SHEAR CAPACITY OF COMPOSITE DECK SLABS WITH CONCRETE FILLED STEEL TUBES

This thesis was submitted to the Department of Civil Engineering of the University of Moratuwa in partial fulfillment of the requirements for the Degree of Master of Philosophy

S.V.T.J. Perera

Supervised by

Dr. (Mrs) M.T.P. Hettiarachchi
Dr. (Mrs) Manoja Weerasinghe

Department of Civil Engineering
University of Moratuwa
Sri Lanka

January 2008

ACKNOWLEDGMENTS

The author would like to thank Dr. (Mrs.) M.T.P. Hettiarachchi for her support, encouragement, and patience. He would also like to thank Dr. (Mrs.) Manoja Weerasinghe for giving this opportunity and guidance. Special thanks go to Prof. Priyan Dias, Dr. Ashoka Peiris, and Prof. S.A.S. Kulathilaka for serving on his progress committee. Thanks also to all faculty members in the Structures Division and Department of Civil Engineering for sharing their many years of wisdom and providing the best education possible. They have all been an inspiration.

The experimental work and test specimen preparation would not have been possible without the help from Mr. S.P. Madanayake and Mr. S. L. Kapuruge. Thanks also to the lab assistants who all worked as a team and helping in the lab. Thanks to Mr. H. N. Fenando, Mr. Linus Perera and Mr. J. M. Gunasekara for helping with many of the push-out tests.

This research has required a great amount of financial support. Thank you to the National Science Foundation Sri Lanka and Department of Civil Engineering for granting the studentship that made studying and researching possible. Thank you to the National Science Foundation Sri Lanka for sponsoring this research.

Abstract

Steel and concrete composite systems are generally used as major structural components in multi-storey buildings. Composite construction in buildings is more popular with profiled steel sheeting (steel decking) since it serves as a working platform to support the construction loads and also as permanent formwork for concrete. To achieve large column free spans (in the range of 8m-12m), as often demanded for multi-storey office buildings, "steel and concrete composite floor trusses" may form economical solutions since they provide the facility to accommodate various service ducts within the structural zone. The concept of introducing a concrete filled steel tube (CFST), instead of the conventional open flanged steel section, as the top chord of these floor trusses has been discussed. However, the viability of this new concept should be ensured by experimental evidence on the longitudinal shear transfer capacity at the composite stage.

This study discusses the experimental results of a series of push-off tests conducted on CFST embedded composite slab panels. The effect of providing different concrete top covers and effect of different concrete strengths have been investigated. With headed shear studs (two studs per sample, Configuration 3) 23%- 29% and 20%- 53% of increase in shear carrying capacity were achieved by increasing the concrete top cover from 20mm to 30mm and the concrete cube strength from grade 20 to grade 45 respectively. Composite slabs with CFSTs were 131% (only steel tube, Configuration 1) - 385% (steel tube with welded two steel strips, Configuration 2) higher than composite slabs with headed shear studs (two studs per sample). Then results of composite slabs with headed shear studs were compared with Eurocode-4 and it was at least 22% conservative.

Keywords: composite slab, steel, concrete, concrete filled steel tubes, steel decking

LIST OF CONTENTS **PAGE NO.**

PAGE NO.

PAGE NO.

PAGE NO.

PAGE NO.

LIST OF TABLES **PAGE NO.**

4. EVALUATION OF EXPERIMENTAL TEST RESULTS

5. ANALYSIS AND DISCUSSION

APPENDIX

PAGE NO.

Concrete Steel Displacement Results

PAGE NO.

PAGE NO.

PAGE NO.

PAGE NO.

PAGE NO.

PAGE NO.

LIST OF FIGURES **PAGE NO.**

1. INTRODUCTION

2. LITERATURE REVIEW

3. METHODOLOGY

4. EVALUATION OF EXPERIMENTAL TEST RESULTS

PAGE NO.

PAGE NO.

5. ANALYSIS AND DISCUSSION