RESEARCH
PROJECT CAPSULE [12-4P]
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TECHNOLOGY TRANSFER PROGRAM

Development of DARWIN-ME Guidelines for Louisiana Pavement Design

JUST THE FACTS:

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Mehodology Used Implementation Potential

PROBLEM

The Louisiana Department of Transportation and Development (DOTD) has the responsibility of administrating and maintaining more than 16,000 miles of state, U.S., and interstate highway pavement structures. Currently, DOTD is using the 1993 AASHTO Pavement Design Guide and its accompanying design software, DARWin 3.1, in all pavement design activities. The basis of the 1993 AASHTO Pavement Design Guide has been the empirical equations developed from the AASHO Road Test. Due to the empirical characteristics and other limitations, the 1993 AASHTO Pavement Design Guide cannot accurately predict the performance of designed pavement structures.

DARWin-ME™ is the next generation of AASHTOWare® pavement design software, which builds upon the newly developed NCHRP Mechanistic-Empirical Pavement Design Guide. By taking advantage of advances in material mechanics, axle-load spectra, and climate data for predicting pavement performance, this design approach can result in smoother, longer-lasting, and more cost-effective pavements.

According to AASHTO, the 1993 AASHTO Pavement Design Guide will soon be sunset and all the technical support for DARWin 3.1 will be ceased on July 1, 2012. To follow the national trend, DOTD plans to adopt the new pavement design package, DARWin-ME, in the next few years. However, DARWin-ME is fundamentally different in many aspects from DARWin 3.1 and requires a large number of design inputs, most of which were not required in the 1993 AASHTO Pavement Design Guide. Therefore, to support the implementation of DARWin-ME and provide related pavement design guidelines for DOTD design engineers, there is an urgent need to evaluate the DARWin-ME pavement design software based on typical Louisiana pavement structures and local conditions.

OBJECTIVE

The objectives of this research study are to:

1. Conduct a pilot mechanistic-empirical pavement design evaluation using DARWin-ME based on typical Louisiana traffic, materials, and environmental information;
2. Assess the short- and long-term performance of typical Louisiana pavement structures using DARWin-ME's nationally calibrated performance models; and
3. Develop implementation guidelines for the future adoption of DARWin-ME in Louisiana.

METHODOLOGY

Figure 1 illustrates the overall methodology of this research. The evaluation of the DARWin-ME software will be based on typical new and rehabilitated pavement structures in Louisiana. First, a survey on the levels of different distresses at pavement failure will be conducted among DOTD pavement engineers. Based on the survey results and other available sources of DOTD pavement information [e.g., Pavement Management System (PMS) pavement distress triggers], a suite of DARWin-ME pavement design criteria based on Louisiana conditions will be determined for the structural pavement design of asphalt concrete (AC) and Portland cement concrete (PCC) surfaced pavements in Louisiana.

Second, for each typical pavement type considered, a number of historical projects will be selected from the DOTD Tracking of Projects (TOPS) system. Each selected project will be re-designed using the DARWin-ME pavement design software, and the design thickness will be compared with the original design based on the 1993 AASHTO Pavement Design Guide (DARWin 3.1). For projects with sufficient pavement performance data from PMS, the original designed pavement structures will be further analyzed using the DARWin-ME, and the predicted pavement performance will be compared with the PMS data.

Third, based on the results of the comparison analysis, the DARWin-ME design modules for designing each selected type of pavement structure will be classified into the following three categories: (1) modules ready for Louisiana implementation without local calibration; (2) modules suitable for Louisiana implementation but need local calibration; and (3) modules that function improperly in the current version of DARWin-ME. Preliminary local calibration will be performed on Category 2 modules if sufficient historical projects and PMS data are available.

Finally, a suite of preliminary implementation guidelines for DARWin-ME will be developed for DOTD. These guidelines will be sorted based on the pavement design categories, namely the new flexible pavement design, the new rigid pavement design, and the pavement rehabilitation design. Specific recommendations for each pavement design category will include: (1) Louisiana DARWin-ME pavement design criteria; (2) Louisiana default design inputs; (3) guidelines for incorporating the results from completed and ongoing MEPDG-related research in Louisiana into the DARWin-ME pavement design; (4) general observations from the previous analysis and possible issues with the design modules; and (5) preliminary calibration factors for certain distress prediction models.

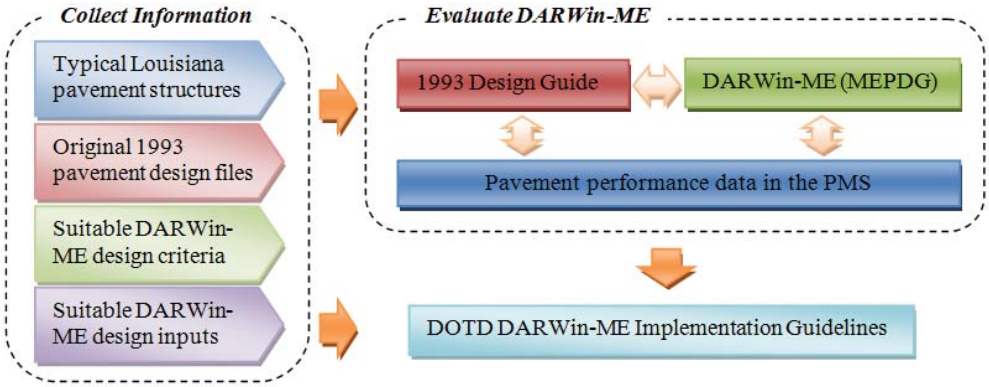

Figure 1
Flow chart of the research methodology

IMPLEMENTATION POTENTIAL

DOTD pavement design engineers may immediately use the developed DARWin-ME implementation guidelines and start to run concurrent design for Louisiana pavement structures. The recommended design criteria, with the consensus of the DOTD engineers, can be used as a DOTD standard. The recommended inputs for traffic, climate, structure, and materials can be used as a set of initial design parameters before more accurate data become available.