OHIO DEPARTMENT OF TRANSPORTATION
OFFICE OF PAVEMENT ENGINEERING
RESEARCH IMPLEMENTATION PLAN

Title: Continued Monitoring of Instrumented Pavement in Ohio

State Job Number: 14652
PID Number:
Research Agency: Ohio University
Researcher(s): Dr. Shad Sargand
Technical Liaison(s): Roger Green, Aric Morse
Research Manager: Karen Pannell
Sponsor(s): Howard Wood, David Humphrey
Study Start Date: 9/3/1996
Study Completion Date: 3/3/2003
Study Duration: 66 months
Study Cost: $1,113,534
Study Funding Type: 80 Federal / 20 State from ODOT SPR (2)

STATEMENT OF NEED:

Beginning in 1992, the Ohio Department of Transportation has sponsored 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 during construction. Information gathered from these projects will be used to refine and improve pavement design and construction procedures. Many of these embedded sensors have exceeded their expected useful life, presenting an opportunity for additional follow up monitoring.

RESEARCH 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, ERI/LOR-2, JAC/GAL-35, & ATH-33)

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

RESEARCH TASKS:

US 35 Joint Performance (Gallipolis)

- Monitor the performance of joint repairs incorporating steel and composite dowels by conducting visual distress surveys and nondestructive testing using the falling weight deflectometer.

US 33 Joint Performance (Athens)

- Monitor the performance of joints constructed with steel and composite, round and "I" shaped dowels by conducting visual distress surveys and nondestructive testing using the falling weight deflectometer.

ERI/LOR-2 Joint Spacing Study

- Monitor the performance of concrete pavement constructed with 21', 40', and 60' joint spacing.

LOG-33 Free Draining Base Study

- Monitor the performance of sections constructed on 304 dense graded aggregate base, type IA, type NJ, ATFDB, and CTFDB by conducting visual distress surveys.

The Ohio/SHRP Test Road

- Continue collection of dynamic load response and environmental data
- Maintain sensors and data acquisition system
- Evaluate back calculation software
- Determine depth to bedrock using the cone penetrometer test truck.

RESEARCH DELIVERABLES:

- Pavement sections on the Ohio SHRP Test Road were monitored as requested by FHWA. Data was forwarded to FHWA for entry into the national database.
- Technical Note, "Early SPS-1 Performance on the Ohio SHRP Test Road".
- Technical Note, "Subgrade Variability on the Ohio SHRP Test Road.
- Interim Report, "Evaluation of Initial Subgrade Variability on the Ohio SHRP Test Road".
- Interim Report, "Final Report on Forensic Study for Section 390101 of Ohio SHRP U.S. 23 Test Pavement"
- Interim Report, "Effectiveness of Base Type on Performance of PCC Pavement on ERI/LOR-2".
- Interim Report, "Petrographic Examination of Concrete Cores Taken from the Ohio Strategic Highway Research Program (SHRP) Specific Pavement Studies Test Road".
- Final report, "Continued Monitoring of Instrumented Pavement in Ohio".
- Four controlled vehicle tests.

RESEARCH RECOMMENDATIONS:

- Do not use stiff base materials, such as the Type NJ non-stabilized drainage base and the cement treated free draining base, under concrete pavement.
- Limit the diameter of fiberglass dowel bars to a minimum of 1 1/2 inch.
- I-beam shaped dowel bars are not recommended.
- Use stiff bases under asphalt pavement.

PROJECT PANEL COMMENTS:

Research findings included:

- On JAC/GAL 35, 1.5" diameter steel dowel bars provided the best load transfer followed by the 1.0" diameter steel bars and the 1.5" diameter fiberglass bars, which performed about the same. 1.0" fiberglass bars are not recommended on PCC pavement.

- On ATH 33, deflection was highest and load transfer was lowest on fiberglass I-beam dowel bars.1.5" diameter round steel dowel bars had the lowest deflection and highest load transfer. After 11 years, no distress is visible at any of the experimental PCC joints.

- From observations on ERI/LOR 2, 307NJ and CTFDB should be discontinued under concrete pavement.

- On AC pavement sections located on LOG 33, cement treated base and unbound materials containing larger aggregate had the lowest deflections.

- These pavements should continue to be monitored to further refine the findings to date.

IMPLEMENTATION STEPS & TIME FRAME:

- ODOT discontinued the use of free draining bases on March 23, 2001.

- Beginning with the 1997 Construction and Material Specifications, fiberglass dowels are permitted in Item 255, Full Depth Pavement Removal and Rigid Replacement. Specified dowel diameter is 1 ½ inch.

EXPECTED BENEFITS:

- Reducing variability will allow ODOT to produce more consistent pavement performance and will allow increasingly effective planning and forecasting. An almost certain byproduct of this increased planning effectiveness will be a more efficient allocation of available funding.

- Accurate load response, environmental, and climatic data was collected and reported to the FHWA/SHRP national database.

EXPECTED RISKS, OBSTACLES, & STRATEGIES TO OVERCOME THEM:

The specifications have not been changed to allow the use of composite dowels in new concrete pavement construction. There is not a cost effective method to mount dowel bars in dowel baskets. This is a problem the industry is trying to solve.

The use of composites will increase the cost of a dowel bar by 75% to 160%. Due to the higher cost, composite dowels are not being used for Item 255 work. The use of grout filled composite tubes, which lower cost but still maintain load transfer and corrosion resistance, is being investigated by others.

OTHER ODOT OFFICES AFFECTED BY THE CHANGE:

None

PROGRESS REPORTING & TIME FRAME:

N/A

TECHNOLOGY TRANSFER METHODS TO BE USED:

The Final Report of the research has been distributed to 49 state transportation departments, different FHWA offices, selected national libraries, and others.

IMPLEMENTATION COST & SOURCE OF FUNDING:

None

Approved By: (attached additional sheets if necessary)

Office Administrator(s):

Signature: David Humphrey Office: OPE Date: 2/10/2006

Division Deputy Director(s):

Signature: Howard Wood Division: Planning Date: 2/14/2006