A STUDY ON LOAD BEARING CAPACITY OF SANDWICH WALL PANELS

Rupasinghe Arachchige Don Lalindra Jayamevan Rupasinghe

(09/8927)

Degree of Master of Engineering in Structural Engineering Designs

Department of Civil Engineering

University of Moratuwa

Sri Lanka

January 2013

A STUDY ON LOAD BEARING CAPACITY OF SANDWICH WALL PANELS

Rupasinghe Arachchige Don Lalindra Jayamevan Rupasinghe

(09/8927)

Dissertation submitted in partial fulfillment of the requirements for the degree Master of Engineering in Structural Engineering

Department of Civil Engineering

University of Moratuwa

Sri Lanka

January 2013

Declaration

I declare that this is my own work and this dissertation 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.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as article or books).

Signature: ………………………………… Date:……………………….

R.A.D.L.J. Rupasinghe

(09 / 8927)

The above candidate has carried out research for the Masters Dissertation under my supervision.

Signature: ………………………………… Date:……………………….

Research Supervisor

Dr.K.Baskaran

Senior Lecturer

Abstract

Sandwich wall panel technology is a new system introduced to Sri Lanka. Thermal insulation, sound insulation, light weight and reduction in natural resources like sand have lead to its popularity in Sri Lanka. The system is faster in construction than conventional wall systems.

The sandwich wall panel system is used in Sri Lanka as partitioned walls in construction industry today. Load from above floors are taken by separate column and beam system. If accurate load bearing estimate is available, it can minimize or omit use of other load bearing systems.

The scope of this research was to recognize suitability of available codes and to identify the reduction in load bearing capacity due to a window opening in a sandwich wall panel.

In this dissertation, method of production of locally available sandwich wall panels and load bearing capacity according to available literature are presented.

Three 1200mm width, 100mm thick and 2400mm high sandwich wall panels were cast. Out of these three, two panels had openings to represent windows. The panels were tested in axial compression while monitoring transverse deflection at mid height of the panel. All three panels' ultimate load bearing capacity was nearly equal. Only one panel had higher degree of lateral movement while loading. All panels have shown local crushing failure near top and bottom loading points.

Three sandwich panel blocks of 600mm length, 100mm thick and 300mm height were tested in a Universal testing machine to get ultimate load bearing capacity. The blocks' ultimate load bearing capacities are also nearly equall to that of 2400mm height panels.

Six numbers of 150mm mortar cubes were also tested in Universal testing machine to find ultimate compressive strength. Samples of diagonal shear connecters (Gauge 9 GI wire) were cut out from specimen and tested for compression capacity in Universal timber testing machine. The samples failed in buckling. 100mm high samples had about 0.7kN compression capacity.

It was concluded that 600mm width and 900mm high opening in the given orientation did not affect load bearing capacity of panel.

Key words: Sandwich wall panel, Load bearing capacity, openings, wythe, insulation layer.

Acknowledgement

I wish to express my sincere gratitude to my research supervisor Dr.K.Baskaran, Senior Lecturer, Department of Civil Engineering, University of Moratuwa, Sri Lanka for his guidance, suggestions and continuous support throughout my research work.

I also extend my sincere gratitude to the Head of Department of Civil Engineering, University of Moratuwa, Sri Lanka for allowing me to use the laboratory facilities and the resources available at the university, for successful completion of my research project.

I wish to thank the Micro Construction (Pvt) Ltd for providing sandwich panels and other test samples for the research. Their kind assistance and knowledge helped me for the success of my research.

I would like to take this opportunity to convey my sincere gratitude to Mr.H.N.Fernando (Lab Assistant-Structural Testing Laboratory) for the assistance extended to me in numerous ways throughout this period.

I also extend my appreciation to my family for the valued cooperation and encouragement received to make my M. Eng. programme a success.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

SWP	:	Sandwich Wall Panel
EPS	:	Expanded Polystyrene Foam
XPS	:	Extruded Polystyrene Foam
BS	:	British Standard
GI	:	Galvanized Iron
PCI	:	Precast/ Prestressed concrete Institute
BOCA	:	Building Officials and Code Administrators
ICBO	:	International Conference of Building Officials
FEM	:	Finite Element Model
OPC	:	Ordinary Portland cement
W/C	:	Water to Cement Ratio
FRP	:	Fibre reinforced plastic
BRC	:	Trade name of a wire mesh manufacturer