Research Project

93-2B

LTRC

Capsule

Technology Transfer Program

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Evaluation of the Fundamental Engineering Properties for Large Stone Asphalt Mixes in LA

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Problem

During the 1980s, permanent deformation of highways was widely reported throughout the country. This distress was attributed to heavier loads and increased tire inflation and contact pressures. Many states evaluated the use of large stone asphalt mixtures (LSAM) in the upper pavement layers in two different designs -- a traditional dense graded design or a stone filled mix design -- to find a solution. The conventional dense graded design was reinforced with the addition of larger stone to provide rock on rock contact. The reported success rate of these designs varied.

During this time, the Federal Highway Administration urged state agencies to incorporate positive drainage systems in newly designed highways or the reconstruction of existing roadways. These FHWA recommendations were made in an effort to upgrade the quality of the national highway system.

Until recently, Louisiana had not experienced permanent deformation since the early 1960s. Approximately twelve pavements have been identified as having early rutting distress to the wearing course. This distress can be attributed to improper use of the maximum density line for gradation analysis and the use of excessive asphalt cement to overcome segregation problems. However, several older pavements have experienced lack of structural support in the binder or base course which was transferred to the surface causing ruts in the final wearing course.

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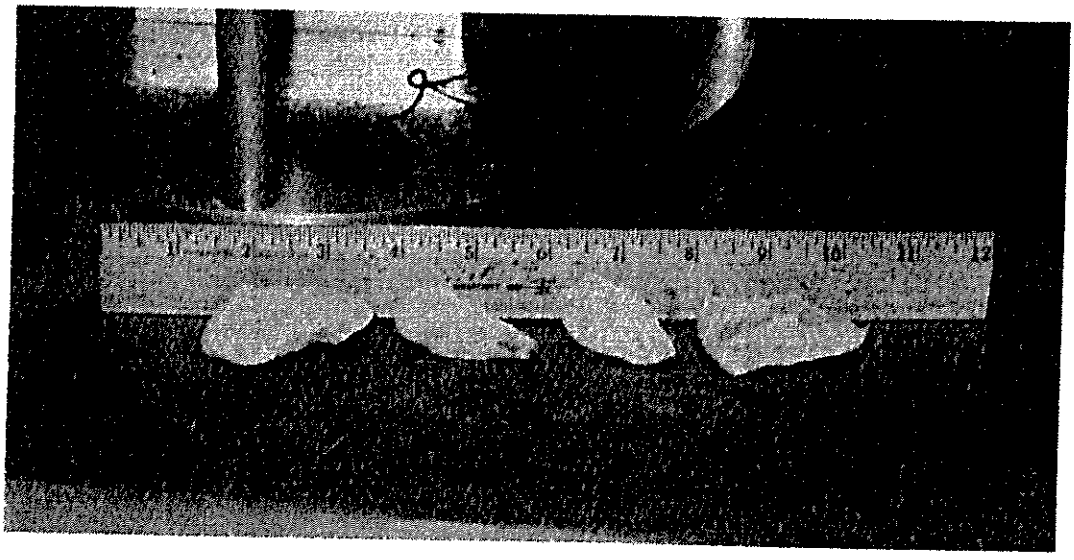

Researchers envision that by using larger stones with reduced asphalt cement by weight can produce a more economical mix of higher structural capacity.

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Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University
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The proposed research would examine the use of LSAM to provide added structure in the zone of maximized shear stress immediately under the wearing course mix. Researchers will also characterize LSAM using fundamental engineering properties such as tensile strength, creep compliance, fatigue and resilient modulus to determine the structural capacity of these mixes. With this information, the use of drainage layers in full depth asphalt concrete pavements can be expedited.

Objectives

This study's objective is to determine the fundamental engineering properties of large stone asphalt mixtures for potential use in Louisiana and to determine AASHTO structural design coefficients to expedite design implementation. The scope of this evaluation includes the characterization of LSAM and conventional mixes through gyratory shear index, indirect tensile strength, creep compliance, fatigue, resilient modulus, and moisture susceptibility tests.

Description

This study will characterize LSAMs in both a gap graded and an open graded format for use as structural and drainage layers, respectively.
Specific aims will include:

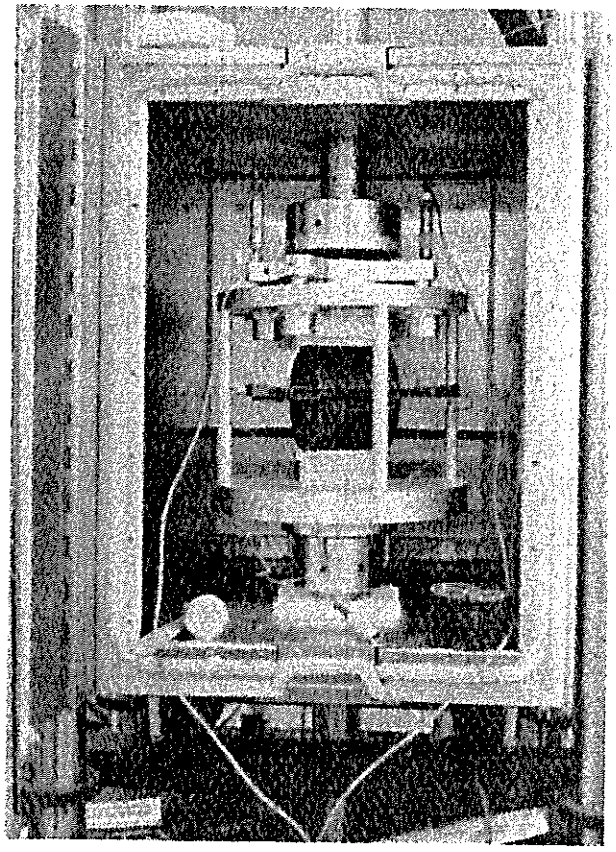
- Evaluate the fundamental engineering properties of large stone gap graded and open graded asphalt mixtures along with conventional mixes.
- Determine the AASHTO structural design coefficients for the LSAMs
- Develop special provisions for field construction of LSAMs
- Acquire gyratory and vibratory hammer compaction devices to generate LSAM specimen and for shear testing as well as fabricating a loading device for indirect tensile testing for larger specimens.

Implementation Potential

Through its mechanical aggregate interlock, LSAM has the potential to improve quality of asphalt concrete mixes by increasing the structural capacity to meet the demands of traffic loading. The use of large stone with less of a crushing requirement and the added benefit of reduced asphalt cement by weight to maintain the same binder film thickness can produce a more economical mix of higher structural capacity. It is envisioned that such a material could replace the current binder course in thin overlays providing a higher grade structural mix and be used in full depth designs to reduce overall pavement design thickness.

The open graded LSAM will provide the department with an improved drainage layer which may have the ability to contribute to structural capacity.

The findings of this study should provide the basic knowledge necessary to demonstrate the potential of LSAM for immediate implementation in prototype sections or for consideration as an accelerated loading facility (ALF™) experimental section. Both LSAMs evaluated should represent more economical pavement systems with increased structural capacity.



An automated Materials Testing System (MTS) is used to characterize highway materials.