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Experimental Investigation of Visco -Elastic Behavior of Glasphalt Mixtures Using Dynamic Non-Destructive Test

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Abstract

Pavement weakness in the case of dynamic loads and short performance lifetimes are the major concerns regarding their repair and maintenance. Important parameters identification in determining behavior of asphalt mixtures under dynamic loading, can lead to efficient and better design of asphalt pavements. Application of new technologies and ideas in design of asphalt mixtures, cause changes in the pavement functional behavior. Among them, the development of using additive materials in asphalt mixtures for improvement their performance against dynamic loads has significantly increased. In recent years glasphalt mixture due to its unique characteristic has widely considered in the world. Previous researches indicated that glass can reduce the construction costs of asphalt concrete pavements while providing better mechanical and dynamic properties. The purpose of this study is investigation of visco-elastic behavior of glasphalt in comparison with conventional asphalt mixtures. To achieve this gold, the dynamic non-destructive test is carried on glasphalt and conventional asphalt specimens and elasticity modulus of this mixture as an effective parameter in such behaviors determined and be compared and evaluated. The results of this study show an improvement in the visco-elastic behavior of glasphalt in comparison with conventional HMA.

Keywords: Asphalt Pavement, Visco-Elastic, Non-Destructive Test, Glasphalt, Elasticity Modulus.

1. INTRODUCTION

In recent years many efforts has been done in order to increase the resistance of pavement against the factors such as cracks caused by temperature changes, fatigue phenomenon, permanent deformations and for improving the performance of asphalt pavements behavior. One of the ways to achieve these goals is use of waste additives materials that have the ability to improve the mechanical properties of asphalt mixtures [1]. Hot Mix Asphalt layers up to certain limit of repetitive loads have been generally considered with linear elastic behavior [2-7]. So evaluation of the visco-elastic behavior of modified asphalt mixtures with additives and determining the parameters affecting this behavior has particular importance. Of course the larger stresses or higher temperatures can lead to nonlinear behavior of asphalt mixtures which linear models can not explain this behavior [8]. According to Previous researches, response of asphaltic pavement is entirely dependent on the temperature and duration of loading. Perl in 1983 showed that Hot Mix Asphalt (HMA) has all three behavior Includes viscous, linear elastic and non-linear elastic. In other words, has the visco-elasto-plastic behavior. Depending on the temperature of mixture and the loading pressure, the contribution of these behaviors varies in the mixtures performance. Behavior of the asphalt mixtures at low temperatures can be assumed to be linear elastic. With increasing the temperature, properties of linear elastic behavior in HMA is decreased and properties of non-linear elastic behavior is increased. In higher temperature, the behavior of HMA is altered and the viscous behavior of mixture begins [9]. The goal of this study is the evaluation of the behaviors of asphalt mixtures modified with additives waste materials. This research is focused on the elasticity modulus parameter in linear range. In this research, waste glass particles have been used as an additive to the HMA. Previous researches indicated that glass can reduce the construction costs of asphalt concrete pavements while providing a better dynamic behavior because of its unique properties [10]. However, the cohesion between bitumen and stone aggregates can be easily destroyed because of the smooth surface of the glass particles in certain circumstances and would result in asphalt pavements stripping. Additives, like hydrated lime, are usually used to remove the harmful phenomenon of glass-asphalt mixtures while retaining their useful characteristics [11]. Burmister's analytical responses in multi layered elastic systems are used for pavement analysis. Assumptions such as continuity, homogeneous, isotropic and linear elastic behavior are used in these responses. Although HMA has a visco-elastic behavior, the theory of