

VISCOELASTIC CHARACTERIZATION OF POLYMER-MODIFIED ASPHALT BINDERS OF PAVEMENT APPLICATIONS

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ABSTRACT:

Rutting is a primary reason of premature deterioration of asphalt highway pavements. Pavements constructed with polymer and other modifiers are showing improved performance. The virgin asphalt and modified asphalt binders and mixes used on several test sections of the I-55 highway rehabilitation project in northern Mississippi are compared. The laboratory creep compliance data for these binders were measured at low temperatures using a modified test procedure adapted for the Bending Beam Rheometer device. Dynamic Shear Rheometer was used at high service temperatures. The creep compliance data of the binder was used as an input to simulate creep compliance behavior of the mix using a micromechanical model. The field evaluation confirms the relatively poor performance of the virgin asphalt section with respect to rutting, compared to modified binder sections.

ZUSAMMENFASSUNG:

Fahrrinnenbildung ist ein Hauptgrund für die vorzeitige Alterung von Asphaltbelägen auf Autobahnen. Beläge mit Polymeren und anderen Modifikatoren zeigen eine verbesserte Güte. Der unbehandelte Asphalt und modifizierte Zusatzstoffe und Mischungen, welche auf verschiedenen Testabschnitten des Sanierungsprojektes auf der I-55 im Norden Mississippis benutzt wurden, werden verglichen. Die im Labor ermittelten Daten der Kriechnachgiebigkeit für diese Zusatzstoffe wurden bei niedrigen Temperaturen gemessen, wobei ein modifiziertes Testverfahren benutzt wurde, welches an das Biegebalken Rheometer angepasst ist. Das dynamische Scherrheometer wurde bei hohen Temperaturen eingesetzt. Die Kriechnachgiebigkeitsdaten der Zusatzstoffe wurden als Eingabedaten zur Simulation des Kriechnachgiebigkeitsverhaltens der Mischung benutzt, wobei ein mikromechanisches Modell herangezogen wurde. Die Auswertung der Feldstudie belegt die relativ geringe Güte des Primärasphaltes in Bezug auf die Bildung von Fahrrinnen, verglichen mit den Abschnitten, welche mit modifiziertem Bindemittel asphaltiert wurden.

RÉSUMÉ:

La première cause de détérioration prématurée des revêtements asphaltiques des autoroutes est la formation d'ornières. Les revêtements obtenus avec du polymère et d'autres adjuvants présentent des performances accrues. L'asphalte vierge, l'asphalte modifié avec des liants ainsi que des mélanges utilisés sur plusieurs sections tests de l'autoroute I-55 dans le cadre d'un projet de réhabilitation de cette autoroute du nord du Mississippi, ont été comparés. Des données de relaxation en fluage ont été obtenues en laboratoire pour ces mélanges à basses températures, à l'aide d'un rhéomètre de fluage dont le protocole expérimental a dû être modifié. Un rhéomètre de cisaillement dynamique a été utilisé pour l'obtention de données à hautes températures. Les données de compliance en fluage obtenues pour l'asphalte modifié avec du liant ont été utilisées comme paramètres dans un modèle micromécanique pour simuler le comportement en fluage du mélange. L'évaluation faite sur le terrain confirme les performances relativement pauvres de l'asphalte vierge comparé à l'asphalte modifié avec du liant, en ce qui concerne la formation d'ornières.

KEY WORDS: asphalt, binder, polymer-asphalt, laboratory, pavement, Superpave

trol asphalt and modified asphalt binder properties. Creep compliance and relaxation modulus data for different binders were measured using a modified BBR test procedure. The performance of the modified asphalt binders was better than the virgin asphalt. This was confirmed by more rutting measured on the control asphalt section after four years of traffic.

The mix creep compliance and relaxation modulus results predicted using the micromechanics approach also indicate poor performance of the control asphalt section compared to Rouse Rubber, Sealoflex, and other modified binder sections. The correct time- and temperature-dependent characterization of asphalt materials is imperative for advanced computer modeling and simulation. These improved laboratory material characterization and analysis efforts are needed for more accurate and meaningful structural response analysis of asphalt pavements and prediction of their performance for resistance to rutting.

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DISCLAIMER

The contents of this paper reflect the views of the author who is responsible for the facts, findings, and data presented herein.

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