Executive Summary

Laboratory Characterization of Materials & Data Management for Ohio-SHRP Projects (U.S. 23)

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Highway design engineers in the U.S. have been relying on the 1986-1993 American Association of State Highway and Transportation Officials (AASHTO) Design Guide, which is based on the many empirical elements obtained in the 40-year old AASHO Road Test. Today, traffic volumes, traffic loads, and expectations for better pavement performance have outgrown the accuracy of the empirical design method. The performance and life of highway pavements have received increased concern across the U.S., since the maintenance and reconstruction of pavement systems cost the state and federal governments billions of dollars each year. Due to the great expense and effort often associated with roadway maintenance, many states are now behind schedule for highway repair. The inability to characterize material properties and their effect on pavement performance is believed to be a contributing factor to the pavement performance problems that exist. About a decade ago, the Federal Highway Administration (FHWA) established a national study called the Long-Term Pavement Performance (LTPP) under the Strategic Highway Research Program (SHRP) to respond to the growing public concerns on the national level. The goal of the LTPP study was "to increase pavement life by investigation of various designs of pavement structures and rehabilitated pavement structures, using different materials and under different loads, environments, subgrade 2 soil, and maintenance practices" (FHWA, 1993a). To achieve this goal, the LTPP study was to establish a National Pavement Data Base (NPDB) that would contain inventory information, traffic data, climatological data, field monitored/test data, field sampling data, laboratory test data, and maintenance data for each pavement section. Therefore, major activities of the LTPP study included collection of inventory data, field test data, and laboratory test data on a large number of pavement test sections. In parallel to the LTPP study, efforts have been continued by various research organizations to try to develop a new pavement design method, which is based more on principles of mechanics and less on empirical elements. The new method is generally labeled as the "mechanistic-empirical (M-E)" procedure. This is because the method, although based on sound engineering principles, still requires special transfer functions to translate predicted strains and stresses to the most likely pavement distresses. Effective implementation of the M-E procedure depends on complete and accurate input of the engineering properties of the pavement layer materials involved. The Ohio Department of Transportation (ODOT) has funded many highway research projects in recent years, with the largest being the U.S. Rt. 23 project in Delaware County, Ohio. This highway project is also part of the Ohio Strategic Highway Research Program (Ohio-SHRP) Test Road. Ohio University coordinated the multiuniversity team assembled for this project and was responsible for most of the field instrumentations, field testing, and monitoring of the pavement sections. The Ohio-SHRP Test Road provides a great opportunity to implement and evaluate the M-E procedure, provided that the actual mechanistic properties of the pavement materials involved in the 3 project are measured according to the SHRP test protocols. The results from the application of the M-E procedure can then be compared to the actual sensor readings and pavement distress

observations made at the Ohio-SHRP Test Road site. In the last two years, personnel at Ohio University have conducted over one hundred experiments to characterize the properties of concrete for the SPS-2 and SPS-8 sections of the Ohio-SHRP project. These laboratory tasks were undertaken in consultation with the Ohio Department of Transportation (ODOT) personnel. The concrete testing conducted by Ohio University was part of the SHRP requirements. Although under the Long Term Pavement Performance Program (LTPP) it was required that the federally funded agency provide limited information on the characteristics of asphalt and subgrade, there is a need for more detailed characterization of all the materials that were used in the U.S. 23 project. The mechanical properties of each component layer are an integral part of any design procedure. Structural responses of the pavement system due to load and/or environmental factors play a key role in development of a mechanistic design or
verification of existing models. In addition to the above, there is a need to integrate all the data from the Ohio-SHRP project. In a comprehensive pavement research project, one central source of data that contains construction sequence information, climatological data, material property data, etc., must be established. 4

Objectives of this study are summarized below:

1. Determine the mechanical properties of the materials that were used in the Ohio-SHRP (U.S. 23) project.

2. Integrate and consolidate all the data for the Ohio-SHRP (U.S. 23) project that could be utilized for implementation in development of calibration of mechanistic design approach by the ODOT engineers and other designers and researchers.