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RESEARCH PROJECT TITLE

Improving the Accuracy and Usability of Iowa Falling Weight Deflectometer Data

SPONSOR

Iowa Department of Transportation
Federal Highway Administration
(InTrans Project 11-419)

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Improving the Accuracy and Usability of Iowa Falling Weight Deflectometer Data

tech transfer summary

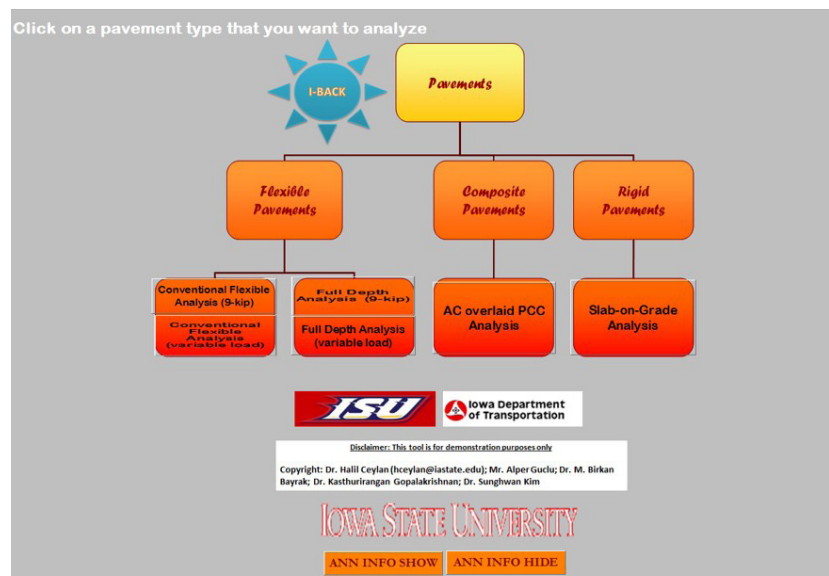
A high-quality, easy-to-use, backcalculation software package called Iowa Pavement Backcalculation (I-BACK) was developed to achieve the project goals.

Background

Highway agencies periodically evaluate the structural condition of roads as part of their routine maintenance and rehabilitation activities. The falling-weight deflectometer (FWD) test measures road surface deflections resulting from an applied impulse loading, simulative of a truck passing on the highway. The measured surface deflections are utilized to determine pavement layer stiffnesses through a backcalculation type structural analysis.

Although the Iowa Department of Transportation (DOT) has been collecting the FWD data on a regular basis, the pavement layer moduli backcalculation techniques used so far have been cumbersome and time consuming. More efficient and faster methods in FWD test data analysis were deemed necessary for routine analysis.

Previous Iowa DOT research projects focused on developing advanced pavement layer moduli backcalculation models using the artificial neural networks (ANN) methodology. The developed models were successfully validated using field data and incorporated into a Microsoft Excel spreadsheet-based backcalculation software toolbox with a user-friendly interface.



Iowa Backcalculation (I-BACK) software screen shot

Objectives

This study was undertaken with the objectives of improving the accuracy and usability of Iowa FWD data and the pavement inverse analysis tools. Based on the requirements by the technical advisory committee (TAC) members representing potential users of the developed backcalculation software system at the Iowa DOT, significant enhancements were incorporated into the fully-automated software system for rapid processing of the FWD data.

