



# **The Ohio Department of Transportation Office of Research & Development Executive Summary Report**

## **Continued Monitoring of Instrumented Pavement in Ohio**

*Start Date:*  
September 3, 1996

*Duration:*  
60 Months

*Completion Date:*  
August 31, 2002

*Report Date:*  
December 2002

*State Job Number:*  
State Job No. 14652(0)

*Report Number:*  
FHWA/OH-2002/035

*Funding:*  
Ohio Department of Transportation  
Federal Highway Administration

*Principle Investigators:*  
Dr. Shad M. Sargand  
Associate Director, ORITE  
Russ Professor of Civil Engineering  
Ohio University

*ODOT Contacts:*  
*Technical:*  
Roger Green  
*Administrative:*  
Monique R. Evans, P.E.  
Administrator, R&D  
614-728-6048

*For copies of this final report go to  
<http://www.dot.state.oh.us/divplan/research>  
or call 614-644-8173.*

*Ohio Department of Transportation  
Office of Research & Development  
1980 West Broad Street  
Columbus, OH 43223*

### **Problem**

Beginning in 1992, Ohio University, under contract with the Ohio Department of Transportation and the Federal Highway Administration, undertook several research projects to measure the response of various highway pavement structures over a range of environmental and loading conditions. Much of these response data were collected from transducers placed in the pavement structures during construction. Information gathered from these projects was to be used to refine and improve pavement design and construction procedures in Ohio.

Many of the embedded sensors exceeded their expected useful life and survived beyond the installation contract, presenting an opportunity for additional follow-up monitoring. Also, final conclusions on performance were sometimes rather tentative due to a lack of early definitive distress patterns. To provide for the continued monitoring of several test pavements around Ohio, this project was initiated on September 3, 1996. The purpose of this project was to build upon the earlier work through extended monitoring and testing of these test pavements, integration of the old and new data for validation, and further implementation of earlier findings.

## Objectives

### DEL 23 (Ohio SHRP Test Road)

- Maintain sensors and data acquisition systems
- Install sensors in rehabilitated sections
- Periodically collect seasonal data
- Monitor pavement performance
- Assist with controlled vehicle tests
- Interpret NDT results

### Other Instrumented Sites:

**LOG 33 (Base types under AC Pvt.)**

**ERI/LOR 2 (Bases under PCC Pvt.)**

**JAC/GAL 35 (Dowel bars in PCC Pvt)**

**ATH 33 (Dowel bars in PCC Pvt.)**

- Monitor pavement distress
- Determine long term performance
- Interpret NDT results

## Overview

In recent years, selected pavements around Ohio were instrumented to monitor dynamic response over a range of loading and environmental conditions. These responses were used to evaluate the structural integrity of pavement structures and to assess the effectiveness of various design parameters on performance. As these initial efforts expired, it became apparent that additional information on long-term performance could be obtained with additional monitoring.

Response measurements included LVDT and strain gauge output to moving trucks, and the Falling Weight Deflectometer. Several sites also contained environmental sensors for periodically monitoring moisture and

temperature conditions within the pavement structures during the year and at the time of the response measurements. Many of the response and environmental sensors remained operational at the conclusion of the initial research efforts.

## Conclusions & Recommendations

Performance and environmental data continued to be monitored throughout this study on the Ohio SHRP Test Road. Response testing included three new series of controlled vehicle tests and two sets of nondestructive tests. Cracking in two SPS-2 sections with lean concrete base confirmed observations elsewhere that PCC pavement may not perform well when placed on rigid base.

Of the five types of base material used on LOG 33 and evaluated for their effect on AC pavement performance, deflection measurements on the asphalt treated base fluctuated most with changes in temperature. None of the other bases were sensitive to temperature. Cement treated base had the lowest deflection. On unbound material, bases containing large size stone gave the lowest deflection.

The preponderance of data collected in the laboratory and at the ERI/LOR 2 site suggests that PCC pavement performs poorly on 307 NJ and CTFD bases. All sections with 25-foot slabs, except those with ATFD base, and the section with 13-foot slabs on 307 NJ base had significant transverse cracking. The 13-foot long slabs with 307 NJ base also had some longitudinal cracking. Considering the relatively short time these pavement sections had been in service, this level of performance was considered unacceptable. The ATFD base appeared to be performing best.

On JAC/GAL 35, subgrade stiffness had a significant effect on dowel bar response. Looseness around dowel bars affected their ability to transfer load. Larger diameter and stiffer dowel bars provided better load transfer across PCC joints. The most effective dowel bar in these tests was the 1.5"

diameter steel bar. The performance of 1" steel dowel bars were similar to 1.5" fiberglass bars. One-inch diameter fiberglass dowel bars were not recommended for PCC pavement.

While undercutting PCC joint repairs initially reduced the forces in dowel bars, the effectiveness of the undercut diminished over time. Dowel bar forces were about the same in the Y and YU types of joint repairs after some time.