

Fatigue evaluation of asphalts highly modified with recycled tire rubber

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Abstract

Fatigue resistance is one of the most frequent and most complex problems to predict in asphalt mixtures. Due to its viscoelastic nature, asphalt is the material that presents the greatest contribution to fatigue within the asphalt mixture. The $G^*\sin\delta$ parameter proposed by SUPERPAVE is the most widely used for fatigue evaluation; however, it has its limitations since it does not allow to observe if the sample is damaged, for example.

The results of the present work allow to demonstrate the benefit of the incorporation of the recycled tire rubber as a modifier residue of the asphalt, through the analysis with the rheometer through the proposed test. Finally, the cycle curves are made based on the imposed deformations, which show a greater resistance to fatigue in the asphalt, with increasing rates of tire rubber out of use.

Keywords: asphalt; fatigue; recycled tire rubber; rheology.

Evaluación a fatiga de asfaltos altamente modificados con polvo de neumático fuera de uso

Resumen

La resistencia a fatiga es una de las problemáticas más frecuentes y más compleja de predecir en las mezclas asfálticas. Por su carácter viscoelástico, el asfalto es el material que presenta mayor aporte a la fatiga dentro de la mezcla asfáltica. El parámetro $G^*\sin\delta$ propuesto por SUPERPAVE es el más ampliamente utilizado para la evaluación de fatiga; sin embargo, tiene sus limitaciones ya que no permite observar si la muestra está dañada, por ejemplo.

Los resultados del presente trabajo permiten evidenciar el beneficio de la incorporación del neumático fuera de uso como un residuo modificador del asfalto, mediante el análisis con el reómetro por medio del ensayo planteado. Por último, se confeccionan las curvas de ciclos en función de las deformaciones impuestas, las cuales permiten evidenciar una mayor resistencia a fatiga en el asfalto, con crecientes tasas de caucho de neumático fuera de uso.

Palabras clave: asfalto; fatiga; neumático fuera de uso; reología

1 Introduction

Fatigue in flexible pavements is one of the main causes of reduced service life. The cracking initiated in the lower part of the asphalt mixture is due to reaching a limit of the value of the specific deformation of the asphalt layer [1,2]. The damage caused by fatigue is caused by a combination of the structural design of the package used and the selection of intervening materials. In turn, it has a great impact, the

thickness of the pavement that comes into play, as well as the volumetric properties of the mixture used. Within the asphalt mix, asphalt has a significant role in fatigue failure [3,4]. Studies carried out by means of fracture mechanics and microsimulation indicate that fatigue cracking initially propagates through the asphalt binder, then passing to the mix matrix.

The methodologies proposed by SHRP (Strategic Highway Research Program), such as the evaluation of the PG grade for