Permeability of MoDOT’s Type 5 Base

Description:
The pavement structure is the most costly element of the highway system, and its premature failure is of major concern (Figure 1). Inadequate drainage has been identified as the most common cause of pavement failure (Figure 2). Prior to the current study, there was no quantitative evidence as to whether Missouri Department of Transportations’s (MoDOT) Type 5 roadway base provided effective drainage beneath pavements.

Procedure:
The objective of this project was to characterize the hydraulic conductivity of the base materials used beneath pavements throughout Missouri. Materials included Type 5 base material from various sources and a rock fill alternate base material. The scope of the work performed included:

- Determination of grain size distribution of the base materials,
- Estimation of the hydraulic conductivity of the base materials using empirical equations,
- Determination of the hydraulic conductivity of Type 5 base material in the laboratory and in situ (Figures 3 and 4), and
- Determination of the drainage characteristics of the base material using pavement design software.

In addition, preliminary investigations of the strength of the Type 5 base under static and cyclic loading conditions were performed.
Conclusions:
The field and laboratory permeability testing showed the Type 5 base to have such low hydraulic conductivities as to be considered undrainable. Preliminary cyclic strength tests showed the base loses strength with increasing number of load cycles. This behavior could explain the premature deterioration of some pavements in Missouri. Providing adequately drainable bases will increase the effective performance life, reduce maintenance frequency and reduce replacement costs for Missouri pavements.

Recommendations:
It is recommended that a more durable roadway base be developed. One that provides an adequate working platform during construction and good drainage for extended lifetimes. Several tasks are recommended in order to gather high quality data (evidence) that is prerequisite for the development of an effective specification for roadway base in Missouri. A program of laboratory strength testing, in situ permeability testing instrumented pavement sections and a geographical information system-based pavement performance database should be undertaken. Such a program will provide the necessary evidence on which to initiate changes to Missouri’s pavement base system which will provide higher performance, longer-lasting and more economical pavement systems.

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