Overview

Since the 1973 oil embargo numerous field construction and maintenance personnel throughout the United States have claimed that asphalt cements have changed and that these changes in asphalts have resulted in construction and early-life performance problems in asphalt concrete mixtures. The general belief of field personnel is that the oil companies are taking the "goodies" out of the asphalt and using them as feedstock for the petrochemical industry. Another widely held belief is that the oil embargo, this country's dependence on foreign crudes, the rapid development of new producing crude oil fields, and economic pressures have forced the oil companies to use less than desirable crudes to manufacture asphalt. Field personnel are convinced that the present asphalt specification tests, which are routinely performed, do not identify the important properties that control field construction and pavement performance.

As evidence of these statements, the field engineers cite a general increase in the occurrence of problems such as placement difficulties (tender mixes), excessive displacement under traffic (low stability), thermal cracking, raveling, and stripping (water susceptibility) of asphalt concrete pavements. These problems result in higher maintenance costs, shorter service life, higher life-cycle costs, and criticism by the driving public.

Certainly the opinions of these experienced field engineers must be heard; however, caution is in order. For example it was indicated that tenderness problems were evident in California pavements in the 1940s. Field engineers complained that asphalt "ain't as good as it use to be" as early as the 1930s, and asphalt cracking problems were evident early in the history of asphalt concrete use. In addition, these claims are often vague in nature and are not supported by definitive physical and chemical property data.

Most construction and early performance problems are associated with more than one potential cause. For example, raveling of an asphalt concrete surface course can be caused by one or a combination of the following factors: poor asphalt quality, low asphalt content, asphalt brittleness, high air void content of mixture, susceptibility to damage by moisture, shear forces due to traffic, and so forth. Clearly, the engineer should investigate all possible causes before "laying blame." Similarly, the properties of the

asphalt cement should not necessarily be blamed for the recent increase in construction and early performance problems experienced on our nation's highways. Basic societal changes including increased weight and number of vehicles, air quality, and worker safety requirements and the development of equipment to increase production have placed ever changing demands on paving materials.

In an attempt to more adequately define historic changes in asphalt cements, research programs were initiated. The papers contained in this publication present information and techniques on the rheology of asphalts, their modification, and their effects. Those papers were presented during the symposium on Rheological Properties of Asphalts and Their Effects on the Mixture Properties and Pavement Performance, which was sponsored by ASTM Committee D-4 on Road and Paving Materials.

This publication is intended to create awareness and understanding of technology relating to asphalt rheology and its influence on pavements performance.

Most of the asphalt cracking problems have more than one cause; however, this publication deals primarily with asphalt and asphalt mixture rheological modifications. A portion of this publication deals with the precision testing of asphalt and asphalt mixtures as related to rheological properties.

The physical and chemical modifications of asphalt rheology allow for a different consideration of mix design and pavement structure since the performance level is indicated to be at a higher range after modification. Modifications, as indicated in the papers, have been accomplished through the use of various additives.

Although the information was largely gathered in laboratories, the information appears promising and needs a greater volume of field data to support the theory.

The information should be of tremendous value to design engineers, materials engineers, contractors, producers, and owners in their efforts to utilize materials of marginal quality, to improve mixture characteristics, and to improve pavement performance.

Oliver E. Briscoe
Maryland State Highway Department, Brooklandville, MD 21022; symposium chairman and editor.