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DURABILITY PROPERTIES OF EARTH BUILDINGS


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DECLARATION

I, Kokila Pranad Arandara, hereby declare the content of this thesis is the output of original research work carried out over a period of 12 months at the Department of Civil Engineering, University of Moratuwa. Whenever others' work is included in this thesis, it is appropriately acknowledged as a reference.

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Abstract

Soil was a popular building material in Sri Lanka with many indigenous construction techniques. Although there were many houses constructed with soil based materials in the ancient times, burnt clay bricks and cement blocks have overtaken the indigenous walling materials in the recent past. However, with the prevailing sand crisis and environmental problems associated with modern construction methods, stabilized earth has been again introduced to Sri Lanka with some technological advancement. With extensive researches carried out on compressed stabilized earth blocks and rammed earth, the strength characteristics of both these materials were proven adequate for load bearing masonry construction. Recently, however it has been thought that it would be architecturally desirable to leave earth walls without any exterior coating, and this has given rise to questions on long-term resistance to driving rain. The research presented in this thesis was organized and aimed at assessing the durability properties of various forms of stabilized earth constructions and to develop improvements with cost effective paints and/or plasters.

In order to achieve the above objectives, the following methodology was adopted. Firstly, a detailed literature review was carried out to investigate the durability enhancement techniques that have been successfully adopted for earth construction in Sri Lanka and other countries. Secondly, a field survey was carried out to identify durability problems with earth buildings already constructed in Sri Lanka. The wall panels were constructed out of compressed stabilized earth blocks and rammed earth to carry out the durability testing, specified in the relevant Codes of Practices and Earth Building Standards. Different paints and plasters were applied on earth wall panels and accelerated durability testing was conducted on panels with erosion test apparatus.

The durability improvements suggested in this study includes provision of long eaves, adequate stabilization levels, suitable protective coatings and strategies to minimize shrinkage that can be applied in the design and construction stages. Such measures will certainly ensure more durable structures built with stabilized earth as a walling material. However, areas subjected to flooding needs special care in terms of

durability. Therefore, special designs should be introduced for the houses built in such locations. The study revealed that 5% cement can be recommended as the optimum in terms of durability aspects. Using durability testings, different surface coatings were assessed for durability aspects. It was found that best combination is cement plaster and emulsion or weather shield paint. The coatings like mud paint on a plaster and Acrylic filler directly on blocks can be recommended in relatively dry areas or for walls adequately protected by eaves. Thus, it can be stated that walls constructed with cement stabilized earth blocks or rammed earth can be either kept exposed with a suitable paint based protection or applied with a plaster of minimum thickness. The machine made blocks allow attractive finish even without plastering and hence allow reaching one of the key goals in sustainable construction of minimizing the use of natural resources.

Key words: earth buildings, durability, stabilization



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