Utilization of Recycled Rubber in Concrete Mix Design

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Summary

There is no doubt that the increasing piles of used tires create environmental concerns. As waste continues to accumulate and availability and capacity of landfill spaces diminish, agencies are increasing application and use of recycled materials such as crumb rubber from tires in construction. The basic building materials in concrete construction are primarily aggregate and cement. The educated use of recycled materials can result in reduced cost potentials and may enhance performance; however, not all recycled materials are well suited for concrete construction applications. The two main reasons for not utilizing a reclaimed material are 1) addition of material is a detriment to performance, and 2) excessive cost. In this study, the performance of recycled materials crumb rubber as valuable substitute for fine aggregates ranging from 0% to 100% in replacement of crushed sand in concrete mixes is investigated. An acceptable compressive strength was obtained with up to 25% by volume replacement of fine aggregates with crumb rubber.

Keywords: recycled waste materials, concrete, rubber

1. Introduction

A humongous amount of used rubber tires accumulate in the world each year – 275 million in the United States [1] and about 180 million in European Union [2]. Generally, the cheapest and easiest way to decompose used tire is by burning them. However, the pollution and enormous amount of smoke generated by this method makes burning quite unacceptable and in some countries it is prohibited by law. Thus, one of the most popular methods is to pile used tires in landfills, as due to low density and poor degradation they cannot be buried in landfills (Figure 1) [3]. These tires can also be placed in a dump, or basically piled in a large hole in the ground. However these dumps serve as a great breeding ground for mosquitoes and due to the fact that mosquitoes are responsible for the spread of many diseases, this becomes a dangerous health hazard [4]. In industry higher amounts of rubber tire waste can be utilized as fuel, pigment soot, in bitumen pastes, roof and floor covers, and for paving industry [2, 5, 6].

The main goal of this research is to find means to dispose of the crumb rubber by placement of the rubber in Portland cement concrete mix and still provide a final product with good engineering properties for certain specified engineering applications.

2. CRUMB RUBBER (CR)

Crumb rubber (CR) is a commodity made by re-processing (shredding) disposed automobile tires [7]. Shredding waste tires and removing steel debris found in steel-belted tires generates crumb rubber. There are three mechanical methods used to shred apart these tires to CR: the crackermill, granulator, and micro-mill methods. CR can also be manufactured through the cryogenation

https://doi.org/10.2749/222137810796063409