

*P*olymer Modified Asphalt Binders

Wardlaw/Shuler
editors



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***Polymer Modified Asphalt
Binders***

Kenneth R. Wardlaw and Scott Shuler, editors

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Peer Review Policy

Each paper published in this volume was evaluated by three peer reviewers. The authors addressed all of the reviewers' comments to the satisfaction of both the technical editor(s) and the ASTM Committee on Publications.

The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution to time and effort on behalf of ASTM.

Foreword

This publication, *Polymer Modified Asphalt Binders*, contains papers presented at the symposium of the same name, held in San Antonio, TX on 4 Dec. 1990. The symposium was sponsored by ASTM Committee D-4 on Road and Paving Materials. Kenneth R. Wardlaw of Exxon Chemical Co. in Alexandria, VA and Scott Shuler of the Asphalt Institute in Lexington, KY presided as symposium co-chairmen and are editors of the resulting publication.

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Overview

The use of asphalt as a binder in the construction of asphalt pavements had its beginning in the early part of this century. The quality of the asphalt binder varied due to the crude oil sources and the refining processes which often caused considerable distress to the engineer. Asphalt technology attempted to solve many of the problems by establishing criteria for fewer grades from which to make a selection. Tests were developed which have been in use for many years and have served the industry well. Like all things, asphalt and asphalt technology has had to change to keep pace with a dynamic and ever changing transportation system that is placing severe demands upon the structural capability of asphalt pavements. Asphalt binder, supplied for the construction of highways, is being modified to meet these demands.

Asphalt binder is a thermoplastic liquid which will behave as an elastic solid at low service temperatures or during rapid loading. At high temperatures or slow loading, it behaves as a viscous liquid. This classical dichotomy creates a need to improve the performance of an asphalt binder to minimize the stress cracking that occurs at low temperatures and the plastic deformation at high temperatures. Daily temperature changes in most areas of the world have significant effects upon most asphalt pavements. Changes in temperatures and traffic loadings during the life of a pavement makes the design and the selection of materials to resist these stresses extremely difficult, as well as impractical.

Asphalt technologists blend asphalt binders at the refinery to meet the specification requirements of the engineer. However, the current asphalt binder being supplied has not, in many cases, performed as expected. Some engineers believe that asphalt "is not what it used to be." This claim is often made when performance falls short of expectations. However, it is probable that the asphalt which has had a good performance history in the past does not have the engineering properties to meet the demands placed on it by traffic stress of today. New techniques for the production of hot mix asphalt, that is, drum mix plants with bag house environmental control systems, can on occasion produce unexpected results.

Modifying asphalt binders is not new, but to meet the required performance standards for the pavements of today, it appears to be a logical, practical, and economical approach. The economics of a longer performing asphalt pavement does indeed serve the interests of the community as a whole.

Many types of polymers are used to change asphalt binders to achieve a wider performance range for asphalt bound pavement materials. There has been a proliferation of many types of polymers in the last 10 years for use in asphalt binder modification. This has created a need for a new understanding of asphalt binders and asphalt pavement behavior. We have generally used empirical methods to explain asphalt pavement performance and this has been quite adequate for most conditions. However, polymer modified asphalt binders requires the development of new technology as the conventional asphalt test procedures are proving to be inadequate. Many polymer modified asphalt binders tend to behave more as a polymer rather than an asphalt. With the advent of performance based specifications from the Strategic Highway Research Program (SHRP) it will be possible to "design" asphalt binders to meet specific pavement requirements. This opportunity has never been closer to reality. In response to these changes in the industry, this symposium, Polymer Modified Asphalt Binders, was organized

to provide a forum for the research activities currently underway in this area of asphalt materials.

The many types of polymers available for asphalt binder modification has created considerable confusion for the user agencies wishing to specify modified asphalt binders. An attempt to classify the various polymers under a generic chemical terminology is being made by ASTM. SHRP will have a long range effect on asphalt binders. It is still to be determined how many grades of asphalt binders now being used will require some form of modification for the construction of asphalt pavements.

While this is not the first, nor will it be the last symposium on polymer modified binders, it is believed that the papers presented at San Antonio and contained in this publication will give the reader a feeling for the challenge that lies ahead for the engineer and the asphalt technologist. The authors were requested to use the generic terms for the various polymers used in proprietary processes, but some trade names do appear in the text. The papers discuss the use of elastomers such as styrene block copolymers, latex rubber, and various plastomers that include ethylene vinyl acetate (EVA) and polyethylene.

The papers are basically divided into two categories: (1) laboratory studies of polymer modified asphalt binders for hot mix asphalt, and (2) emulsions and full scale field experiments which explore construction aspects of polymer modified asphalt pavements.

It is believed that the Symposium and this publication will help to explain the differences between modified and nonmodified asphalt binder systems. A more fundamental basis for new technology based on polymer modified asphalt binders must be developed. Without this fundamental science many years will be required to develop the empirical basis for judging the adequacy of pavements constructed with polymer modified asphalt binders.

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