



ENHANCEMENT OF LATERAL LOAD RESISTANCE OF HOUSES CONSTRUCTED WITH LOADBEARING MASONRY

by

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(07/8010)

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THESIS SUBMITTED TO THE DEPARTMENT OF CIVIL
ENGINEERING IN FULFILLMENT OF THE REQUIREMENT
FOR THE DEGREE OF MASTER OF SCIENCE IN
ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF MORATUWA
SRI LANKA

2008

91160



Abstract

Masonry buildings are one of the most widely used building materials in the world. In case of masonry buildings, similar to the compressive strength, the flexural strength also plays a major role under the extreme forces of nature like earthquakes, cyclones, tsunami and floods. However, there are only limited amount of studies carried out in Sri Lanka regarding the flexural strengths of masonry. The field surveys carried out in many parts of the Sri Lanka after natural disasters like Tsunami of 2004, severe floods in 2006 and earth tremors in 2007 have shown that the lack of awareness of people on disaster preparedness is the main reason for the loss of lives and damage to the built environments and properties. Therefore, the main aim of this research was to develop suitable set of guidelines for masonry structures to enhance their disaster resistant properties in a cost effective manner.

Properties of burnt clay bricks such as strength and the quality of manufacturing can affect the bond strength of masonry to a great extent. Sand type could have a significant influence on bond strength. The results from couplet and triplet tests showed that the mortar with higher coarse-sand percentage could give higher bond strength values. Pre-compression added on a masonry wall can enhance the lateral load resistance of a masonry wall. In case of a two storied or multi storied buildings, this pre-compression can be exerted by using floor slabs. However, for a single storey houses, this is not possible with floor slabs. Therefore, the use of tie beams was identified as a possible way to enhance the lateral stability of a masonry wall. It is shown that the panels tested with low pre-compression can be used to determine the flexural strength of masonry. A series of experiments was carried out to find out the effect of tie beam in masonry buildings and it was shown that tie beams can enhance the lateral load resistance by about 30%. Computer modeling with SAP 2000 and a theoretical model were used to verify the results achieved from laboratory experiments. Application of return walls also shows an enhancement in lateral load resistance and it can be used as lateral load enhancement technique for masonry construction, especially with tie beams.

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MASONRY**

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SRI LANKA
JANUARY 2008**

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DECLARATION

I, Konthesingha Muhandiramlage Chaminda Konthesingha, 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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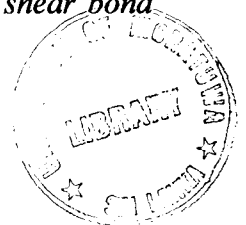
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Properties of burnt clay bricks such as strength and the quality of manufacturing can affect the bond strength of masonry to a great extent. Sand type could have a significant influence on bond strength. The results from couplet and triplet tests showed that the mortar with higher coarse sand percentage could give higher bond strength values. Pre-compression added on a masonry wall can enhance the lateral load resistance of a masonry wall. In case of a two storied or multi storied buildings, this pre-compression can be exerted by using floor slabs. However, for a single storey houses, this is not possible with floor slabs. Therefore, the use of tie beams was identified as a possible way to enhance the lateral stability of a masonry wall. It is shown that the panels tested with low pre-compression can be used to determine the flexural strength of masonry. A series of experiments was carried out to find out the effect of tie beam in masonry buildings and it was shown that tie beams can enhance the lateral load resistance by about 30%. Computer modeling with SAP 2000 and a theoretical model were used to verify the results achieved from laboratory experiments. Application of return walls also shows an enhancement in lateral load resistance and it can be used as lateral load enhancement technique for masonry construction, especially with tie beams.

Key words: *Natural disasters, flexural strengths, tensile bond strength, shear bond strength*



ACKNOWLEDGEMENT

The author wishes to extend his sincere gratitude to Vice Chancellor, Dean, Faculty of Engineering and the Senate Research Committee (SRC) of University of Moratuwa for granting the necessary approvals related to funding of this study.

The author is immensely grateful to the research supervisor, Dr. (Mrs) C. Jayasinghe, Senior lecturer of the Department of Civil Engineering for her invaluable guidance and support throughout the research period, and obtaining necessary funds from Senate Research Committee.

Author wishes to thankfully acknowledge the relentless support and guidance given by Prof. M.T.R. Jayasinghe, Department of Civil Engineering.

The support given by Prof.W.P.S. Dias (Head, Department of Civil Engineering), and Dr. S.A.S. Kulathilake (Research Coordinator, Department of Civil Engineering) is acknowledged gratefully. The author wishes to thank Prof. S.M.A. Nanayakkara and Dr. K. Baskaran of Department of Civil Engineering for their valuable ideas, which helped to make this research a success. All the other lectures and research students are thanked for the positive attitude they adopted in promoting research at Civil Engineering Department.


The technical officers of the Department of Civil Engineering, Messrs S.P. Madanayake, S.L. Kapuruge, H.P. Nandaweera, G.V. Somarathna and laboratory assistants Mr. L. Perera and Mr. H.N. Fernando assisted the detailed experimental programme very much. Mr. J.M. Gunasekara helped in many ways with the apparatus manufactured. Sincere gratitude is also due for all those who participated in the questionnaire survey.

Finally, the author wishes to thank all those who contributed to the completion of this project successfully.

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