



The American University in Cairo

School of Sciences and Engineering

**Strengthening of Lightweight Autoclaved Aerated Concrete
Masonry Wall Using Ferrocement**

BY

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A thesis submitted in partial fulfillment of the requirements for the degree
of

Master of Science in Construction Engineering

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Fall 2013

Acknowledgement

In the name of Allah, The Most Gracious and The Most Merciful

First and foremost I would like to thank gracious GOD for His continuous support, guidance and giving me the knowledge and ability to accomplish this work.

I would also like to take this opportunity to thank all those who made the completion of this thesis possible.

I express my deepest gratitude to my supervisor, Dr. Mohamed Abdel Mooty, for his continuous enthusiasm, inspiration, and efforts to explain things clearly and simply. I have been able to acquire a lot of skills and experience during the years of working with him. This thesis would not have been done without his great help and advice. I would like also to extend my gratitude to Dr. Ezzat Fahmy and Dr. Naguib Abou Zeid for always giving me the confidence to conquer and advance. In addition, I would like to thank Eng. Ezat Sallam for his great help in finishing the finite element analysis of this thesis using ANSYS software program.

I would like to extend my gratitude to all the engineers, technicians and workers in the Materials and Structures Laboratories of the American University in Cairo (AUC). I wish to express my warm and sincere thanks to my colleagues; Eng. Yomna Ali, Eng. Yosra El Maghraby, Eng. Sherif Shaaban, Eng. Waleed Alkady and Eng. Mohamed Saleh. In addition, I would like acknowledge that this thesis was supported by award No. UK-C0015 made by King Abdullah University of Science and Technology (KAUST)

Last but not least, I want to thank my parents and I devote this thesis to them. Because of their spiritual support, I have been able to accomplish my masters program at AUC.

ABSTRACT

Ferrocement sandwich wall system with core of AAC blocks has been developed to act as a wall bearing structural system instead of conventional reinforced concrete elements. The proposed structural wall bearing element is suitable for building in the harsh climates such as the desert environment. The proposed system should provide the desired properties such as thermal insulation, crack resistance, and environment friendly as well as the ease of construction. Different tests were conducted to assess the physical, and mechanical strength, and thermal conductivity for the proposed structural system and to highlight its advantages and limitations of it. Experimental, theoretical, and analytical model investigations were conducted to examine the effectiveness of using this application of ferrocement.

The experimental program is designed to investigate the effect of selected parameters on the behaviour of ferrocement reinforced AAC masonry wall. The selected parameters included: thickness of the AAC bricks, type and presence or absence of shear connectors, and the type of the mortar. The experimental program is divided into three types of testing in this research. The first and the second tests aimed at determining the mechanical properties of the ferrocement walls, namely axial compression loading testing, flexural loading testing. The third testing is in-plane lateral loading testing conducted to simulate seismic and wind load effect on structural walls. This thesis included thirty eight specimens which were examined using different kinds of tests. A total of twenty three specimens were tested under axial compression loading, and five specimens were tested under bending as simply supported flexural elements, while ten full scale wall specimens were tested under lateral in-plane loading.

Theoretical models were developed to simulate axial compression, and flexural loading model. A comparison between the theoretical and the experimental results was conducted and showed reasonable agreement, which served as verification for the developed models.

A finite element model was developed and verified against the experimental work to represent the masonry wall and the ferrocement overlay. A commercial general purpose

finite element programme named ANSYS was used to develop the models of the test specimens due to its ability to deal with causes of nonlinearity including material and geometrical nonlinearities. The results of the finite element model correlate well with the experimental results which served as verification for the analytical model. Thus, the analytical model could be used in the future to investigate additional parameters.

The experimental, theoretical, and analytical results showed that the proposed ferrocement sandwich wall system is applicable as wall bearing structural element. Yet, further work needs to be done in order to deeply investigate other relevant properties of this innovative system.

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