

Effect of Mineral Filler on Damage Resistance Characteristics of Asphalt Binders

Ahmed Faheem¹, Haifang Wen², Lawrence Stephenson³, and Hussain Bahia⁴

Abstract

Numerous studies have indicated that the addition of mineral filler to an asphalt binder increases the stiffness of the binder. The stiffening ratio and change in rheological properties have attracted researchers to report data and model the changes due to physical and sometimes mineralogical nature of fillers. There is, however, limited information about the effects of fillers on the damage resistance of binders to permanent strain accumulation and fatigue. In this study, the effects of filler content and type on the damage resistance of mastics (filler-binder system) were investigated. The mastics and binders were tested to evaluate the effects of type and content of the fillers on fatigue and rutting performance of mastics. Two binders and two fillers of different mineralogy, limestone (basic) and granite (acidic), were included in the study. Two filler contents, 25% and 50%, were used by the volume of asphalt binder.

Based on the tests results, it is evident that the presence of fillers significantly increases the complex shear modulus and fatigue life of binders as compared to those of the base binders. It is also found that the fatigue life of mastics was significantly larger than that of binders. The limestone filler was found to have more positive effects on the fatigue resistance than the granite filler. For creep and recovery measurements, tests were conducted at three different temperatures, 52 C, 58 C and 64 C. The addition of the fillers enhanced the resistance to rutting, in terms of total terminal strain and non-recoverable compliance. The binder-filler interactions need to be considered in estimating the performance of mastics and asphalt mixture.

Keywords: Mineral Filler, Mastic, Fatigue, Rutting, Shear Modulus

¹Graduate Student, University of Wisconsin at Madison

² Researcher, University of Wisconsin at Madison

³ Former Graduate Student, University of Wisconsin at Madison

⁴ Professor, University of Wisconsin at Madison