The benefit/cost analysis was performed in 1999

JTRP/INDOT RESEARCH PROGRAM

Research Pays Off

Implementation of Subgrade Resilient Modulus for Pavement Design and Evaluation

The resilient modulus is a property to measure the capacity of a paving material to recover from repeated load applications, and is one of the major parameters used in pavement structure design. Usually, the higher the resilient modulus of subgrade, the greater the pavement structural capacity. High resilient modulus also results in great resistance to rut development in asphalt pavements by reducing residual deformation in subgrade soil.

AASHTO issued a new AASHTO testing protocol (AASHTO T-294-94), which replaced the earlier testing protocol (AASHTO T-274-82), for resilient modulus. INDOT wished to update laboratory equipment, and educate and train technical personnel so as to conform fully to the new testing protocol. In addition, INDOT wished to test soils to establish a new database toward providing subgrade resilient modulus for pavement design in accordance with the new testing protocol. This project, initiated in 1994 and completed in 1998, was intended to make it possible for INDOT to perform the necessary testing and analysis to establish a soil's resilient modulus for pavement design purposes in a metric mode.

Research Findings and Implementation

In the course of performing this study, both the old and new AASHTO testing protocols for resilient modulus were reviewed and existing testing equipment was upgraded. Laboratory tests were performed for evaluating subgrade soils statewide. Training was provided to technical personnel from the INDOT Division of Materials and Tests, and to pavement design engineers. Based on this project, a procedure has been developed for determining the subgrade resilient modulus for pavement design. The procedure consists of identifying the subgrade soil, preparing specimens, performing an unconfined compression test, calculating the resilient modulus, and estimating the change in water content. Two equations were presented for calculating resilient modulus, one for the predicted as-compacted resilient modulus and the other for the resilient modulus at equilibrium or under the normal subgrade condition. Tables for determining the resilient modulus under frozen conditions were also developed. Estimation of the resilient modulus under thawed conditions was also performed. A chart was developed for estimating the monthly variations in resilient moduli.

In addition, problems associated with support software were identified. To minimize the volume of samples to be tested, a procedure was defined on the basis of the minimum pavement thickness and road classification. The test procedure was documented as a standard for determining the subgrade resilient modulus for Indiana soils.

Benefits

This project developed procedures, tables and charts for a large range of Indiana soils which will allow INDOT to fulfill the mandated use of resilient modulus in pavement design.

Cost of Research $221,566

Contact

- G. Altschaeffl, School of Civil Engineering, Purdue University