

ODOT LEADS NATIONAL POOLED-FUND EFFORT ON THE STRUCTURAL PERFORMANCE OF ASPHALT AND CONCRETE PAVEMENTS

For the past several years, ODOT, FHWA, and a team of universities in Ohio have been monitoring a variety of environmental, performance and response parameters on 40 sections of experimental pavement constructed for the Strategic Highway Research Program (SHRP) on US 23 north of Delaware in 1994-1996. The basic objective of this effort was to determine the effect of various structural parameters, including pavement thickness, lane width (PCC), base type and thickness, and the presence or absence of pavement underdrains on the service life of asphalt and concrete pavement. Environmental data being collected include: air temperature, precipitation, wind and solar radiation from a weather station located at the site; and soil moisture, pavement temperature and frost depth measured in 18 pavement sections. Performance data include: pavement roughness, skid resistance, rut depth, and visual condition ratings. Response data include: nondestructive testing with the Falling Weight Deflectometer (FWD) and Dynaflect trailer; and deflection, strain and pressure measured in 33 pavement structures as trucks passed over sensors mounted in the sections. Traffic loads are continuously being monitored with weigh-in-motion scales in each lane.

It is important to measure dynamic deflection, strain and pressure simultaneously under known environmental conditions as a pavement structure responds to the passage of moving vehicles. Essentially all currently used pavement models are based on deflection alone since deflection is the simplest response parameter to measure. While measured and theoretical deflections may agree quite well in a given model, the difference between actual and theoretical strain and pressure calculated with the same model may be profound. Hence, if a deflection-calibrated model is used to calculate strain and pressure as indicators of stress and service life and, if these calculations are in error, the estimations of stress and service life will also be in error. By being able to validate and calibrate models for deflection, strain and pressure, much greater confidence can be placed in the predicted result by analytical modeling.

The ODOT dump truck shown in Figure 1 was one of the three types of trucks used in the controlled tests on US 23. These trucks included single and tandem-axle dumps, and a special Canadian National Research Council tanker configured for tandem and tridem axles with adjustable spacing between the axles. The weight of each tire on the trucks was recorded prior to each series of tests, and the lateral offset distance from the sensors to the truck tires was recorded for each vehicle pass. During each truck pass, data acquisition systems continuously recorded the output of 30-40 deflection, strain and pressure sensors in each section at the rate of 250,000 data points per second. Figures 2, 3 and 4 show typical traces obtained from the three types of sensors during a single truck pass with calculations derived from one finite-element model.

Another benefit of the US 23 controlled tests is the measurement of response to actual moving trucks. Most deflection responses are obtained with nondestructive test devices such as the FWD or Dynaflect, both of which apply cyclic loads to simulate load waves generated by moving vehicles. Data from US 23 will allow the correlation of responses from nondestructive test devices with responses measured under moving trucks.

As the volume of data continues to grow for the Ohio SHRP Test Road and other test pavements around Ohio, FHWA and seven other states opted to combine their financial resources and join Ohio in utilizing these data to evaluate the structural performance of asphalt and concrete pavements. The other states include: California, Connecticut, Kansas, New York, North Carolina, Pennsylvania, and West Virginia. Michigan has also expressed some interest in participating in this national pooled-fund study. Of particular interest to the pooled-fund participants are dynamic deflection, strain and pressure responses measured by Ohio University on US 23 as trucks with various axle configurations traveled past sensors in 33 test sections at different weights, speeds, and lateral distances from the sensors; and during a range of environmental conditions. The labor intensiveness, technical complexity and expense associated with controlled vehicle testing on in-service pavements make these types of data extremely scarce in the literature.

A meeting of the pooled-fund participants was held in Kansas City, Kansas on February 28-March 1 of this year. The participating states were pleased with the study's progress and requested that the models being considered for calibration be currently available, have reasonable run times, be applicable to the new AASHTO 2002 Design Guide, and be non-proprietary, if possible. There may be one model set recommended for practitioners and one more complex model set recommended for researchers.

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