IMPLEMENTATION SUPPORT FOR AASHTO 2002 PAVEMENT DESIGN GUIDE IN FLORIDA

BACKGROUND

National Cooperative Highway Research Program (NCHRP) Project 1-37A delivered the *Mechanistic-Empirical Pavement Design Guide* (M-E PDG) and its companion software (Version 0.7) in 2004. This design method considers site conditions (traffic, climate, subgrade, existing pavement condition for rehabilitation) and construction conditions in proposing a trial design for new pavement construction or rehabilitation. For an engineer to design a specific pavement using this program, he or she needs to assume an initial structure and run the program repetitively until a pavement design is identified that satisfies the performance criteria for the given problem. From this perspective, many practitioners have remarked that the program is more like an analytical tool for predicting pavement performance. The performance models in the new program were also developed and calibrated based on a national database of field pavement performance data. For states seeking to implement the M-E PDG, the developers of the design guide have recommended that the models be calibrated to local conditions. Given these considerations, and recognizing that further changes to the design guide will come about from on-going national research projects, the decision was made to conduct a staged implementation of the M-E PDG program in Florida. This report documents the initial steps taken to implement an M-E PDG-based design procedure within the Florida Department of Transportation (FDOT).

OBJECTIVES

The primary objectives of this project are to:

- provide a database for verifying and calibrating, as necessary, the performance models in the existing M-E PDG program; and
- establish a conceptual framework for developing a new Florida pavement design method based on the M-E PDG.

To accomplish these objectives, the researchers, with assistance from FDOT, conducted the following tasks:

- examination of Florida's pavement condition survey database to identify in-service pavement sections for model calibrations;
- sensitivity analyses to identify critical factors affecting predicted pavement performance from the M-E PDG program;
- characterization of climatic-soil variations across Florida;
- field and laboratory tests to characterize material properties of in-service pavement sections for model calibration;
- compilation of database for model calibration; and
- development of conceptual framework for establishing an M-E PDG-based pavement design guide for the Florida DOT.

FINDINGS AND CONCLUSIONS

Based on the research conducted, the following findings are noted:

- From the review of M-E PDG input requirements and sensitivity analyses, researchers identified the laboratory and field tests needed to characterize material properties for calibrating the performance models in the design guide program. The test program conducted during this project characterized design factors that were found to significantly affect predicted pavement performance from the M-E PDG program. These factors include mixture properties that determine the dynamic modulus of the asphalt concrete material, and properties of the underlying unbound layers in flexible pavements that include the resilient moduli of the base, subgrade, and embankment materials, and the soil-water characteristic curve.
- For jointed plain concrete pavements, the sensitivity analyses identified the concrete thermal coefficient of expansion and compressive strength as significant predictors of rigid pavement performance. In addition, joint spacing and dowel diameter were found to significantly affect the performance predictions from the M-E PDG program. However, the moduli of the underlying unbound materials as well as the modulus of subgrade reaction (*k*-value) were found to have minimal effect on the PCC performance predictions for the range of *k*-values characteristic of Florida embankment materials.
- From the cluster analysis of climatic variables, researchers identified four climatic regions into which Florida may be subdivided. In addition, researchers established representative soil-water characteristic curves for the different Florida counties based on a comprehensive review of soil survey reports and published soil suction data. Verification of curves determined from this review found a reasonable agreement between the curves and data from soil suction tests conducted in this project. However, the correlation needs to be further verified with additional test data.
- M-E PDG runs made to evaluate the effect of ground water table depth showed that the effect of this factor on the performance predictions diminishes with depths greater than 20 ft. Thus, for the field tests done on the calibration sections, borings to determine the depth of the water table were made to a depth of 20 ft or until the water table was reached, whichever came earlier.

BENEFITS

Phase I of this M-E PDG implementation effort produced a database of performance and materials information on in-service pavement sections for calibrating the performance models in the current release of the M-E PDG program. It also established a conceptual framework for developing an M-E PDG-based design method for the Florida DOT. These products are crucial to making the transition from the current design method, which is largely empirical, to one based on the mechanistic-empirical design concepts embodied in the new pavement design guide. In particular, the Phase I results will enable development and implementation of an initial M-E PDG-based pavement design method tailored to Florida conditions and current pavement design practice. This development is being pursued in the Department's on-going design guide implementation effort.

This project was conducted by researchers at the Texas Transportation Institute (TTI) of the Texas A&M University System. Dr. Emmanuel Fernando of TTI was principal investigator. For more information, contact the Project Manager, Mr. Bruce Dietrich, FDOT State Pavement Design Engineer, at (850) 414-4371 or by email at Bruce.Dietrich@dot.state.fl.us.