Cairo University

STRENGTHENING OF R.C. FLAT SLABS WITH CUT-OUT EDGE OPENINGS

By

FAISAL WALID HAFEZ

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
STRUCTURAL ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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Key Words:

Strengthening, R.C. Flat slab, Edge opening, Steel Bars, Steel Plates, CFRP Sheets, ECC.

Summary:

In this research different methods of strengthening of flat slabs with edge openings are studied theoretically and experimentally.

The experimental program consists of six square slabs with dimensions of (110*110*10) cm with cut-out edge opening of 30cm*30cm. Two slabs are considered as reference slabs with and without opening. The other four slabs were strengthened using various methods including additional steel bars, Carbon Fiber Reinforced Polymer (CFRP) strips, steel plates and bolts and near surface mounted Engineered Cementations Composite (ECC) steel mesh 10cm*10cm on the tensile face only. In addition, a numerical Finite element model is used to correlate and explore various conditions for strengthening techniques. The results showed that, the ultimate load carrying capacity increased for all the repaired slabs. Also, strengthening by steel bars was the most effective method of repair.

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DEDICATION

Dedicated to my parents, my sister and my brother with love

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