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SEISMIC REHABILITATION OF RC BEAM-COLUMN CORNER JOINTS USING CFRP SHEETS

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In moment resisting reinforced concrete framed buildings, corner joints are found at the roof level. These joints, if designed for gravity loads and are based on pre-seismic codes, may suffer substantial damage during earthquakes particularly under opening cycles, i.e. those causing flexural tension on the inside of the joint. Several techniques of repair and strengthening of reinforced concrete joints, damaged by earthquakes, have been reported in earthquake prone countries such as Japan, Mexico, and Peru. Of the various repair techniques used, the most common involved were RC or steel jackets. Plain or corrugated steel plates have also been tried. These techniques cause various difficulties in practical implementation at the joint, namely intensive labor, artful detailing, increased dimensions, corrosion protection and special attachments. To overcome the difficulties associated with these techniques recent research efforts have focused on the use of epoxy-bonded Fiber Reinforced Polymer (FRP) sheets or strips with fibers oriented properly so as to carry tension forces due to shear.

In the present paper an innovative and practical technique for the seismic rehabilitation of poorly detailed beam-column corner joints using FRP composite sheets has been proposed. A full scale corner beam-column sub-assemblage was constructed with inadequate joint shear strength and no transverse reinforcement in the joint; representing pre-seismic code design construction practices of joints and encompassing the vast majority of existing joints. The corner joint specimen was tested under reversed cyclic lateral load histories so as to provide the equivalent of severe earthquake damage. The damaged specimen was repaired using suggested scheme and then subjected to the similar cyclic lateral load history. Response histories of the specimen before and after repair were then compared through hysteretic loops, load-displacement envelopes, ductility, stiffness degradation and energy dissipation. The test results indicated that the suggested repair scheme is very effective in upgrading the shear capacity and ductility of the joint. The results also show that, with the proposed FRP scheme of repair, the repaired specimen achieves a substantially higher load carrying capacity, larger energy dissipation and slower stiffness degradation.