Continuing Investigation of Polishing and Friction Characteristics of Limestone Aggregate in Ohio

Problem

Maintaining adequate friction and texture properties of the pavement surface has been an important mission of highway agencies to ensure the safety of traveling vehicles. A common practice adopted by most highway agencies, including Ohio Department of Transportation, has been to regularly monitor friction of pavement surface by way of routine measurement of skid number (SN) using the Locked Wheel Skid Trailer (LWST). Once the measured SN falls below certain threshold criteria, ODOT would resurface the pavement to prevent wet weather accidents. This practice is commendable but passive, as it cannot serve the purpose of screening the polishing and friction behavior of the various aggregate sources and the specific job mix design of hot mix asphalt concrete. In the past, ODOT has experienced the need for early resurfacing due to rapid polishing aggregates or improper hot mix design. Therefore, there is a need to develop a simple, yet effective and fast, laboratory test procedure to determine the polishing and friction
characteristics of the aggregates and HMA.

Standard laboratory test procedures to test aggregate samples for their polishing and friction behavior are available. Nevertheless, the standard British Wheel Polishing procedure and the chemical analysis recommended for testing aggregate polishing behavior are tedious, time consuming, and non-consistent. The existing laboratory test apparatus for polishing HMA are bulky, time consuming, and requiring large specimen size. Accordingly, there is a need to develop and validate a simple, fast, and repeatable laboratory-scale accelerated polishing test apparatus and the accompanied testing procedure to screen the polishing and friction performance of Superpave HMA.

Objectives

▪ Develop a new accelerated polishing device for Superpave HMA to facilitate rapid simulation of wear and polish actions between vehicle tires and asphalt pavement surface

▪ Develop a complete test protocol to include sample preparation method, test sequence, data precision and bias analysis method, and acceptance criteria

▪ Develop recommended specifications for the new test method

▪ Conduct training and transfer the device to the ODOT Bituminous Lab

Description

Two pieces of accelerated polishing device, using the mechanical abrasion and high pressure water jet concepts respectively, have been designed, fabricated, and tested in the initial phase of the study. Based on initial findings, the mechanical polishing utilizing rubber pads was selected for further refinement, validation, and correlation studies. The capability of the developed accelerated polishing device was validated by favorable comparisons with the results from aggregates tests done by the British Polishing Wheel tests as well as by the repeatability and bias analysis of the triplicate sample test results.

Correlation studies have been carried out between the laboratory determined polishing and friction behavior of HMA specimens and the field monitoring results from eight pavement sections using different aggregate sources and the corresponding job mix formula.

The acceptance criteria for the Superpave HMA specimens based on the laboratory accelerated polishing test results have been suggested for screening the acceptance of job mix design during the initial hot mix design.

Conclusions and Recommendations

The developed laboratory accelerated polishing device has been shown to be capable of mimicking the actual wear and polish mechanisms between the
vehicle tires and the bituminous pavement surface.

The developed laboratory accelerated polishing device provides a simple and fast test method that can be used as part of hot mix design procedure to ensure the satisfactory performance of the HMA in the field, especially from the standpoint of providing high polishing resistance and high friction values over the expected life span of the pavement.

The correlations between the laboratory test results and field measured data for the same hot mix have enabled the development of acceptance criteria for screening appropriate aggregate sources and approving a specific job mix formula to ensure satisfactory polishing and friction performance.

It is recommended that the correlation studies between the laboratory test data from the accelerated polishing equipment and the field performance data be continued so that the long-term time history correlations can be established.

**Implementation Potential**

The developed laboratory accelerated polishing equipment has a potential to be adopted by both the state highway agencies, the aggregate producers, the asphalt paving industry, and the test equipment manufacturers for routine testing purpose. It is recommended that ODOT takes an active role in disseminating the findings from this research to the potential users so that additional validation tests and correlation studies can be conducted by different state agencies for their respective aggregate sources and job mix design procedure.
The Ohio Department of Transportation has determined that the developed accelerated polishing device can be a very useful tool for its assessment of the Hot Mix Asphalt Concrete mix design, particularly to ensure long-term satisfactory performance of the pavement surface for skid resistance. As an implementation effort, the ODOT has commissioned the principal investigator to conduct a continuing research: "Long Term Validation of an Accelerated Polishing Procedure for HMA Pavements". This 3-year research effort will collect relevant field friction data and develop correlations between the field friction data the accelerated laboratory friction data. The research would not only validate the proposed acceptance criteria but also facilitate the development of ODOT Supplement Specifications for implementation.