Research Project

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C a p s u l e

Technology Transfer Program

LTRC

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The Stability of Calcium Sulfate Base Course in a Wet Environment

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Louisiana Transportation Research Center

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

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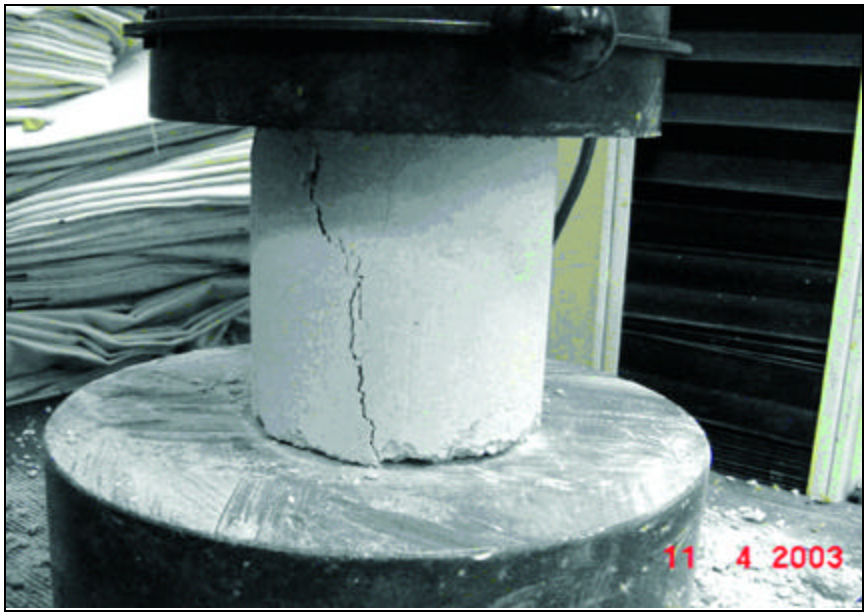
Problem

The Louisiana Department of Transportation and Development (LADOTD) has used blended calcium sulfate (BCS) for pavement base course, roadway embankment, and aggregate surface course on a case-by-case basis for the past 15 years. This material, previously known as florolite, is a by-product of the Louisiana chemical industry. A low-cost recycled material produced in Ascension Parish, it is a highly competitive alternate to stone in south Louisiana and has produced unconfined strengths greater than 500 psi after 45 days of curing.

Although BCS has performed satisfactorily on many projects, LADOTD is evaluating some unresolved issues. BCS cannot be added to the LADOTD Qualified Product List for aggregate because of its laboratory performance when subjected to abrasion (AASHTO T96) and sulfate soundness (AASHTO T104) tests. Additionally, the strength of BCS is moisture-sensitive when tested in accordance with AASHTO T135 (wet-dry test).

Research is needed to better quantify the moisture sensitivity of BCS material, determine appropri-



Unconfined strength testing of BCS sample

ate site conditions for its use, produce construction specifications that provide a consistent product, and if necessary, determine appropriate admixtures to enhance the performance of BCS material.

Objective

Research objectives are to 1) develop an understanding of the mechanism by which BCS gains strength over time, 2) establish correlation of BCS strength variation with moisture content, 3) explore remedies to preserve BCS strength in wet conditions, and 4) compare mechanical properties of BCS with those of soil cement or crushed stone.

Description

The proposed research includes laboratory testing and field testing. The main purpose of the laboratory testing is to understand the mechanisms and conditions whereby BCS gains or loses strength, and to explore remedies for strength preservation under varying conditions. The main purpose of the field testing is to assess the performance of BCS as a pavement base course under different environment and traffic conditions.

The first phase of the laboratory program is the systematic testing of BCS specimens to understand the mechanism by which BCS gains strength and the factors that influence the strengthening process. This mechanism underlies the relative effects of gradation, moisture content, and curing conditions, and must be understood so that BCS may be more effectively used in the field.

The second phase of the laboratory program will focus on the mechanism of BCS strength loss. A significant disadvantage of BCS as a pavement base is that the material can lose most of its strength under wet conditions. Several mechanisms may contribute to such strength deterioration. Each mechanism needs to be studied. Tests will be conducted to evaluate the sensitivity of long-term ultimate strength of BCS with variations in moisture content.

The third phase of the laboratory program will explore potential remedies to alleviate BCS strength loss due to moisture sensitivity. Potential remedies include the addition of cementitious materials such as fly ash or ground granulated blast furnace slag. Varying percentages and combinations of cementitious materials will be added to BCS test specimens for laboratory testing. The most cost-effective mixtures will be recommended for field testing.

The field testing program will evaluate the performance of BCS used as a pavement base under different drainage conditions. Test sections will be designed based on findings from the laboratory program. Test sections will be built, and long-term performance will be monitored, analyzed, and compared with control sections of soil-cement or crushed stone bases. In-situ testing devices, such as the Dynamic Cone Penetrometer, Falling Weight Deflectometer, and Dynaflect will be used for this purpose.

Implementation Potential

Findings from this research will result in greater understanding of BCS strength variation due to moisture. Site conditions that are appropriate for using BCS will be recommended, including suggested mixtures for improved engineering properties. In order to provide a consistent product for use in pavements, construction specifications will be developed.