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Strengthening of Lightweight Autoclaved Aerated Concrete Masonry Wall Using Ferrocement

BY

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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 highlights 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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