

## ABSTRACT

Most of the Indian buildings are vulnerable to seismic action due to improper reinforcement detailing within the beam-column joints. The reinforced concrete frames without seismic provision are often characterized by an unsatisfactory structural behaviour due to low available ductility and lack of strength which in turn induces global failure mechanism. Hence it is very much essential to retrofit the vulnerable building to cope up for the next damaging earthquake.

In the present work, experimental and analytical investigations have been carried out to study the structural behaviour of columns strengthened by Glass Fiber Reinforced Polymer (GFRP), Carbon Fibre Reinforced Polymer (CFRP), Reinforced Concrete jacketing (RC), Steel plate, Steel strip, Corrugated steel jacketing and Ferro cement jacketing of beam -column joint. The entire study was divided into 5 distinct phases. In the first phase, the performance of Reinforced Concrete columns subjected to cyclic loading is studied to determine the desirable percentage of longitudinal reinforcement. The effect of lateral loading is more severe in the case of slender column than that of short columns. Hence the dimensions of column specimens were selected to simulate slender columns. The percentage of reinforcement was varied as 1.13%, 2.01% and 3.14% in order to study the performance of column. Based on the studies it was found that, out of the three percentage of longitudinal reinforcement considered, 2.01% gives better performance.

In the second phase, six experiments were conducted to find out the effectiveness of using Fibre reinforced polymer jackets for enhancing the seismic shear strength and ductility of column. The specimens were subjected to reverse cyclic loading under constant axial load to address the use of the specimens in seismic regions. One specimen was tested without GFRP/CFRP jacketing and other three specimens were tested with 2 layers, 4 layers and 6 layers of GFRP wrapping. Two specimens were tested with one layer of CFRP wrapping. Experimental results indicate a significant increase in load carrying capacity, energy dissipation capacity and ductility of column with CFRP and GFRP jacketing.

In the third phase, nine experiments were conducted to find out the effectiveness of using Reinforced concrete jacketing. The specimens were designed as per IS 456-2000 Indian standard of plain and Reinforced concrete code of practice. One specimen was tested to failure without jacketing. Four specimens were tested up to the first crack and then they were jacketed with reinforced concrete. The percentage of additional longitudinal reinforcements for jacketing was varied as 0.18%, 0.32%, 0.50% and 0.72% respectively. The jacketing reinforcements were detailed as per IS13920:1993 Indian standard ductile detailing of reinforced concrete structures subjected to seismic forces. Finite element modeling of column specimen with varied percentages of reinforcement was carried out using the finite element software package ANSYS and the experimental results were validated with the result obtained from the finite element models. The RC jacket was found to be efficient in the retrofitting of existing structures not meeting current seismic code requirements.

In the fourth phase, seven experiments were conducted to find out the effectiveness of using steel plate, steel strip and corrugated steel jacketing of column for enhancing the seismic shear strength and ductility. It was found that the strength and ductility of columns with jacketing are more than the columns without jacketing. The variable in the test specimen is the type of steel jacketing. One specimen was tested up to failure without any jacketing. Three specimens were jacketed with (i) steel plate, (ii) steel strip and (iii) corrugated sheet and were tested to study the effectiveness of jacketing. Meanwhile other three specimens were tested upto initiation of first crack and then retrofitted with steel plate, steel strip and corrugated sheet under reversed cyclic loading at constant axial load.

In the fifth phase, four experiments were conducted to find out the effectiveness of Ferro cement jacketing of column for enhancing the seismic shear strength and ductility. One specimen was tested without Ferro cement jacketing and three specimens were tested with one, two and three layers of Ferro cement jacketing.

Comparison of load carrying capacity, energy dissipation capacity and ductility of the specimens retrofitted with CFRP, GFRP, RC, Steel and Ferro cement jacketing were made. It was found that all the jacketed specimens performed well and can be concluded that Reinforced Concrete jacketing is an effective method of jacketing with respect to load carrying capacity, ductility, energy dissipation capacity and economy.