HIGHWAY RESEARCH
CIRCULAR

Number 139 Subject Area: Bituminous Materials and Mixes August 1972
Pavement Design
Construction
General Materials
Bridge Design

RESEARCH PROBLEM STATEMENTS

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Research Project Title:

Determine the Effects of the Interaction of Temperature-Moisture Cycles and Traffic on the Bitumen-Aggregate Combination.

General Problem Area:

Bituminous Paving Mixtures for Base and Surface.

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Research Problem Statement:

While adhesion is recognized as an important factor in pavement performance, the interacting effects of temperature and moisture cycles within a bituminous system are not clearly understood or defined. This problem is further compounded with the addition of loading cycles (traffic). The problem is influenced by many factors such as aggregate properties, mix design, construction techniques, and asphalt qualities as well as environmental conditions and traffic. Water in its several states (solid-liquid-vapor) and the continuing transition from one state to another adds to the complexity.

The base of the pavement must contribute its strength under cyclic moisture-temperature conditions as exist in the pavement--a condition not necessarily obtained in current strength tests on the pavement material. Hence, rational design of pavements is hampered.

Dimensional changes of the pavement resulting in transverse cracking and displacement are a function of traffic, temperature, and probably moisture-temperature cycles.

Loss in pavement performance is often attributed to poor adhesion induced by moisture (water in its various forms, liquid, vapor, adsorbed-desorbed, absorbed, etc.). Numerous tests have been developed but there is little agreement among the results or as to their significance. This in part may be due to a failure to simulate field conditions.

So that the confusion may be eliminated, the problem understood and solutions systematically obtained, a need exists for (a) identifying the pavement temperature and water regimes (temperature cycles and water in its various forms, and levels corresponding to the temperatures in the cycle) as exist in the pavement, as influence asphalt adhesion, and as are critical to pavement performance; and (b) the measurement of the effect of such regimes on pavement or laboratory specimen strengths, moduli (stiffnesses), dimensions, and fatigue resistances.

Objectives

1. Develop information as to the environment in which pavements perform, particularly as to the nature of the everyday temperature and moisture changes and their interaction. This should, in part, include a review of the literature that deals with this subject.

2. Develop information as to the individual and cumulative effects of these temperature-moisture cycles and traffic on the loss in pavement performance, their critical levels, and their measurement as a function of age of the pavement.

3. Develop a laboratory system approaching field conditions to assess the effect of thermal moisture cycles and traffic on the properties of bituminous systems, i.e., strength, stiffness, dimensional changes, adhesion, stripping, etc. (This is in part now under contract NCHRP4-8(3).)

4. Provide the paving community a systematic treatment of (a) the conditions responsible for the loss of pavement performance due to water in its various states or as induced by water-temperature interaction, (b) means of predicting loss of performance, and (c) means for developing solutions to adhesion problems.

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EVALUATING THE ELECTROSLAG WELDING PROCESS
FOR
DYNAMIC LOADING CONDITIONS

I. Research Problem Statement

Engineers are hesitant to permit the use of the electroslag welding process for weldments subject to dynamic loading because conclusive research has not been performed which can be accepted with some degree of confidence. Hence, this economical welding process although known by many is used by relatively few.