Research Project

04-4GT

Capsule

LTRC

Technology Transfer Program

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Effect of Drainage in Unbound Aggregate Bases on Flexible Pavement Performance

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Louisiana Transportation
Research Center

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Problem

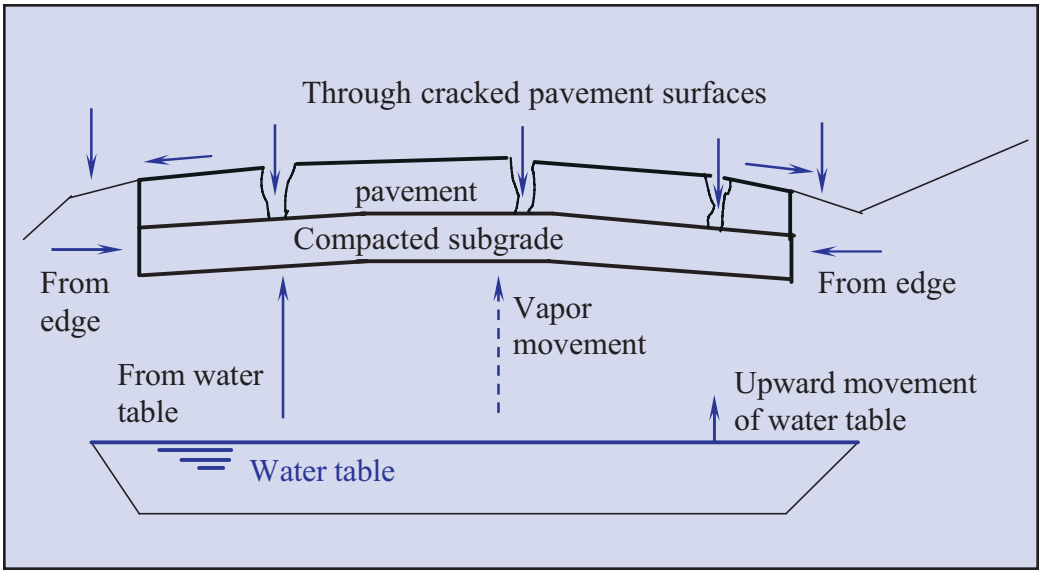
Subsurface drainage is commonly believed to enhance the performance of asphalt pavement. In the last several decades, great strides have been made in the design, construction, maintenance, and field monitoring of subsurface drainage systems. However, two aspects of these drainage systems—regular maintenance requirements and cost-effectiveness—have limited their widespread application in highways.

Objectives

This study's first objective is to quantify the need for pavement subsurface drainage in Louisiana's environmental condition. Issues such as how much water gets into pavement structures, when this happens, how this happens, etc., will be investigated to justify a suitable subsurface drainage system as a component of the pavement structure.

The second objective is to determine, according to Louisiana's need, the feasibility and effectiveness of different subsurface drainage systems, which include one already used by DOTD. Aggregates with different gradations will be tested in the laboratory and field for both drainability and stability in Louisiana's climatic conditions.

The third objective is to determine the cost and benefits of subsurface



Schematic diagram of how water infiltrates into pavements

drainage systems by comparing both the short-term and long-term performance of various strategies, such as FHWA's recommended subsurface drainage system, DOTD's more permeable base system, and pavement without any subsurface drainage system. Short-term cost-effectiveness can be studied through the variation of resilient modulus in pavement structures with the degrees of saturation. Long-term cost-effectiveness will be investigated by continuous field monitoring over time and comparing the life spans of different alternatives.

Description

The proposed research approach will include laboratory tests, field instrumentation and survey, and numerical analyses. Moisture sensors will be embedded in pavement structures at selected locations throughout the state, and this system will be monitored both during and after the project. This information will be used to establish the criterion for drainage needs in asphalt pavement in Louisiana.

Different subsurface drainage systems will be tested and their effectiveness will be evaluated both in the laboratory and the field. Laboratory work will concentrate on the fundamental physical and mechanical properties of aggregates used for more permeable bases, such as gradation, compaction, permeability, strength, resilient modulus, etc. Field work will include building test sections and then monitoring and comparing their performances.

After field and laboratory testing data are examined and analyzed, the effectiveness and cost-effectiveness of different subsurface drainage systems will be compared and evaluated. "Effectiveness" is the system's capability to drain the free infiltrated water in a pavement structure; "cost-effectiveness" measures the cost of the drainage system in relation to the extra service life it produces for the pavement structure.

Finally, a long-term monitoring program will be prepared for implementation, and an interim guideline for using the more permeable base system in asphalt pavement will be ready for DOTD to use.

Implementation Potential

This study will present an accurate and reliable method to assess the cost-effectiveness of a more permeable subsurface base and provide a guideline on the use of subsurface drainage systems suitable for Louisiana's climatic conditions.