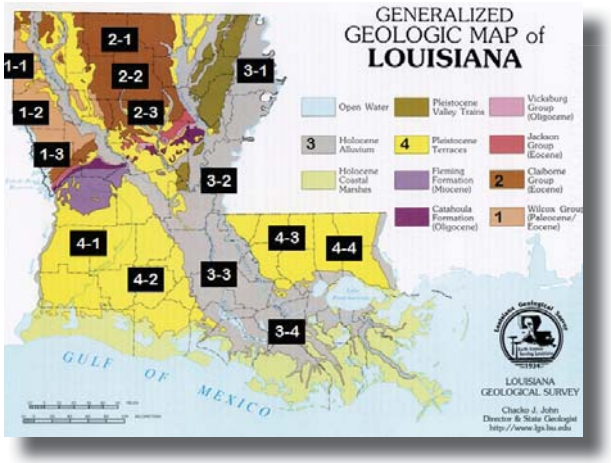
RESEARCH
PROJECT CAPSULE [12-2P]
September 2011
TECHNOLOGY TRANSFER PROGRAM

Assessment of Environmental, Seasonal, and Regional Variations in Pavement Base and Subgrade Properties



PROBLEM

The Enhanced Integrated Climatic Model (EICM) used in the Mechanistic Empirical Pavement Design Guide (MEPDG) was developed to simulate changes in pavement layers (pavement, base course, and subgrade) due to seasonal environmental fluctuations. This study focuses on base course and subgrade layers only. It has gone through several generations of upgrades and refinements that are outlined in National Research Program (NCHRP) report numbers 1-37A, 602, 9-23A, I-40D, and 9-23B.

OBJECTIVE

The purpose of this project is to validate the prediction of seasonal variation strengths in the base course and subgrade, validate MEPDG provided soil properties and strengths, validate soil properties and locations from soil unit maps, link soil unit maps with the Louisiana Department of Transportation and Development (LADOTD) geotechnical database, document water table depths, and obtain Level 2 modulus inputs with data from the falling weight deflectometer (DCP). A companion study will be conducted through the Southeast Superpave Pool Fund study to refine the historical climatic model and build new future climatic models to be utilized in the MEPDG.

METHODOLOGY

This research project will focus on the climate and structure (base course and subgrade layers only) of the MEPDG. The climate portion of the MEPDG uses data from weather stations to build models that predict monthly infiltration and evapotranspiration cycles, which, in conjunction with soil properties, are utilized to estimate changes in moisture content and resilient modulus in the base course and subgrade for Levels 1 and 3 datasets of the EICM. Level 2 inputs will be determined through testing with the falling weight deflectometer (FWD) and dynamic cone penetrometer (DCP). This will be accomplished through the following tasks:

Task 1: Conduct a comprehensive literature search including detailed reviews of NCHRP projects relevant to this topic.

JUST THE FACTS:

Start Date:
September 1, 2011

Duration:
24 months

End Date:
August 31, 2013

Funding:
Federal

Principal Investigator:
Kevin Gaspard, P.E.
LTRC Pavement Research Engineer Manager
225-767-9104

Administrative Contact:
Mark Morvant, P.E.
Associate Director, Research
225-767-9124

Technical Contact:
Zhongjie "Doc" Zhang, Ph.D., P.E.
Pavement & Geotechnical Research Administrator
225-767-9162

Louisiana Transportation Research Center
4101 Gourrier Ave
Baton Rouge, LA 70808

Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

POINTS OF INTEREST:

Problem Addressed / Objective of Research / Mehodology Used Implementation Potential

Task 2: Integrate soil unit maps developed by the U.S. Department of Agriculture (USDA) into the Louisiana geographic information system (GIS) database. Compare data from soil unit maps to data collected from this study to determine how representative the soil unit classifications are.

Task 3: Select research sites from the four geologic regions that cover most of the state: Wilcox group, Claiborne group, Holocene Alluvium, and Pleistocene Terraces. It is proposed that three sites be selected from the Wilcox and Claiborne sub-regions and four sub-regions from the Holocene Alluvium and Pleistocene Terraces (14 existing sites total). Additionally, one to three sites will be selected from newly constructed embankments.

Task 4: Instrument and assess research sites to determine initial strength and soil property characteristics. Soil samples will be procured with Shelby tube sampling and assessments will be conducted with the FWD, DCP, and the neutron probe. Instrumentation includes time domain reflectometers, soil suction devices, temperature devices, and electric conductivity devices.

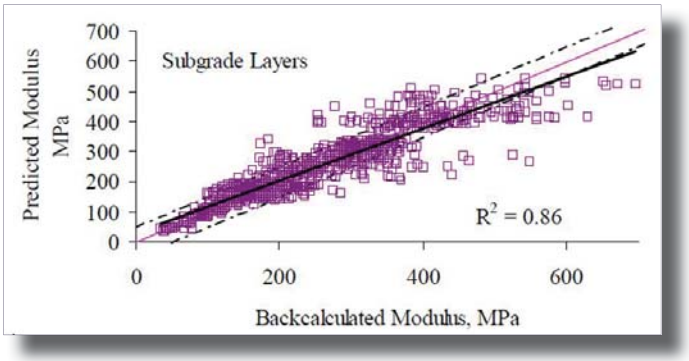
Task 5: Begin soil property determination at the LTRC Geotechnical Laboratory as soil samples are procured from each site. Testing includes standard soil property tests, resilient modulus, soil water characteristic curve parameters, and mineralogical tests.

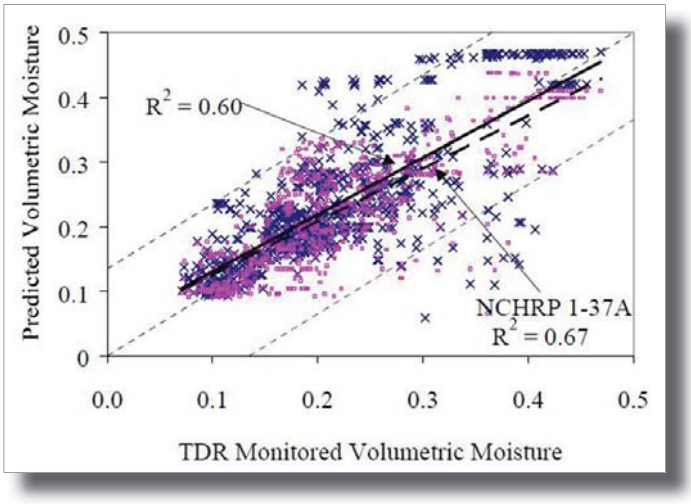
Task 6: Produce a comprehensive final report covering the following:

- Discuss site location and instrumentation plan
- Discuss initial strength conditions, soil properties, and soil state of stress results
- Validate resilient modulus correlations developed under LTRC 03-3P between FWD, DCP, and cone truck to laboratory derived resilient modulus parameters
- Compare field samples to soil unit map values, integrate soil unit maps into DOTD GIS system, and share finished product with NCHRP
- Present seasonal variation of resilient modulus, water table depths, and moisture content profile from sites during this phase.
- Conduct a sensitivity analysis comparing MEPDG predictions to field measured data.

IMPLEMENTATION POTENTIAL

An implementation team to utilize the results of this study will be established at the end of Phase I. The team shall develop an implementation plan. Modifications to the Policy and Procedure Manual (PPM) Engineering Directives and Standards (EDSM), and testing procedure manual (TR) will be performed as directed by the team and approved by the appropriate executives in LADOTD. Templates compatible with the MEPDG shall also be provided.





For more information about LTRC's research program, please visit our Web site at www.ltrc.lsu.edu.