COST EFFECTIVE TECHNIQUES FOR BUILDING CONSTRUCTION IN SRI LANKA

by

W.D.R.P.Chitrangani

A thesis submitted to University of Moratuwa
in partial fulfilment of the requirement for the degree of
Master of Structural Engineering Design

Research work supervised

by

Professor M.T.R.Jayasinghe
and
Dr (Mrs) C. Jayasinghe

DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF MORATUWA
MORATUWA
SRI LANKA

February 2006

ABSTRACT

The cost of construction is gradually becoming a deterrent for large scale projects since a high capital cost will need higher returns from the facilities to make the investments viable. Therefore, there is an urgent need to control the cost of construction per square metre in order to make civil engineering projects financially more attractive. This can create more employment in the civil and building sectors for all segments involved. During the past decade, a large number of alternative building materials have been developed for the housing sector. Some of these include walling materials, alternative slab systems and roofing materials. Some of these can match the performance in both structural and durability terms while costing less. Some of these also allow reducing the amount of money spent for finishes and may have savings in formwork/falsework requirements. Most of these products are environmentally more acceptable. In this research, the structural concepts are developed for adopting the alternative building materials for reinforced concrete frame construction used in large engineering projects. Detailed designs and costing based on work studies have been used to evaluate the cost advantages offered by the use of these alternative materials. This thesis presents the details of this study in terms of structural performance, durability, savings in finishes and cost aspects which can make the alternative building products much more popular for large building projects.

In Sri Lanka cement stabilized soil block technology is used for single and two-storey construction. It is yet to penetrate to large building projects. Another alternative to brickwork is chip concrete blocks. These are initially introduced as hand moulded blocks, but now becoming popular with machine moulding. The main advantages are greater strength, lower shrinkage and lesser use of cement. The feasibility of using these materials as infill walls is investigated. Another advantage is the ability to avoid the plastering thus achieving further cost saving.

An alternative reinforced concrete precast slab system was introduced to the housing sector recently. The feasibility of using this in framed building is also investigated. Based on all these investigations, the design methodology, construction techniques and alternative finishes were presented. Detailed cost studies were carried out to determine the cost savings associated with different combinations of adopting above alternative materials. The cost savings were calculated as the basis of the actual costs and the associated project costs.

Acknowledgement

I am grateful to the Vice Chancellor, Dean, Faculty of Engineering and Head of the Department of Civil Engineering for granting me an opportunity to follow the M. Eng. Degree on Structural Design. I wish to thank Dr. (Mrs.) M.T.P. Hettiarachchi for the encouragement given as the co-ordinator of research projects.

The staff members of Structural Engineering Division of Department of Civil Engineering who worked with much dedication during the lecture series are thanked with gratitude. The knowledge gained through lectures were of immense benefit to the research work presented in this thesis.

I am most grateful to my research supervisors Professor M.T.R.Jayasinghe and Dr Mrs. C. Jayasinghe of Department of Civil Engineering for their excellent support and encouragement given for the research work. A very special thank is due to them for their valuable advices and guidance from beginning till completion of this project.

I am most grateful to Venerable Priest at Sri Sudarshana Bimbaramaya temple at Malamulla, Panadura for the excellent support and giving me an opportunity to visit the site at temple and employing his workers to cast machine moulded chip concrete blocks for my research work. Also I wish to thank the workers at the temple who helped me during that period with enthusiasm.

The staff of the Building Materials and Structural testing laboratories has helped me in many ways to make this research work a success. The excellent support given by them is acknowledged gratefully. Special thank is due for the technical officers Messers S.P.Madanayaka, S.L.Kapuruge and H.P.Nandaweera who took a special interest to carry out the laboratory work. Mr. G.V. Somaratna of computer laboratory also assisted with computer work.

Last, but not least, I wish to thank the staff of the Western Provincial Council who helped me in various ways to make this event a success.

I also wish to thank all those who have helped me to carry out this research work successfully.

Contents