



Waste Phosphate in Hot Mix Asphalts to Improve Rutting Resistance

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Abstract

Fillers have an important role in rutting phenomenon on highways. Investigating the rutting behavior of hot mix asphalts containing phosphate waste filler is the purpose of this research. The results compare with mixtures that contain lime stone filler (standard mixtures). The Marshall characteristics were improved for mixtures which contain waste phosphate comparing to standard mixtures. The Wheel tracking machine (WTM) results revealed that phosphate waste filler improved the rutting resistance 1.6 times as compared to the standard mixture.

Keywords: Waste phosphate, Hot mix asphalt, Rutting resistance, Deformation, Wheel Track.

INTRODUCTION

Rutting is a major distress form found in asphalt pavements, especially when the ambient temperature is high as in a hot tropical climate or during the summer months of temperate countries. Rutting is caused by the accumulation of irreversible or permanent deformation in all pavement layers under the action of repeated traffic loading. Among the contributions of rut depth by the various pavement layers, the cumulative permanent deformation in the surface course of asphalt pavement is known to be responsible for a major portion of the final rut depth measured on the pavement surface. Therefore rutting resistance of a paving asphalt mixture is one of the important considerations in standard procedures for asphalt mix design ~Asphalt Institute 1997; SHRP 1994.

Large amount of phosphate rocks are available in Iran. Large proportions of mined phosphate are waste and have a direct negative impact on the environment. Consequently, this research focuses on using a kind of phosphate waste as fillers in a typical wearing course mixture. Such phosphate waste will include the 4.5-mm reject. The limestone filler will be incorporated in a typical wearing course mixture and will be considered in the analysis as a control mixture for comparison purposes. In this research, the optimum binder contents for the mixtures considered will be calculated using the Marshall mix design (ASTM 1974). In addition to investigating the Marshall characteristics of the various mixtures, the wheel tracking machine (WTM) will be used to evaluate mixture resistance to deformation (Specifications 1991). The following sections will consider the properties of the phosphate waste that was used in this research, test methods and their results, and conclusions.

BACK GROUND

The name Phosphorus is derived the Greek word "Phosphoros" that meaning "light bearer & light bearing & bringer of light" which was the ancient name for the planet Venus. Phosphorus is a White, black and brownish-red nonmetal, with the symbol of P, atomic number 15, atomic weight 30.973, specific weight 1.82 gr/cm³, boiling point 280°C and melting point 44.3°C. Its abundance (weight) is 0.13% in the crust. Phosphate is located in periodic table group 15 (VA) and the alteration period 3 and nonmetal Series. White phosphorus (P₄) is a lustrous, soft, waxy, flammable, solid. Brownish-red phosphorus is powdery and usually