factors were found to be much higher than those calculated in this study. Temperature variation along the depth of Superpave pavements and pavement deterioration based on International Roughness Index values were analyzed and reported.

Report Information

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