



**Faculty of Engineering
Department of Public Works**

EFFECT OF USING THE GRAVEL IN WARM MIXES ASPHALT IN IRAQ

A Thesis

Submitted to the Faculty of Engineering
Ain Shams University for the Partial Fulfillment
of the Requirement of M.Sc. Degree
In Civil Engineering
(Highway and Traffic Engineering)

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CAIRO-EGYPT

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Statement

This dissertation is submitted to Ain Shams University, Faculty of Engineering for the degree of M. Sc. in Civil Engineering.

The work herein was carried out by the researcher in the Department of Public Works, Faculty of Engineering, Ain Shams University.

In any form, no part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

Therefore, 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.

Date: / / 2014

Signature:

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Acknowledgement

I am heavily indebted to my indefatigable supervisor; Prof. Hassan Mahdy. I am very grateful to him, for his continuous support, ceaseless encouragement, and fatherly instructions during the process of making this thesis. Indeed, without him, my thesis would not have come into being.

Likewise, my sincere gratitude goes to Dr. Hamdy El-Sayed Ibrahim for his constructive and backbone guidance. Frankly speaking, his priceless inputs were of monumental importance in the well being of my thesis.

In the same vein, I wholeheartedly thank Dr. Nabil Ibrahim, whose advices were always the solution to my lot problems in achieving this thesis. His bids taught me to be persistent in accomplishing the thesis.

Moreover, I can not, but pour my votes of thanks to Prof. Dr Khaled Kandil on his thoroughbred and warming kindness and support. And so, Mohammad Al-Naqyib, I will always doff my hat for your support.

I would like to sincerely render my gratitude and appreciation to my dear Shatha; the engineer responsible for road laboratory in the Faculty of Engineering, University of Tikrit.

For Mr. Tariq Karim, the Manager of laboratory structural in Salahuddin province I extend my big thank to you, just like also the kind officials of the laboratory (Eng Ahmed Ibrahim and engineer Um Ahmed), I will live to remember your utmost help. I find it necessary to thank with heartfelt gratitude to my dear Engineer Asmaa El-Rufai who gave me hand anytime need arose. The same thing goes to my entire friends and well wishers; Saleh Hassan Mahmoud, Eng. Ahmad Atef, Eng. Ahmad eldsuky, Alaa Abu Bakr as well as Osama Yossef, I sincerely thank you for the love and support. Nevertheless, I will be unfulfilled without thanking my caring father and mother; you have always been the secret behind my success. My brothers and sisters, I hail and appreciate your meaningful backing; really you are brothers and sisters indeed.

Last, but indeed not the least; I wholeheartedly express my heartfelt gratitude to my darling wife and sons, who have always been encouraging. I thank everybody who helped me in this thesis on one way or the other. I remain indebted and thankful to you all.

Abstract

There are constantly technological improvements in the asphalt industry that would enhance the performance of materials and increase the efficiency of the pavement and preservation of the resources and the environment. It makes sense that these goals are achieved through reducing the temperatures of asphalt mixes production and hence introduction of the concept of warm mix asphalt over the past few years as a mean to achieve these goals. In this research the asphalt mixes have been produced utilizing gravel commonly used in the construction of roads in Iraq. Necessary tests have been conducted to assess the possibility of using this technology with gravel and their conformity with the Iraqi Standard Specification for Roads and Bridges (SCRB) and American Association of State Highway and Transportation Officials (AASHTO). Gravel is one of the important materials which affects the properties and the quality of the asphalt mix.

There are two types of gravel used depending on the type of road and type of layer to be established. The objective of this research is to study the impact of gravel on the properties of the Warm Mix Asphalt as it affects the strength and durability of the mix. Therefore crushed and non- crushed gravel have been used with different bitumen contents and additive in Warm Mix Asphalt. The asphalt mix design was made using the Marshall Method for aggregates gradation values in the middle of the Iraqi standard specifications. Also, two types of bitumen grade (bitumen 40/50 and 60/70) were used in this research. Results were compared to the corresponding results for Hot Mix Asphalt.

Therefore, the work was divided into different tasks to know the effect of changing the proportion of additives on the asphalt mix as well as the effect of changing the content of bitumen in the asphalt mix. An assessment of the basic engineering properties of the mixes stabilized Marshall requirements was implemented. Also an assessment of the performance of the mix was implemented through the indirect tensile test, loss of stability test and wheel tracking test. The analysis and discussion of the results have been done. This research emphasize the benefits of using Warm Mix Asphalt technology in terms of environmental, economic, production and paving

aspects. Test results showed that the temperature could be reduced for processing of these mixes to approximately 130 °C to achieve the required properties that meet standard specifications. In Conclusions this research addresses possibility of using gravel in warm asphalt mixes technology.

Keywords

Warm Mix Asphalt (WMA), Aspha-min® zeolite , WMA technologies and description of products, Crushed Gravel, Marshall Mix design, Tensile Strength ratio (TSR), wheel track test.

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