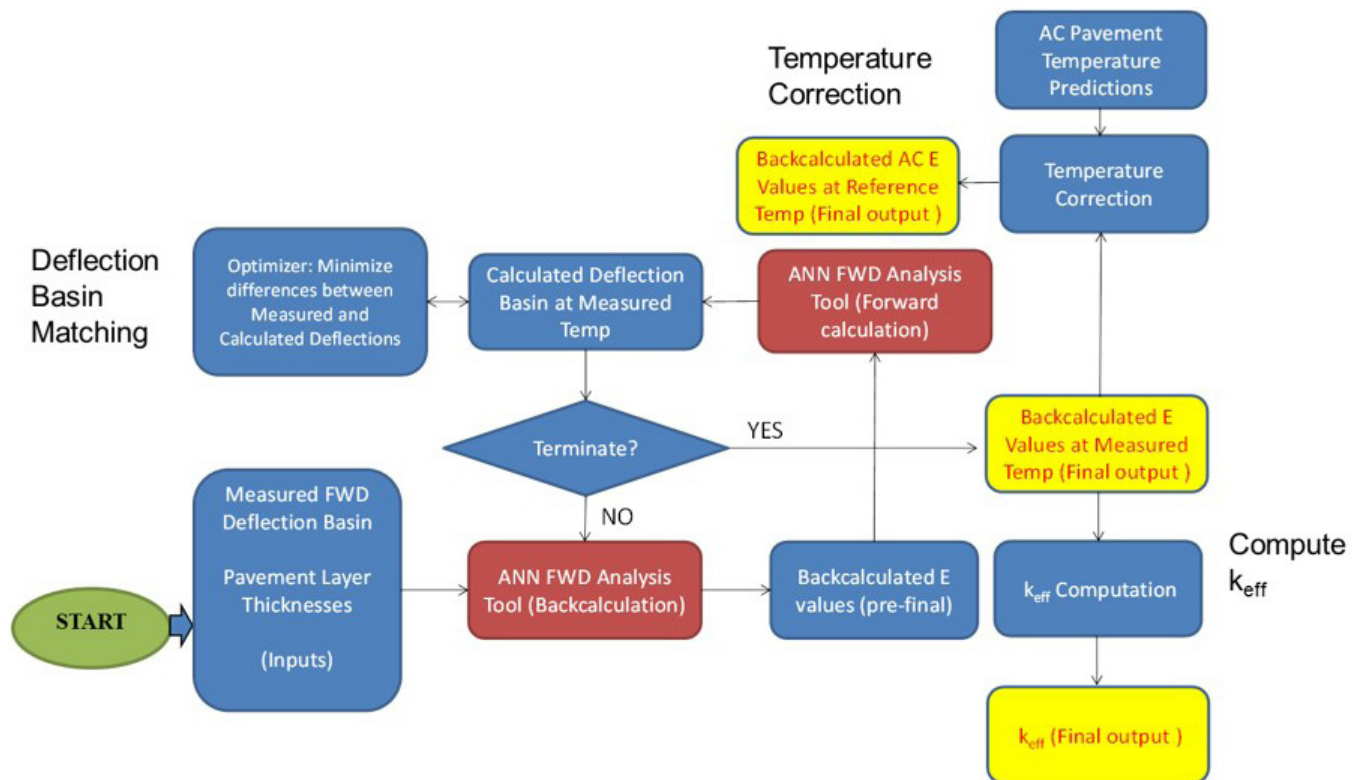
These enhancements include the following:

- Refined prediction of pavement layer modulus through deflection basin matching/optimization
- Temperature correction of HMA layer modulus
- Computation of 1993 AASHTO design guide-based effective structural number and effective k-value
- Computation of Iowa DOT asphalt concrete (AC) overlay design-based structural rating (SR) and k-value
- Enhancement of user-friendliness of input and output from the software tool

Implementation Readiness and Benefits

A high-quality, easy-to-use, backcalculation software package called Iowa Pavement Backcalculation (I-BACK) software was developed to achieve the project goals and yielded the following highlighted benefits:

- Provides more-fine-tuned ANN pavement backcalculation results by implementation of deflection matching optimizer for conventional flexible, full-depth, rigid, and composite pavements
- Provides temperature normalized/corrected hot-mix asphalt (HMA) layer modulus at a standard reference temperature for conventional flexible, full-depth and composite pavements
- Provides effective S_{Neff} and the effective k-value as final outputs for pavement/asset management purposes
- Provides SR and k-value as final outputs to make FWD deflection measurements suitable for use in the existing Iowa DOT AC overlay design procedure
- Produces separate smaller-sized output files from backcalculation analysis



I-BACK composite pavement analysis flow sequence