DEVELOPMENT OF AN AUTOMATED PROCEDURE FOR IMPLEMENTING THE RESILIENT MODULUS TEST FOR DESIGN OF PAVEMENT STRUCTURES IN FLORIDA

PROBLEM STATEMENT

Resilient modulus (M_R) is a required engineering input parameter for implementing the 1993 AASHTO Guide for Design of Pavement Structures. Several major research projects have been conducted in the past ten years to study the M_R characteristics of Florida pavement soils. The resilient modulus test procedure and the selection of an appropriate design M_R value for pavement materials have always been significantly complicated by the fact that the resilient modulus is affected by many factors: soil type, test method, specimen moisture and density, specimen size, confining pressure, deviator stress, and so forth. One soil specimen may have many different resilient modulus values depending on the states of stresses.

Conducting the resilient modulus test in a triaxial chamber is a time consuming task. Failure to do the checks as specified in the test protocol will result in unreliable M_R data. In addition to running the test, engineers must spend much time and effort designing spreadsheets, entering data, consulting complementary protocols, and, eventually, performing the statistical analysis and printing final reports. The amount of time and effort required to conduct the M_R test could be significantly reduced through computer automation. An automated procedure would also improve the reliability of the M_R test results.

OBJECTIVES

The purpose of this study was to develop an automation procedure for implementing the resilient modulus test for the design of pavement structures. The primary objective was to develop a M_R database and software system to store the available M_R test data and to facilitate the soil M_R evaluation for the design of pavements.

FINDINGS AND CONCLUSIONS

Researchers developed a M_R database software system, Soil Lab Assistant (SLA), using Visual Basic 6.0 and Microsoft Access. The entities and relationships were defined for the relational database model. The SLA software application was intended to help soil lab engineers run the soil M_R and other tests, analyze the test data, store the final test results to the database, retrieve data from the database, and produce final test reports. A user's manual was prepared for the Soil Lab Assistant (SLA) application. The SLA could also be used to design pavement structures using retrieved M_R test data from the database for subgrade and base materials (per the AASHTO 1993 Guide for Design of Pavement Structures).

To better understand the M_R concept and to conduct the test, comprehensive guidelines were provided on the M_R test for soil and aggregate materials using the Long-Term Pavement Program (LTPP) findings. The research results provide detailed information regarding the usefulness of test results in pavement design,

especially in a mechanistic context; the background and usefulness of the test procedure; and the techniques that can be used to reduce laboratory variability (i.e., to achieve repeatability).

BENEFITS

This project was conducted to supplement and enhance the future implementation of the M_R test for design of pavements in Florida. The findings of this study could impact the performance of laboratory testing of pavement materials. The developed software system could assist soil laboratory engineers in conducting the M_R test and facilitate the pavement design process. Generally, the M_R database could be very useful for data management and pavement design. Pavement design is tied to the M_R of the subgrade, which means that any process that results in the use of subgrades with better performing M_R will improve the performance of the pavement. Improved pavement performance means less maintenance, reduced interruptions to the traveling public, and cost savings.

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