



Experimental behaviour of externally confined concrete columns with inadequate lap spliced rebars under fully reversed cyclic loading

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Abstract

The seismic performance of RC elements can be significantly impaired by inadequate lap-splicing of their reinforcing bars. In this paper the main findings of an experimental investigation of this influence are presented. Two rehabilitation techniques by means of external confinement of lap-splices are also examined. Cyclic tests on twelve (12) column-like specimens were performed. Four (4) types of specimens were tested, one (1) with no reinforcement lap-splicing and three (3) with lap-splicing of their longitudinal reinforcement inside their critical regions (plastic hinges). For each type different lap-lengths were used. All specimens had the same geometry and reinforcement detailing. The tests were fully instrumented and monitored. The experimental results of this study are presented hereafter. Conclusions regarding the shear response, the hysteretic energy dissipation and the effectiveness of the strengthening techniques used are made.

Keywords: concrete; FRP; steel jacket; strengthening; retrofitting; lap-splicing; Eurocodes; cyclic tests; monitoring; fibre-optic-sensors.

1 Introduction

Reinforced Concrete structures are an essential part of society's infrastructure. Assessment and rehabilitation of these structures is becoming an issue as a result of the increasing number of aging infrastructure assets. Moreover, initially un-designed maintenance is common in order to make these structures operational for a longer period than their original design life.

A major issue of existing RC structures is the inadequate lap-splicing of their longitudinal reinforcement. Lap-splices designed according to past Design Codes are deemed inadequate by

modern standards, in terms of various aspects, e.g. lap-splice length, concrete cover, transverse reinforcement, etc. The practice of arranging lap-splices inside the critical regions of RC elements, commonly applied in the past, is now prohibited by modern Design Codes. Therefore, structural rehabilitation of RC elements with inadequate lap-splices is often required to ensure or improve the structural redundancy of aging RC structures.

An experimental program devoted to RC elements with lap-splices is completed at the Laboratory of Reinforced Concrete of the National Technical University of Athens, Greece. This program aims at the proposal of a rational and safe theoretical