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Analysis and Comparison of Performance Characteristics of Asphalt Mixtures Containing Steel Slag and rPET

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ABSTRACT

Asphalt mixtures are composed of two components, namely aggregate and bitumen, so many structural weaknesses of an asphalt mixture can be resolved by modifying these components. In the past, various research works have been done to improve these weaknesses using a versatile spectrum of different materials. Among others, recycled materials have attracted more attention thanks to their further environmental benefits. On this basis, in the present work, steel slag and recycled polyethylene were used with different compositions at different percent dosages. In order to evaluate the effects of these two materials, we used the resilience modulus test, Marshall Resistance test, dry and wet indirect traction tests, and moisture sensitivity test. Results showed that the incorporation of both materials in a mixture provides for a better output than the use of either of them alone. Indeed, the blending of these two materials helps address the weaknesses of either of them.

Keywords: Steel slag, Recycled polyethylene, Asphalt mixture, Performance Characteristics

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1. INTRODUCTION

The lifetime of road pavements is among the most important and effective parameters for the economy of a country. Hence, one of the initial objectives of the design and execution of asphalt pavements for the roads is to achieve the best performance in terms of durability and stability under optimum conditions. The pavement quality depends on various factors, including constituent materials like stone materials (aggregates) and bitumen [1]. Aggregates include the greatest percentage of the mixture, and any change in their type and structure could affect the characteristics of the ultimate mixture. On the one hand, while bitumen has a much lower weight than aggregates, but has a very important role in the performance of asphalt pavements [2]. Changes in the main structure of constituent materials of asphalt mixture are applied with the aim of modifying

and improving the mixture properties and are more directed toward the use of additives with specific objectives [3]. Although researches on the applicable materials used for pavements are very extensive, in a general classification, one could state that such polymers as SBS, SBR, nanomaterials like nano clay, zycotherm, nano lime, recyclable materials like rubber powder, and recyclable polyethylene are among the most important materials that are used for bitumen modification [4,5]. On the other hand, recycled asphalt pavement (RAP) and artificial aggregates such as light polyethylene aggregates and slag are accounted as the main replacement materials for modifying the aggregates [6-9]. Among these materials, the recyclable materials, while improving some properties of the mixture, have many environmental advantages as they prevent the accumulation of waste