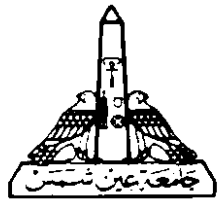

Utilization of Steel Slag Aggregate in Hot Asphalt Mixes in Egypt

A Thesis
Submitted to the Public Works Department
Faculty of Engineering
Ain Shams University
for the Fulfillment of the Requirements of M. Sc. Degree
In Civil Engineering (Highways and Traffic)

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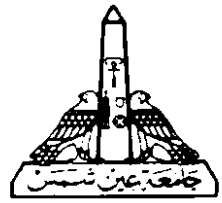
Cairo, 2018



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Date: …../…../ 2018

DEDICATION

This work took a part of my life. I wish to dedicate it to who suffered to educate, prepare and help me to be as I am,

TO MY MOTHER AND MY FATHER

Also, I wish to dedicate my thesis

to my brothers and my sisters

for their encouragement and help to complete this work.

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Statement

This dissertation is submitted to Ain Shams University, Faculty of Engineering, Public works department for the degree of M. Sc. in Civil Engineering (Highways and Traffic).

The work included in this thesis was carried out by the author in the department of Public Works, Faculty of Engineering, Ain Shams University, from 2017 to 2018.

No part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

Steel slag is a byproduct from either the conversion of iron to steel in a basic oxygen furnace, or the melting of scrap to make steel in an electric arc furnace. If not used it will end up in landfills costing money and causing environmental problems. Concurrently the world faces many problems with management of disposals. Nowadays many countries utilize their production of steel slag in different fields of industry such as cement industry and road construction. Many research papers have shown that using steel slag in road construction especially in asphalt mixtures has a lot of benefits. Therefore this study aims to evaluate the performance of hot mix asphalt (HMA) containing steel slag aggregate (SSA) as a coarse aggregate replacing the coarse portion of traditional aggregate in the Egyptian environment.

The physical characteristics of SSA were evaluated to determine its viability to be used in HMA. Six percentage of SSA (0%, 20%, 40%, 60%, 80%, 100%) were used to conduct HMA mixtures according to Marshall mix procedure. Two types of mixtures (4-C, 3-D according to the Egyptian code of practice classification) were investigated in this study. Mixtures performance was assessed using Marshall stability, flow, stiffness, indirect tensile strength (ITS), loss of stability test, dynamic modulus, and flow number test.

Results have shown that adding SSA to the HMA improving the mixtures performance. It was also observed that the 60% SSA is the optimal replacement percentage as the 60%SSA mixture improved all the mechanical properties. Based on these test results SSA could be especially beneficial in Egypt in both binder and surface courses.

Key words: steel slag aggregate, asphalt mixtures, Marshall, indirect tensile strength.

Acknowledgement

First, and foremost, thanks are due to Allah,

the most beneficent and merciful of all.

In the beginning I would like to extend my sincere thanks and respect to **Prof. Dr. Hassan Mahdy** who helped and supported me to finish this work.

Having a supervisor like **Prof. Dr. Khaled Kandil** was one of the best experiences I had. His care, patience, support and encouragement, are most appreciated. Despite his busy program, his door was always open for my questions, problems, and guidance to recover when my steps faltered.

I am greatly indebted to my colleagues for their appreciated help and support in the field works of my research.

I also wish to thank all staff members and colleagues of the public works department, Ain Shams University, for their kind help, moral support and nice feelings.

Table of contents

Statement ..... **I**

Abstract ..... **III**

Acknowledgement ..... **V**

Table of contents ..... **VII**

List of figures ..... **XIII**

List of tables ..... **XVII**

List of abbreviations **1**

Chapter One Introduction **1**

1.1 Background 2

1.2 Problem Statement 4

1.3 Objectives 5

1.4 Thesis Organization 5

Chapter Two Literature Review **7**

2.1 Introduction 8

2.2 The Production, Formation, Classification, and Basic Properties of Steel Slag 9

2.2.1 Production of steel slag 9

2.2.1.1 Basic Oxygen furnace 10