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# ALTERNATIVE BUILDING MATERIALS AND METHODS FOR SRI LANKA

by

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**A thesis submitted to University of Moratuwa  
for the Degree of Doctor of Philosophy**

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## ABSTRACT

The housing requirement in Sri Lanka is rising due to the growth of population and urbanisation. This rising demand has to be met in an environment of rapidly rising prices of conventional building materials. Over exploitation of conventional building materials such as bricks, sand and timber has caused a number of environmental problems such as excessive clay and sand mining and deforestation. In this context, introduction of cost effective and environmentally friendly alternative building materials is of considerable importance. Such alternative building materials should be sufficiently strong and durable so that social acceptance would be at a reasonably high level.

In the research work presented in this thesis, cement stabilised soil blocks are introduced as an alternative to brickwork and cement sand blockwork. These blocks are manufactured with laterite soils using a suitable machine. Since brickwork can be used as a loadbearing material with considerable saving for residential buildings, an attempt was made to use cement stabilised soil blocks also as a loadbearing material. This will require structural designing of residential buildings for which the design methodology, design data and the quality controlling required at construction need to be established. A detailed experimental programme was conducted to establish such information as a part of the research work presented. These findings can be used to carryout detailed structural design of cement stabilised soil block structures and hence it will now be possible for practising engineers to introduce this technology to Sri Lanka with a lot of confidence. A detailed design study and a cost study are also presented as guidance.

Reinforced concrete solid slabs are often used in multi-storey residential buildings as the preferred option in Sri Lanka. These insitu cast slabs need a considerable amount of formwork and falsework. Since timber is a scare resource, the prices are increasing rapidly, thus making solid slabs an expensive solution for floor slabs. The utilisation of concrete in solid slabs is also not optimum. As an alternative to insitu cast solid slabs, a precast reinforced concrete composite beam slab system is introduced. This system has optimised usage of concrete, steel and minimises the need for formwork and falsework, thus leading to considerable savings in cost. The results of load testing are used to show that these composite slab systems can be designed by using the guidelines given in BS 8110 : Part 1 : 1985. It is also shown that only 66.67% of the concentrated imposed load need be considered for the design of individual precast slab panels of the composite system due to load sharing. A detailed cost study is also presented which can be used as guidance for cost comparison purposes. Therefore, now it would be possible to use this cost effective slab system in residential buildings with a lot of confidence and also to adopt it for other buildings as well.

**Key words:** cement stabilised soil blocks, precast reinforced concrete slabs, alternative building materials.

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## **Declaration**

This thesis is a report of research work carried out in the Department of Civil Engineering, University of Moratuwa, between July 1995 and February 1999. Except where references are made to the other work, the contents of this thesis is original and includes nothing which is the outcome of work done in collaboration. The work has not been submitted in part or in whole to any other university. This thesis is 215 pages.

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