Research Project

99-3GT

Capsule

Technology Transfer Program

LTRC

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Rapid Moisture Content Test Under Field Conditions

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LTRC

Louisiana Transportation Research Center

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

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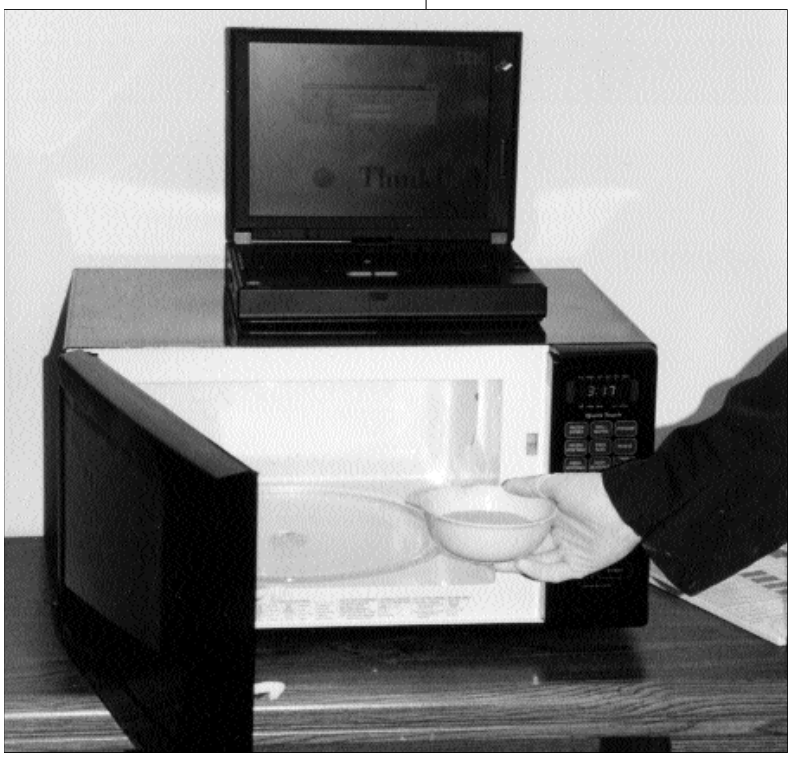
Problem

The Louisiana Department of Transportation and Development (DOTD) has committed a significant portion of its budget to the overlay program. Many of the roads resurfaced under this program include the stabilization or re-stabilization of the existing base course with cement. DOTD strives to construct roadways that function adequately for the duration of their projected design life. Therefore, quality control on these projects is important for proper soil cement base course and lime treated subgrade construction.

Recently, DOTD has adopted a new standard which requires a minimum of three proctor tests per zone. Each proctor is accompanied with a moisture content test for a moisture-density rela-



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tionship which requires approximately 45 to 60 minutes to perform the moisture content test using the stove-pan method (DOTD TR 403). The stove pan method is conducted by placing soil in a pan or skillet over an open flame. The soil is stirred and heated until all the moisture has evaporated. Errors can occur due to overheating which vaporizes the organic material in the soil, and asphalt coating on recycled pavement blended into the base course. Additionally, some material may spill out of the pan during the mixing process. Furthermore, by the time the results are tabulated, the contractor is usually in the next construction zone. If the results are unfavorable, it may be to late to change operations for that zone.

In an effort to enhance productivity and accuracy, a new method for determining moisture content is needed. The new method will use a device and procedures that reduce the time required for moisture content determination, protect against overheating the soil, and require little if any monitoring from the technician.

Objectives

The purpose of this research is to validate a new field method to obtain moisture content on stabilized or raw soils with aggregate typically used in Louisiana highway construction. The device will be portable, durable, lightweight, (<50 pounds), environmentally safe, user friendly, and capable of delivering moisture content results in less than 20 minutes.

Research Approach

The proposed research will consist of a comprehensive field and laboratory program, a literature review to identify microwave technology that meets requirements, and a survey of other states that have used microwave technology for moisture content testing. Soils will be acquired from various roadway sites and tested in the laboratory. Also, the device will be transported to construction sites and used to test soils under field conditions.

The laboratory program will test samples obtained from re-stabilized bases with recycled asphaltic concrete pavement, raw soils, and soils with aggregate. A minimum of four re-stabilized base courses will be acquired from various districts to ensure a good cross section of samples. Raw soils from the A-1, A-2, A-5, and A-7 soil grade groups will be acquired for testing. The acquired soils will be moisture content tested with additives such as lime and cement as well as in their natural state. After a sample has been prepared, it will be divided into three portions. The three portions will be tested in the microwave, stove-pan, and oven. The accuracy of the moisture content obtained from the microwave and stove-pan will be determined by comparing it to the results of the moisture content test from the oven dried specimen. A conventional microwave will be used to test some samples for comparison. Additionally, the time required to obtain the moisture content from the microwave oven and stove-pan will be recorded for each sample.

The field program will take place at the construction site. Three soil cement construction projects will be identified to field test the device. A minimum of five zones will be tested on each project. The procedure utilized for moisture content determination and comparison in the laboratory program will be replicated in the field. A cost/benefit analysis will be conducted comparing the cost of the device with the cost of the man-hours saved.

Implementation Potential

The results of this study will validate the accuracy of microwave ovens in the determination of moisture contents under both field and laboratory conditions. Microwave ovens will enhance productivity in both the field and laboratory. The microwave will be included in DOTD TR 403 as an approved soil and aggregate drying device for both field and laboratory conditions. The device will be demonstrated for each district laboratory as well as the materials laboratory.