EVALUATION OF BOND STRENGTH BETWEEN HOT MIX ASPHALT AND STONE MASTIC ASPHALT SURFACING LAYERS

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To my beloved father and mother

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ABSTRACT

Poor bonding between asphalt layers cause many distresses, and the most typical problem is the slippage failure. This failure usually occurs when there are exists insufficient bond between the interfaces of the two layers in contact. Therefore, sufficient tack coat is needed to provide greater bonding strength between pavement layers to be able to withstand traffic and environmental stresses. Thus, this study is conducted to evaluate the influence of tack coat, application rates, and layer thickness on the interface bond strength between hot mix asphalt and stone mastic asphalt. A total of three tack coat materials have been used, which are RS-1K and RS-2K and RS-2KL. These tack coat materials were applied at three different application rates, 0.25 *l*/m², 0.40 *l*/m² and 0.55 *l*/m² which represent low, medium and high application rates respectively in accordance with the JKR specification. Direct shear test has been conducted at shearing rate 1 mm/min and shearing platens 5 mm gap. Analysis obtained shows interface shear strength increased as layer thickness and application rate increase. High viscosity of tack coat produced high interface shear strength than low viscosity tack coat.

ABSTRAK

Ikatan yang lemah antara lapisan asfal menyebabkan banyak kerosakan pada jalan, dan masalah yang paling biasa berlaku ialah kegagalan gelinciran. Kegagalan in biasanya berlaku apabila terdapat wujudnya ikatan yang tidak mencukupi antara permukaan kedua-dua lapisan asfal. Oleh itu, salut jelujur yang mencukupi diperlukan untuk memberi ikatan yang lebih kuat antara lapisan turapan agar dapat menahan tekanan dari trafik and alam sekitar. Maka, kajian ini dijalankan untuk menilai pengaruh salut jelujur, kadar aplikasi, dan ketebalan lapisan pada kekuatan ikatan antara permukaan *HMA* dan *SMA*. Sebanyak tiga bahan salut jelujur digunakan, iaitu RS-1K, RS-2K dan RS-2KL. Ketiga-tiga bahan ini digunakan pada tiga kadar aplikasi yang berbeza, 0.25 *l*/m², 0.40 *l*/m² and 0.55 *l*/m dan tiga kadar aplikasi tersebut mewakili kadar aplikasi rendah, sederhana dan tinggi mengikut spesifikasi JKR. Ujian ricih dijalankan pada ricih 1 mm/min dan jurang ricih pada 5 mm. Analisis yang diperolehi menunjukkan kekuatan ricih antara permukaan lapisan meningkat apabila ketebalan lapisan and kadar aplikasi meningkat. Salut jelujur yang mempunyai kelikatan yang tinggi menghasilkan kekuatan ricih yang tinggi antara permukaan lapisan daripada salur jelujur yang mempunyai kelikatan yang rendah.

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INTRODUCTION

1.1 Introduction

Asphalt pavement plays an important role in order to ensure that the pavement distribute the traffic loadings to the base course. Asphalt pavement consists of several layers and it is depends greatly on the mechanical properties of each layers as well as the bonding between the pavement interlayers to perform better during its service life.

Besides that, pavement surface course consists of wearing course and binder course, which is the crucial part during construction to provide good bonding between the pavement layers in order to maintain the structural integrity of pavement. Therefore, the most important variable which influences the bond between the pavement layers is a tack coat.

The use of tack coat is to provide the sufficient adhesive bond between the pavement layers. Tack coat is a very light application of asphalt, usually it is applied to a new or an existing pavement prior to paving works. Apart from that, the bonding between the pavement layers work together as a monolithic structure in order to withstand the traffic and environmental loading.

Asphalt emulsion is the most common used of tack coat followed by the paving grade and cutback asphalt. However, the use of cutback asphalt as tack coat has significantly decline due to the environmental concern related to the volatile components. Thus, asphalt emulsion is the most favored use as tack coat due to the simplicity of being capable to be applied at lower temperature and relatively pollution free.

1.2 Problem Statement

The influence of surface characteristics on the bonding properties at the interlayer is important to understand better how multilayered pavements behave under traffic conditions**.** Nowadays, problem related to the pavement surface due to the poor bonding no longer new issues. Poor bonding between asphalt layers cause many distresses, and the most typical problem is the slippage failure. This failure usually occurs when there are exists insufficient bond between the interfaces of the two layers in contact as shown on Figure 1.1. Normally, slippage cracking occurs at location where there is a sharp curves and busy junction where the vehicle accelerates and decelerates continuously. However, this problem was also results from where vehicle is likely to exert high horizontal force.

Besides that, other pavement distresses which were related to the insufficient bonding between asphalt layers such as surface layer delamination, premature fatigue and top down cracking and potholes. Despite the presence of any of these distresses can be seriously affects the pavement structural integrity as the loss of bond leads to increased subgrade deformation as well as reduce the riding quality. In Malaysia, delamination and potholes can be considered also one of the most common types of pavement distress which related to the poor bonding due to the less comprehensive guidelines on the proper tack coat application during construction.

Figure 1.1: Slippage failure due to poor bonding between HMA layers (West et al, 2005)

1.3 Objective of the Study

The specific objective of this research was to evaluate the influence of tack coat types, application rates, and layer thickness on the interface bond strength between hot mix asphalt and stone mastic asphalt.

1.4 Scope of Study

This study was focus on the performance of tack coat materials on the stone mastic asphalt (SMA) pavement wearing course. The mixtures with the nominal maximum aggregates size of 14 mm were studied. A total of three tack coat materials will were used, which are RS-1K and RS-2K and RS-2KL. These tack coat materials were applied at three different application rates, which are 0.25 *l*/m², 0.40 *l*/m² and 0.55 *l*/m² represent low, medium and high application rates respectively in accordance with the JKR specification (2008). Three specimens are prepared for

each test. Direct shear test was conducted at shearing rate 1 mm/min and shearing platens 5 mm gap.

1.5 Significance of the Study

This study was carried out to enhance the pavement bonding between the layers. Besides that, the lack of tack coat between pavement layers can lead to premature failure. Thus, this study was investigating the factor that lead to this failure, therefore premature failure can be avoided.

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