



**AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING**

**FACTORS AFFECTING THE UNSYMMETRICAL PUNCHING
SHEAR RESISTANCE OF THE FLAT SLAB STRUCTURES**

BY

ENG. MANSOUR MOHAMMED ABD EL-HALIM

A THESIS

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Supervised By

Prof. Dr. OSAMA H. ABD-EL-WAHED

Professor of RC Structures,
AIN SHAMS UNIVERSITY

Dr. WAEL W. EL-DAKHAKHNI

Assoc. Prof. of Structural Eng.,
AIN SHAMS UNIVERSITY

Dr. AMGAD A. TALAAT

Asst. Prof. of Structural Eng.,
AIN SHAMS UNIVERSITY

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Civil Engineering (Structural).

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No part of this thesis has been submitted for a degree or a qualification at any other university or Institute.

Date : / / 2010

Signature :

Name : Mansour Mohammed Abdel Halim

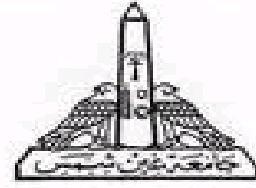
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Ain Shams University
Faculty of Engineering
Department of Structural Engineering

M.Sc.thesis:

**Factors Affecting the Unsymmetrical Punching shear Resistance
of the Flat slab Structures**

Submitted by :

Eng. Mansour Mohamed Abdel Halim

Supervisors:

Prof.Dr.Osama Hamdy Abdel-Wahed

Dr. Wael Waghieh El-Dakhakhni

Dr.Amgad Ahmed Talaat

ABSTRACT

One of the most common floor systems is the flat slabs. It provides architectural flexibilities, more clear space, less building height, easier Form work and consequently shorter constructions time.

A serious problem that can arise in flat slab is the brittle punching shear failure due to shear and moment transfer from slabs to columns. As a result of the combined effect of the moment and the shear on the critical section, the shear stress is no longer uniformly distributed.

One of the objectives of this research is to evaluate experimentally the behavior of slab-column connection with and without shear reinforcement, and the effect of shear reinforcement in increasing the punching shear resistance and ductility of the connections. Another objective is to summarize and evaluate the punching shear provisions of several major codes for edge column connection with moment transfer.

Six tested specimens of reinforced concrete slabs with a square concrete column at the edge were slab S1 without shear reinforcement, slab S2 contained vertical closed stirrups spacing = $d/2$, slab S3 contained shear Stud reinforcement, slab S4 contained shear head reinforcement, slab S5

contained vertical closed stirrups with higher concrete strength and slab S6 contained closed stirrups spacing $=d/4$.

The over all behavior of the tested slabs have been observed.

Key Words: Reinforced concrete, flat slab, shear, column, shear reinforcement, shear head, stirrups.

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