ABSTRACT of M.SC. THESIS

Title	**:**	**Bond Behaviour of High Strength and Corrosive Resistant Steel Reinforcement**
Submitted by	**:**	Judy Mohamed Ibrahim Soliman
Supervisors	**:**	Distinguished Prof. Dr. Sami Rizkalla Prof. Dr. Aly Sherif Abd El-Fayad Dr. Tarek Kamal Hassan

ABSTRACT

Bond between the concrete and the reinforcing steel is the main factor affecting the behaviour of the reinforced concrete structures. Advances in material science have led to the production of High Strength reinforcing bars that are characterised by their higher strength and corrosion resistance compared to the conventional steel. Using these bars allows the reduction of the reinforcement ratio hence leads to a more economical design and expand the service life of concrete structures.

The objective of this research is to evaluate the bond behaviour of High Strength reinforcing bars for concrete structures and to study the effect of different parameters believed to affect

the bond characteristics. Nine reinforced concrete spliced beams were constructed using ١٣ mm and ١٩ mm bar diameters, having different development lengths and levels of confinements. The beams were tested using Four Point bending setup to provide constant moment region over the splice zone. Test results indicate that using a splice length of ٣٠ϕ, stresses up to ٨٥٠ MPa and ٦٣٠ MPa can be developed for bar sizes ١٣ mm. and ١٩ mm. MMFX bar without confinement, respectively. Using the minimum spacing for ١٠ mm. diameter stirrups for ٣٠ϕ splice length, the ultimate tensile strength and the yield strength can be developed for the ١٣ mm. and ١٩ mm. MMFX bar, respectively. Research findings indicate that published equations of the ACI ٤٠٨ Committee report (٢٠٠٣) can be safely used to predict the splice strength of MMFX steel reinforcement with a reduction factor of ٠,٩٢. Splice strength can be also very conservatively predicted by the Egyptian Code (٢٠٠٢). Using test results of this research combined with test results by researcher at N.C. State University, a rational model to estimate the stresses in spliced MMFX bars was developed which can be adequately used to predict the splice strength of MMFX steel reinforcement.

INFORMATION ABOUT THE RESEARCHER

Name	**:**	Judy Mohamed Ibrahim Soliman
Date of Birth	**:**	February. ٥, ١٩٨٣
Place of Birth	**:**	Cairo, Egypt
Qualifications	**:**	B. Sc. Degree in Civil Engineering (Structural Eng.) Faculty of Engineering, Ain Shams University-Hon. (٢٠٠٥)
Present Job	**:**	Teaching Assistant in Structural Engineering Department, Faculty of Engineering, Ain Shams University
Signature	**:**	*Judy Soliman*

EXAMINING COMMITTEE

Name and Affiliation	Signature

Prof. Dr. Aly Abd El-Rahmen Youssef

Chairman of Cairo University

Professor of concrete structures

Cairo University, Cairo, Egypt

Prof. Dr. Abd Allah Abd El-Moteleb Abo-Zeid

Professor of concrete structures

Ain Shams University, Cairo, Egypt

Prof. Dr. Aly Sherif Abd El-Fayad

Professor of concrete structures

Ain Shams University, Cairo, Egypt

<u>STATEMENT</u>

This thesis is submitted to the Engineering Faculty of Ain Shams University for the degree of Master of Science in Civil Engineering (Structural Engineering).

The work included in this thesis has been carried out by the author in the department of Structural Engineering, Ain Shams University, from October ٢٠٠٥ to December ٢٠٠٧.

No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

Date ٢٧ / ١٢ / ٢٠٠٧

Signature *Judy Soliman*

Name **JUDY MOHAMED IBRAHIM SOLIMAN**

ACKNOWLEDGEMENT

First I would like to start by thanking God for his many blessings throughout my life and through whom everything is possible.

Next I would like to thank North Carolina State University for supplying the MMFX steel and for their generous financial support of this research.

It is with sincere gratitude that I thank my advisor, Dr. Sami Rizkalla for his time, help, guidance, advice and support. It is a true pleasure to work with such a unique professor by all means. I would also like to thank Dr. Aly Sherif for being such an outstanding teacher, I would like to thank him for his continues advices and support and for making this thesis appear in such a period of time. Thanks are extended to Dr. Tarek Hassan, for his guidance throughout my studies and his generous and continuous support. It is such a great honor to work with such an exceptional man, who is willing to help, support and guide his students.

I am greatly indebt to Dr. Amr EL-Deeb for his sincere help and guidance with all aspects of material work and test set-up solid equipments, without him this experimental work would never had been as precise as it has been.

Thanks are extended to my fellow colleges at Ain Shams University for their help and friendship.

I really want to thank the entire staff at the Structural Laboratory of Ain Shams University, especially Mr. Mahmoud Badr for his help with all aspects of this project. His assistance was invaluable in dealing with the details of laboratory testing. Mrs Magda Hanafi Mahmoud and Mrs Wallaa Khairy Ahmed can not be thanked enough for their constant presence and help with the intricacies of the administrative requirements.

I am truly thankful to my cousin, Amr Hosny for his sincere help in providing the necessary data for the analytical model presented in this thesis. Amr's extensive knowledge was a tremendous asset to this analysis. It was truly a joy to work with someone with such compassion, commitment and professional skills.

I would like to thank all of my family and friends for their support, guidance and encouragement throughout my life and studies.

I would like to extend a heartfelt thank to my dear and be-loving husband Mr. Karim El Mestekawy, for his unconditional love, patience, understanding and encouragement. He just made things so much easier for me to accomplish this work.

Finally, I would like to express my appreciation to my unique parents for their love, guidance, help and support.

DEDICATION

To my parents

Who are the reason why I am everything I am

To my husband

For whom I am trying to be the best I can

Thank you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES