Title: Three-Dimensional Modeling of Flexible Pavement

State Job Number: 14654
PID Number:
Research Agency: Ohio University
Researcher(s): Shad Sargand
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Study Start Date: 9/3/96
Study Completion Date: 9/3/98
Study Duration: 24 months
Study Cost: $30,000
Study Funding Type: 80% Federal/20% State

STATEMENT OF NEED:
The accuracy of mechanistic/empirical pavement performance prediction is dependent on many factors including; the material characterization input values, the degree to which the model accurately predicts response, and the accuracy of the transfer functions to empirically predict performance based on response. Many of the asphalt pavement analysis programs are based on linear elastic models. A linear viscoelastic models would be superior to linear elastic models for determining the response of asphalt concrete pavements to loads. There is a need to develop a user friendly viscoelastic based three dimensional finite element program for analysis of the data collected on the Ohio/SHRP test road.

RESEARCH OBJECTIVES:
Develop a user friendly three dimensional finite element program for analysis of flexible pavement systems which can run on ODOT computers.

RESEARCH TASKS:

- Develop computer code for a three dimensional viscoelastic model.
- Verify the program using data from the Ohio/SHRP test road

RESEARCH DELIVERABLES:

- Flexible pavement analysis software
- Final report

RESEARCH RECOMMENDATIONS:
Realistic problems required up to several days to complete on ordinary desktop computers. Specialized servers would need to be employed to solve useful problems in a few hours.

PROJECT PANEL COMMENTS:
While responses predicted for FWD and moving trucks appeared to be reasonable, the long processing time required to complete the modeling indicated the computer technology at the time was insufficient to
make use of this software practical for ODOT. Using internal funds, Ohio University has continued to update, verify and validate the software. Problems can now be completed on today’s ordinary desktop computers in a reasonable time.

**IMPLEMENTATION STEPS & TIME FRAME:**

Ohio University has agreed to provide copies of the current version of the software to ODOT for internal use. However, the primary use of software has been analysis of response data by Ohio University on ODOT, pooled fund, and FHWA funded projects.

**EXPECTED BENEFITS:**

Linear viscoelastic models can more accurately explain the response measured during truck load tests on instrumented pavements. More accurate predictions of pavement response will result in more precise prediction of pavement performance. The sheer magnitude of annual expenditures on pavements justifies the application of the best available analysis procedures to optimize the use of highway funds. Any improvements in this area will have significant and sizeable implications in reducing the cost of maintaining these pavements.

**EXPECTED RISKS, OBSTACLES, & STRATEGIES TO OVERCOME THEM:**

None

**OTHER ODOT OFFICES AFFECTED BY THE CHANGE:**

None

**PROGRESS REPORTING & TIME FRAME:**

Software has been implemented for analysis of US 23 response data, no further reporting is needed.

**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:**

N/A

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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