COMPARISON BETWEEN THE ROLLING THIN FILM OVEN TEST AND THE PRESSURE AGING VESSEL AGING SIMULATION TESTS

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ABSTRACT

Three samples of fresh bitumen of 80/100 pen, 60/70, and PG70 were tested to determine whether pressure Aging Vessel (PAV) test for 25 hours would provide similar results to the protocol of Strategic Highway Research program (SHRP) coupled aging procedure, Rolling Thin Film Oven Test (RTFOT) and PAV. Bitumen conducted by both procedures (a) PAV only for 5 and 25 hours (b) RTFOT only and RTFOT+PAV 20 hours. Two procedures compared on the basis of the bitumen conventional properties, penetration at 25ºC, softening point, and viscosity at 135ºC tests. This study was intended to simulate the aging process by using Rolling Thin Film Oven Test to compare with Pressure Aging Vessel. The results show that there is equivalence between the effects of using RTFOT and PAV for 5 h at temperature of 100ºC under pressure 2.1MPa for the unmodified bitumen 80/100 and 60/70 penetration. It appears that the modified bitumen binder PG70 has significant difference in the results.

ABSTRAK

Tiga bahan daripada bitumen yang terdiri daripada 80/100 PEN, 60/70, dan PG70 di uji melalui ujian Pressure Aging Vessel (PAV) selama 25 jam untuk mendapatkan keputusan yang sama berdasarkan teknik yang ditetapkan oleh Strategic Highway Research program (SHRP) dengan ujian Rolling Thin Film Oven Test (RTFOT) dan PAV. Proses bitumen berdasarkan dua jenis iaitu (a) Ujian PAV untuk 5 dan 25 jam (b) hanya menggunakan RTFOT sahaja dan RTFOT+PAV untuk 20 jam. Dua proses di bandingkan dengan proses kaedah yang asal. Kajian ini perlu bagi membuat simulasi proses jangka hayat dengan menjalankan ujian Rolling Thin Film Oven untuk membuat perbandingan dengan ujian Pressure Aging Vessel. Keputusan menunjukkan ia adalah sama di antara kesan ujian RTFOT dan PAV untuk 5 jam pada suhu 100 ºC di bawah 2.1MPa bagi bitumen yang biasa iaitu 80/100 dan 60/70 PEN. Bagi PG70 menunjukkan perbezaan yang ketara boleh berlaku berdasarkan prinsip ujian RTFOT.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

It is generally agreed that one of the most important factor that causes asphalt pavements to crack and disintegrate is binder aging, because of hardening phenomena. Hardening of the binder occurs in two different stages. The first stage is short-term aging, because of loss of binder volatile components during mixing. The second stage is long-term aging, because of oxidative hardening during service life. The hardening that results from loss of volatile components has recognized as the significant and the highest aging stage. The hardening that results from oxidation may be strong function of the source or the chemical composition of the original binders. The fact has been proven by early studies on binder aging Anderson (1994).

In the last decades, a significant amount of research has been focused on the use and behavior of asphalt cements within pavement applications. It is well documented that environment plays a significant role in characterizing the paving material properties as a function of time, which in turn affects the pavement performance. The major environmental factors that affect material properties include temperature and moisture changes with time. The original Superpave performance system developed through the Strategic Highway Research Program (SHRP) incorporated mixing and environmental effects as integral components. This has provided the capability to predict temperature and moisture conditions in the structure of the pavement throughout its service life and thus account for specific, short-term and long-term effects of mixing and climate on material properties and pavement performance.

An exclusive of laboratory studying attempted to evaluate neat bitumen physical properties. Bitumen are according to the specification that given by Malaysia Department of Public Works (JKR). This procedure will reflect the binder aging during first stage that mentioned above and binder will compare with short-term aging simulation. The second stage of binder hardening during service life will simulate by pressurized aging vessel (PAV) according to (SHRP) research where it is available in American society of Testing Materials (ASTM). This simulation attends to predict aging during service life between 7 to 10 years as proven recently by Strategic Research Highway Program (SHRP). Aging tests predict binder aging and thus predict its effect on pavement performance.

1.2 Problem statement

Typically, most aging binder specifications conducted by advanced tests such as dynamic shear rheometer where it can be considered to be one of the most complex and powerful instruments for characterizing the flow properties of bitumen. SHRP research has improved binder experimental procedures, specifications and evaluation. Local specification is normally based on conventional properties such as penetration, viscosity, and softening point. There are no items to predict these elements and to be specifically related to the local conditions.

Thus there is a need for detail study the effect of aging using Rolling Thin Film Oven Test (RTFOT), and the pressure aging vessel (PAV).

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