

**COMPARATIVE STUDY ON BUILDING MATERIALS FOR  
THE CONSTRUCTION OF REFUGE SPACE**

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Degree of Master of Science

Department of Civil Engineering

University of Moratuwa

Sri Lanka

May 2020

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Thesis submitted in partial fulfillment of the requirements for the degree Master of  
Science in Civil Engineering

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## DECLARATION

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## **ACKNOWLEDGEMENT**

I am grateful to gain this opportunity to express my thanks to the individuals who have so far guided me to successfully complete this research project.

I wish to thank my supervisors, Prof. M. T. R. Jayasinghe, Senior professor, Department of Civil Engineering, University of Moratuwa, Dr. C. S. Lewangamage, Senior lecturer, Department of Civil Engineering, University of Moratuwa, Prof. Tim Ibell, Professor, Department of Architecture & Civil Engineering, University of Bath for the immense support and guidance provided throughout the year to successfully complete the research study.

My heartiest gratitude to Prof. (Mrs). C. Jayasinghe for the valuable advices, guidance and support in the success of this research and report. My sincere thanks to Prof. S. A. S. Kulathilaka, Head of Department of Civil Engineering, University of Moratuwa, for his support and providing the necessary facilities in completing this study. The valuable suggestions and comments of Dr. J. C. P. H. Gamage and Dr. H. G. H. Damruwan are acknowledged.

I am obliged to give my special thanks to Eng. M. B. J. N. Fernando, EPCI homes (Pvt.) Ltd. for providing space and resources for the construction of refuge space

Furthermore, sincere thanks to the staff of the Department of Civil Engineering, University of Moratuwa for the support and guidance provided towards this research. I extend my gratitude to all previous researchers, whose contributions I have made use of in carrying out this research project. Last but not least, I am truly thankful to all my colleagues for the great help extended when carrying out the research project from the beginning to the end. Thank you.

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## **ABSTRACT**

With the effects of climate change, natural disasters are becoming more severe and more frequent, resulting in loss of lives and an impact on a country's economy. Disaster resistant structures play a vital role in preventing loss of lives and damage to the belongings. As a consequence of a whole disaster resistant house being unaffordable, converting a part of the house to a disaster resistant refuge space could be attractive and could pave a way to build resilient communities.

Selecting a suitable building material is a vital decision as they account for almost 60% of the total cost and govern the disaster resistance of the structure. There are many options to choose from alternative materials in addition to conventional building materials. One such alternative material is produced by recycling Expanded Polystyrene (EPS) wastes. It is the EPS based lightweight concrete (LWC) wall panels.

This study aims at evaluating the material properties and characteristics of this construction method. A detailed comparative study was conducted in comparing the strength, durability, thermal performance, embodied energy and carbon footprint of the LWC panels to the conventional building materials: bricks and cement blocks. Furthermore, this study presents details of work study and cost analysis conducted on a full-scale model construction. The potential of LWC panels as a mainstream building material is shown with the comparative study.

Moreover, this study presents the aspects of a survey conducted among experienced and young engineers, professionals, and the general public on the importance of material properties. This thesis also discusses a multi-criterion decision problem solved through the Analytical Hierarchy Process (AHP) in obtaining the most suitable material as a case study.

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## **LIST OF ABBREVIATIONS**

EPS – Expanded Polystyrene

LWC – Lightweight concrete

AAC – Autoclaved aerated concrete

FB – Fired bricks

HCB – Hollow cement blocks

URM – Unreinforced Masonry

NERDC – National Engineering Research Development Centre

BSR – Building schedule of rates

EE – Embodied energy

CF – Carbon footprint

MCDA – Multi-criteria decision analysis

AHP – Analytical Hierarchy Process

INT – Interior

EXT – Exterior