# SEISMIC STRENGTHENING OF SMALLSCALE PLAIN CONCRETE COLUMNSWITH NEW HYBRID STEEL-FRP JACKETS

Mohammad Reza NOORI SHIRAZI
*PhD. Candidate of Structural Engineering, Faculty of Civil Engineering, Sahand University of Technology, Academic Staff of Islamic Azad University of Chaloos, Tabriz, Iran*
*m_noori@sut.ac.ir, mrns1981@gmail.com*

Hassan AFSHIN
*Associate Professor, Faculty of Civil Engineering, Sahand University of Technology, Tabriz, Iran*
*hassanafshin@yahoo.com*

Karim ABEDI
*Professor, Faculty of Civil Engineering, Sahand University of Technology, Tabriz, Iran*
*k_Abedi@sut.ac.ir*

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## ABSTRACT

In present study, a novel hybrid retrofitting device including inner steel strips and outer peripheral FRP wraps proposed and investigated experimentally for strengthening of concrete cylinders specimens. A total of 4concrete cylinderswhich had an inner diameter of 84.1 mm and a height of 345.0 mmillustrating slenderness ratio of 4, were prepared. For comparison purpose, one specimen was strengthened using only CFRP confinement with four layers, whereas the other was reinforced using proposed hybrid steel-FRP. Four steel strips (two percent of concrete specimen volume) attached using two part SIKA resin epoxy binder while one, two and three layer CFRP confined aforementioned steel. The retrofitting design philosophy of proposed scheme explained briefly based on some common codes. Axial compression tests were conducted using the universal structural testing machine with maximum capacity of 2000 KN. Particle image velociemetery (PIV) method was used for calculating the stress-strain curves of specimens accomplished using a digital image correlation code, GeoPIV.Due to the lower cost, potential of obtaining the whole displacement field on common structural tests and applicability for data recording of explosive testssuch as FRP collapse at high level loading conditions, PIV method can be widely used as asuitablealternative to conventional measurement techniques. The PIV dataverified toward the strain gauges data. The role of some parameters was examined by comparing axial load-versus-axial (peak force, drift ratios and energy dissipation). The results demonstrate that steel-FRP hybrid confinement method is a viable solution toward enhancing the flexural strength and ductility of plain concrete columns under seismic loads.

## INTRODUCTION

Over the world, earthquakes have exposed the vulnerability of existing structures. The columns and piers are the most important members of each common structure (Dionysios et al., 2009).Some olden structures such as railroad and road bridges have the piers build using masonry and plain concrete materials. However the thick concrete section can enhance the shear strength of the pier, but these concrete gravity piers which have built without consideration of an earthquake-resistant design, have the problem of inadequacy at flexural strength and the possibility of the pier overturning due to lateral loading such as braking force or earthquake shakes (choi et al.,2011) . Many researches were conducted about the retrofitting of reinforced concrete columns, but the investigations are rare in the case ofplain concrete piers.