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

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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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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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