PUNCHING OF SELF- COMPACTING HIGH STRENGTH REINFORCED CONCRETE FLAT SLABS AT CORNER COLUMN

A Thesis
Submitted to the Faculty of Engineering
Ain Shames University for the Partial Fulfillment
of the Requirements of The Degree of Master of Science
In Civil Engineering (Structural Engineering)

Prepared by
ENG. WAEL NABIL HANNA KERLOS
B.Sc. in Civil Engineering, June 2012
Higher Institute of Engineering – El Shorouk Academy

Supervisors

Prof. Dr. AYMAN HUSSEIN HOSNY KHALIL
Professor of Reinforced Concrete Structures,
Ain Shams University, Cairo, EGYPT

Dr. MAHMOUD MOHAMED EL-KATEB
Assistant Professor, Structural Engineering Department,
Ain Shams University, Cairo, EGYPT

Cairo - 2018

PUNCHING OF SELF- COMPACTING HIGH STRENGTH REINFORCED CONCRETE FLAT SLABS AT CORNER COLUMN

A Thesis For

The M.Sc. Degree in Civil Engineering

(STRUCTURE ENGINEERING)

By

ENG. WAEL NABIL HANNA KERLOS

B.Sc. in Civil Engineering, June 2012

Higher Institute of Engineering – El Shorouk Academy

THESIS APPROVAL

EXAMINERS COMMITTEE	SIGNATURE
Prof. Dr. Mohamed El-Saied Issa Professor of Concrete Structures, Faculty of Engineering, Cairo University.	----------
Prof. Dr. Omar Ali Mousa El Nawawy Professor of Concrete Structures, Faculty of Engineering, Ain Shams University.	----------
Prof. Dr. Ayman Hussein Hosny Khalil Professor of Concrete Structures, Faculty of Engineering, Ain Shams University.	----------

Date 9/8/2018

STATEMENT

This dissertation is submitted to Ain Shams University, Faculty of Engineering for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author in the department of Structural Engineering, Faculty of Engineering, Ain Shams University, from April 2013 to August 2018.

No part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

Date : 9/8/2018

Name : **WAEL NABIL HANNA KERLOS**

Signature : ……………………….

AUTHOR

Name	**:** Wael Nabil Hanna Kerlos
Date of birth	**:** 20 August 1990
Place of birth	**:** Qalubia, Egypt
Academic degree	**:** B.Sc. in Civil Engineering
Major	**:** Structural Engineering
University	**:** El Shorouk Academy
Date	**:** June-2012
Current job	**:** Teaching Assistant, Civil Engineering, El Shorouk Academy

ABSTRACT

High strength concrete and shear reinforcement can be used to increase the strength of concrete flat plates in punching. And this could help in reducing the slab thickness, weight and cost of structure. If high strength concrete is self-compacting, the production would be more industrialized. However, to be effective, the shear reinforcement must be well anchored in the compression and tension zones of the slab.

This research investigates, experimentally, the behaviour of corner slab-column connections made of high strength self-compacting concrete and provided with shear reinforcement. The experimental program included testing of six flat slab specimens having dimensions 1100*1100 mm with 160 mm thickness. The investigated variables are the concrete compressive strength, the shear reinforcement, and the aspect ratio of supporting column. The concrete compressive strength varied from 30MPa to 80MPa, while the aspect ratio of supporting column ranged from 1 to 3. The tested six specimens were loaded at corner column with a single concentrated load until failure.

The general deformational behavior of the tested specimens was examined and recorded (cracking, deflection, and strain in steel). To evaluate the results of the tested specimens, different international codes have been used to calculate the punching strength of test slabs.

The test results showed that using of High Strength Self-Compacting Concrete improved the performance of slab behavior and increased the shear punching capacity; also showed that the presence of shear reinforcement improved punching shear but without remarkable percentage, while changing the column aspect ratio had remarkable effect on the punching shear capacity.

Key Words: Punching shear, High strength self-compacting concrete, Shear strength, Shear reinforcement, Flat plates.

ACKNOWLEDGMENTS

First and foremost, praise and thanks for God.

I would like to express my deepest gratitude and appreciation to my supervisor **Prof. Dr. AYMAN HUSSEIN HOSNY KHALIL**, Professor of Reinforced Concrete Structures, Ain Shams University, for his kind supervision, support, guidance, help, encouragement and useful suggestions since the start of this work.

I am indebted to **Dr. MAHMOUD MOHAMED EL-KATEB**, Assistant Professor, Structural Engineering Department, Ain Shams University, for his constant supervision, planning, generous support, helpful advice and constructive thoughts throughout this work. For his kind, long discussion and his continues revision of the work.

Finally, I make all the meanings of love, gratitude and appreciation to **my family** for their love and encouragement.

TABLE OF CONTENTS

TABLE OF FIGURES

page

TABLE OF TABLES

page