AN INNOVATIVE TECHNOLOGY FOR PRODUCING ECO-FRIENDLY GEO-POLYMER COMPRESSED EARTH BLOCKS

By

Nouran Mohammed Abdelfatah Mohammed Eloani

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
Structural Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
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Title of Thesis:

An Innovative Technology for Producing Eco-Friendly Geo-polymer compressed Earth Blocks

Key Words:
Compressed Earth Blocks; Vibrated (CEBs); Slag; CKD; Geo-polymer Earth Blocks.

Summary:
The thesis represents an experimental program designed to study the possibility of replacing cement as a stabilizer in earth blocks by industrial by- product such as slag or thermally treated cement kiln dust in different temperature degrees. The effect of using different curing regimes on the performance of earth blocks, the effect of different ways of compaction, activator modulus (Ms) and water to binder ratio on the strength of compressed, vibrated earth blocks. Using slag, thermally treated CKD with alkali activators geo-polymer earth bricks was produced with properties complying with the Egyptian Standard Specifications (ESS).

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:

Signature:

Dedication

My Dad, Mum & My Husband,
My family that has a great effect on my life,

All my love to you
To Dr Mohamed Serag

Who has a great effect on my life

Acknowledgments

First of all, thanks to **GOD** for giving me the effort to complete this work. Thanks a lot for my eminent professors who led me a lot for getting this work.

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Abstract

The need for eco-friendly building materials for sustainable development is now a major environmental issue in the construction industry. Compressed earth blocks are an old heritage needs to development to fit the development of construction field and to be compatible with the new standard specification of building bricks. Over the last decades the researchers tried to use the eco-friendly bricks because of its compatibility with the environment and its low costing compared with the ordinary burnt bricks. Those trials depended on using cement as the main stabilizer material with lime and trials to use cement kiln dust (CKD) as a partial substitution of cement with different percentages. In this thesis the steel slag was used as a main geo-polymer component to produce geo-polymer earth blocks. An extensive research works carried out in Cairo University under the supervision of Prof Dr. Mohamed Serag, two Pending Patents [No 106/2018] and [No 640/2018] Introduced to the Academy of Scientific Research and Technology (Patent Office), the first concerning activating the CKD through thermal treatment to enhance its cementitious properties while the second concerning the production of geo-polymer earth blocks using industrial by-products. These bricks reduce the consumption of gas and fuel which are necessary for burning the silt bricks and the high price of cement which is necessary for producing cement bricks and burnt clay bricks.

Key Words:
Compressed Earth Blocks; (CEBs); Vibrated; Slag A; Water Cooled Steel Slag; CKD; Thermally Activated CKD; Geo-polymer Earth Blocks.