



Experimental Assessment of Mineral Filler on the Volumetric Properties and Mechanical Performance of HMA Mixtures

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Abstract

This research is conducted to evaluate the influence of mineral filler on the volumetric properties, mechanical and field performance of Hot Mix Asphalt (HMA). Two mineral filler types, namely, Hydrated Lime (HL) and Dust Plant (DPT) were used. Three filler proportions were utilized greater than 1% which represents the most applicable percentage, especially for HL, used by the Ministry of Transportation Ontario (MTO). The effect of filler on various volumetric properties including Voids In Mineral Aggregates (VMA), Voids Filled With Asphalt (VFA), dust to binder ratio (Dp) is examined. Mechanical and predicted field performance of HMA to the best filler proportion that meets all the MTO limitations is also investigated. The obtained results indicated that the Optimum Asphalt Content (OAC), VMA, and VFA decrease as the filler content is increased. HMA mixtures that includes DPT filler had the higher values of VMA, VFA, and OAC compared to the hydrated lime. The addition of filler with 2.5% percentage is very successful for both filler types due to satisfying all MTO requirements for volumetric properties of HMA. Based on MTO specifications, the addition of 2.0% filler seems to be unsuccessful for both filler types due to lowering the Dp ratio. Mix design with 3.0% filler was also unsuccessful because of the lower value of OAC meaning that the mix is dry and there is insufficient asphalt binder to coat the aggregate particles. Besides, filler type has a significant effect on the mechanical properties of the HMA mixtures. As a filler in HMA mixtures, the utilization of HL as a portion of 2.5 % leads to a significant improvement in mixture resistance to water and freezing and thawing. The mixtures that included HL have a higher cracking resistance, greater stiffness, and a higher fracture stress than the mixtures that included DPT. Furthermore, predicted field performance indicated better outcomes for mixes with HL compared to DPT mixes.

Keywords: Volumetric Properties; Mineral Filler; Superpave Mix Design; Hot Mix Asphalt; Mechanical Performance of HMA.

1. Introduction

For the construction of road pavements throughout the world, one of the essential materials required is asphalt mixture [1]. It is widely known that asphalt mixture is a heterogeneous material that essentially consists of different

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