

# Seismic Response of Interior RC Beam-Column Joints Upgraded with FRP Sheets

(Part – I: Experimental Study)

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## ABSTRACT

In this paper, efficiency and effectiveness of Carbon fiber reinforced polymers (CFRP) in upgrading the shear strength and ductility of seismically deficient beam-column joints have been studied. For this purpose, four reinforced concrete interior beam-column sub-assemblages were constructed with non-optimal design parameters (inadequate joint shear strength with no transverse reinforcement) representing pre-seismic code design construction practice of joints and encompassing the vast majority of existing beam-column connections. Out of these four, two specimens were used as baseline specimens (control specimens) and other two were strengthened with CFRP sheets under two different schemes (strengthened specimens). In the first scheme, CFRP sheets were epoxy-bonded to the joint, beams and part of the column regions. In the second scheme, however, sheets were epoxy-bonded to the joint region only but they were effectively prevented against any possible debonding through mechanical anchorages. All four sub-assemblages were subjected to cyclic lateral load histories so as to provide the equivalent of severe earthquake damage. Furthermore, the damaged control specimens were repaired after filling the cracks through epoxy and wrapping them with CFRP sheets under the same above two schemes. These repaired specimens were subjected to the similar cyclic lateral load history and their response histories were obtained. Hence, a total of six specimens were tested: two control; two strengthened; and two repaired. Response histories of control, repaired and strengthened specimens were then compared. The results were compared through hysteretic loops, load-displacement envelopes, column profiles (maximum horizontal displacements of column along its height), joint shear distortion, ductility and stiffness degradation. The comparison shows that CFRP sheets improve the shear resistance of the joint and increase its ductility. Results of two chosen schemes of strengthening were also compared and the importance of beam upgrading was highlighted.

**CE Database subject headings:** Connections, Beam-column joints, CFRP, Seismic, Retrofitting, Strengthening, Repair, Cyclic loads.

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