

## SEISMIC RETROFITTING OF CONCRETE PLATES

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### ABSTRACT

Seismic retrofitting of existing concrete structural elements is a viable means for improving the performance of such elements. Plenty of strengthening-related research work on beams, columns and beam-columns has been conducted. However, research work related to concrete plates and beam-column connections strengthening is very scarce. Hence, there are academic and industrial needs to investigate such an issue experimentally and theoretically. This research work presents an experimental and theoretical investigation of the shear and flexural strengthening of concrete plates.

The experimental phase of this research work includes testing of three groups of specimens. The first and second groups are composed of specimens strengthened using steel plates and steel bolts. The specimens of the first group are loaded concentrically only. The second group of specimens is loaded centrally combined with a lateral static or cyclic moment. The specimens of the third group are loaded centrally and strengthened with either Carbon Fibre Reinforced Polymer (CFRP) strips or Glass Fibre Reinforced Polymer (GFRP) laminates.

**Key Words:** Steel Strengthening, GFRP strengthening; Concrete Plates and Cyclic moment on beam column connections

### 1 INTRODUCTION

Strengthening of existing structures is an accepted and guaranteed means of improving both load-carrying capacity and serviceability performance of such structures. In the literature, plenty of research efforts have been made to investigate different strengthening techniques of structural elements using different materials. However, research work related to concrete plate and seismic strengthening is very scarce. Hence, there are academic and industrial needs to investigate such an issue experimentally and theoretically. In general, there are different methods to increase the carrying capacity of a plate against seismic loads. Strengthening techniques include casting a concrete topping, gluing flexural reinforcement, installing shear reinforcement, or installing both shear reinforcement and flexural steel plates.

An overview of various strengthening methods about punching shear strength of two-way slabs using shear reinforcement only or combination of sandwich steel plates and shear bolts. Öberg (1990) presented a method for shear strengthening by post-tensioned steel wires. The tests were mainly applied on beams. Also five slab specimens with 900 mm width were tested. The specimens were provided with 6 mm high strength steel wires.that authors will submit carefully written and proofread material

Several research works have been conducted on different kinds of shear reinforcement for slabs. It was proven that the most effective technique for enhancing the shear strength of a flat slab is to provide vertical shear reinforcement in the form of shear studs around the punching load (Dilger and Ghali 1981; Marzouk and Jiang 1997).