



Evaluation the Moisture Susceptibility of Asphalt Mixtures Containing Demolished Concrete Waste Materials

Hala Hamza Nazal ^{a*}, Mohammed Qadir Ismael ^b

^a M.Sc. Student, Civil Engineering Department, University of Baghdad, Baghdad, Iraq.

^b Assistant Professor, Civil Engineering Department, University of Baghdad, Baghdad, Iraq.

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Abstract

The distress of moisture induced damage in flexible pavement received tremendous attention over the past decades. The harmful effects of this distress expand the deterioration of other known distresses such as rutting and fatigue cracking. This paper focused on the efficiency of using the waste material of demolished concrete to prepare asphalt mixtures that can withstand the effect of moisture in the pavement. For this purpose, different percentages of waste demolished concrete (0, 10, 20, 30, 50, 70 and 100) were embedded as a replacement for coarse aggregate to construct the base course. The optimum asphalt contents were determined depending on the Marshall method. Then after, two parameters were founded to evaluate the moisture susceptibility, namely: the tensile strength ratio (TSR) and the index of retained strength (IRS). To achieve this, the indirect tensile strength test and the compressive test were performed on different fabricated specimens. The results show that mixtures with a higher percentage of demolished concrete possess higher optimum asphalt content as this parameter increased from 3.9 % for control mixture to 4.5 % for mixture with coarse aggregate that fully replaced by demolished concrete. This work indicated that optimum percent of waste demolished concrete that can be utilized in the asphalt mixtures is 30 %, whereas this percent recorded higher value of increased increments for TSR and IRS by 10.6 % and 7.9 % respectively.

Keywords: Asphalt; Moisture Susceptibility, Recycled Concrete Aggregates; Indirect Tensile Strength; Compressive Strength.

1. Introduction

Recently, the increase of construction prices coupled with the increase of the environmental regulations and awareness has driven a strong movement toward the adoption of sustainable technology in various construction projects including the asphalt concrete pavement [1]. The concrete is the most significant component in the construction and demolition waste. The management of these huge waste quantities is considered as a serious challenge due to the landfill shortage and transport costs. This leads to the introduction of the RCA concrete aggregate as an alternative sustainable material for asphalt mixes. So far, recycle concrete aggregate has been utilized for the production of soil stabilization, new concrete, in addition to materials for the construction of the road pavement, mainly for sub-base and unbound base layers [2]. In the US, as much as 85% of RCA is used as road base [3]. Globally, “the amount of construction and demolition waste generated each year has been estimated to be 1183 million tonnes” [4]. In general, recycle concrete aggregate differs from natural aggregates because the newly created aggregate particles consist of natural aggregate combined with residual cementitious mortar. In addition, as a result of processing construction and demolition waste (C&D waste), it may also contain different impurities such as ceramic products, wood, glass and plastic This feature has a significant

* Corresponding author: enghala.199@gmail.com

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