



Laboratory Study on the Effect of Rejuvenator Material on Improvement Fatigue Performance of Aged Asphalt Pavement

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Abstract

Currently about 22 million km of world roads have been covered with asphalt pavements that around 1 million km of them are being repaired and rebuilt per year to ensure safety and performance requirements. Fatigue is one of the most important factors that could reduce the life of asphalt pavements. Over several years, due to the oxidation of bitumen hydrocarbons, the stiffness and flexible property of asphalt pavement is reduced and lead to the micro cracks in asphalt pavement. Using of rejuvenators agents in these mixtures is one solution to restore the initial properties of the aged asphalt mixtures. These agents restore the original ratio of Asphaltene to Maltene, and reduce the formation of cracks in the pavement layers. The purpose of this study is laboratory research on the effect of rejuvenator material in restoring the original properties of asphalt pavement that aged with Rolling Thin Film Oven test. For this purpose, the indirect tensile fatigue test is carried out on initial asphalt samples and aged asphalt samples that containing rejuvenators agents. The result illustrate that the using of rejuvenators materials in aged asphalt samples cause to significantly improvement in fatigue life in comparison with initial asphalt samples.

Keywords: Rejuvenator Material, Asphalt Pavement, Fatigue, Aging, Rolling Thin Film Oven

1. INTRODUCTION

Every year, there is a demand of more than 110 million metric tons of asphalt all around the world. This represents a huge amount of money and energy, from which a good part is for the preservation and renovation of the existing pavements. The problem of asphalt is that it oxidizes with time and therefore its beneficial properties disappear [1]. Cracking due to asphalt layer fatigue, occur of repeated tensile strain that caused by many passing vehicle and pavement expansion due to temperature changes. According to Structural Analysis, Its maximum value is occurring under bitumen layer. Crack will emissions upward after creating that cause gradual weakening of the structure. [2] Corrosion process, largely dependent on the type of asphalt consumption and this process do not occurred only during asphalt surviving time. Chemical and physical properties of bitumen changes in three stages: 1- Operation and mixing time 2- Distribution time on road surface and compression operation 3- throughout the lifetime of the pavement. At The first two, high mixing temperature cause bitumen exhaustion because high temperature due to the presence of oxygen beside the bitumen, oxidation accelerate, Maltyn percent reduced and asphalt with little flexibility are prone to fatigue cracks .[3] At the service time, viscosity of the asphalt surface due to oxidation And having more contact with sunlight increase, the fragility increased and Pavement level because of repeating load putting ,Cracks that the spread of cracks between layers led to pavement failures. [4]

Numerous methods are being employed for asphalt pavement preservation, including rejuvenator emulsions, fog seals, and several different thin overlay technologies. Only the first method, rejuvenators, partially restores the original properties of the pavement. The most important goal of rejuvenator products is to restore the asphaltenes/maltenes ratio [5]. In 1979 at Iowa road office, Zyrly For the first time studied the influence of rejuvenators in old bitumen. He used Step by step extraction method of rejuvenators in old bitumen during the time, realized the penetration rate of this materials in four steps as you see. In the first stage, rejuvenators created a thin layer with low viscosity around the aggregate coated with old bitumen, in the second stage, rejuvenators penetrate into old bitumen and reduce the viscosity of the external wall of the old bitumen .In the next step, rejuvenator penetration into old bitumen and reducing the viscosity continues as far as in the final step, there are not any rejuvenators that did not penetrated in old bitumen. [6] Rejuvenators covered the pavement against water and air penetration, delayed the Oxidation and guarantee the surface rise and ruga which its result is Lifetime increasing in the depth of pavement. [7]