شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

MONA MAGHRABY

Cairo University

USING MODIFIED EMULSION TO IMPROVE COLD IN PLACE RECYCLING PROPERTIES (CIR)

By

Eng.Eslam MohamedEl_Bahady Abdallah

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Civil Engineering – Public Works

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

- *The Student must Return to the Postgraduate Office
- ** It must be Bold

USING MODIFIED EMULSION TO IMPROVE COLD IN PLACE RECYCLING PROPERTIES (CIR)

By

Eng.Eslam MohamedEl_Bahady Abdallah

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Civil Engineering – Public Works

Under the Supervision of

Prof. Dr. Laila Salah El-Din Radwan

Professor of Highways, Airports, and Traffic Engineering
Public Works Department
Faculty of Engineering, Cairo University

Prof. Dr. S. S. Name**

………………………………

Associate Professor
Department Name
Faculty of Engineering, Some University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

- *The Student must Return to the Postgraduate Office
- ** It must be Bold

USING MODIFIED EMULSION TO IMPROVE COLD IN PLACE RECYCLING PROPERTIES (CIR)

By
Eng.Eslam MohamedEl_Bahady Abdallah

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Civil Engineering – Public Works

Approved by the
Examining Committee

____
Prof. Dr. First E. Name, Thesis Main Advisor**

____
Prof. Dr. Second E. Name, Advisor**

____
Prof. Dr. Third E. Name, Internal Examiner**

____
Prof. Dr. Fourth S. Name, External Examiner**
- Write his Work & Place

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

- *The Student must Return to the Postgraduate Office
- ** It must be Bold

Engineer's Name: Eslam MohamedEl_Bahady Abdallah
Date of Birth: 20/9/1992
Nationality: Egyptian
E-mail: eslammohamedabdallah@gmail.com
Phone: 01151317406
Address: ……………………………….

Registration Date: 1/10/2016
Awarding Date: …./…./……..
Degree: Master of Science
Department: Highway, Airport, and Traffic Engineering

Supervisors:

Prof. Dr. Laila Salah El-Din Radwan
Dr. …………..

Examiners:

Prof. ………………… (Thesis main advisor)
Prof. …………………(advisor)
Prof. …………………(Internal examiner)
Prof. …………………(External examiner)

(Any External Prof Dr. must write his work place)

Title of Thesis:

USING MODIFIED EMULSION TO IMPROVE COLD IN PLACE RECYCLING PROPERTIES (CIR)

Key Words:

Cold in place recycling (CIR);styrene-butadiene rubber (SBR); modified emulsion; cold recycling; design cold mix

Summary:

Cold in place recycling recycle old existing pavement layers by addition water, additives and emulsions without heat to create new binder layer. It is used in local streets, airports, parking and highway roads. CIR layer should has high stability and resistance to the moisture damage. In the research, cationic slow setting emulsion (CSS-1h) is used with copolymer styrene-butadiene rubber (SBR) to improve the stability by 39%, and the resistance of the moisture damage by 40% for CIR mix compared to emulsion only without using copolymer. Modified emulsion increases indirect tensile strength (ITS) between particles with each other by 32% for CIR mixtures, also improves cracking resistance, and rutting resistance by 71%. In Egypt, the usage of CIR layer decreases the cost, the time, increases life time of the pavement with overlay, and saves the energy in addition to environmental benefits compared to alternative maintenance methods. CIR process saves the cost by 25-40% using asphalt emulsion and 33-48% using foam bitumen.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Date: ../../…(it's the date that you handover the thesis)

Signature:

Dedication

I dedicate my thesis to my parents and sisters which supported me to complete this study. I thank my responsibility and my friends in the work to save all required possibilities to make tests and save their experiences to do this with best methods. Finally, I thank the professors and doctors' faculty of engineering, Cairo University ahead of them professors and doctors' highway, airport, and traffic department.

Acknowledgments

I would like to kindly thank all those who helped me with their valuable support during my research to accomplish my master's thesis.

First I would like to thanks and my gratitude to my professor DR.Laila S.Radwan , for her thoughtful guidance and support me throughout this thesis and through many difficult times my work.

I thank my responsibility and my friends in my work at garblt to save all required possibilities to make tests and save their experiences to do this work by best methods.

Last but not least, I appreciate my family, which I owe a big debt of gratitude to them for their full support during my entire life.

Table of Contents

List of Tables

List of Figures