DESIGN CONCEPT OF RETROFITTED RC BEAM-COLUMN JOINTS BY PRESTRESSED JOINT ENLARGEMENT

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ABSTRACT

Post-earthquake inspections of damaged RC buildings have demonstrated that poorly detailed beam-column joints can suffer serious damage. A retrofit technique called “joint enlargement using prestressed steel angles” was experimentally investigated by authors and found to be an effective and practical technique for the seismic retrofit of non-seismically detailed reinforced concrete beam-column joints. In this method, the beam-column joint is enlarged by locatingstiffened steel angles at the re-entrants corners of the beam-columnjoint, both above and below the beam, with the steel angles mountedand held in place using high tensile strength bars.The main objective of designing the proposed retrofit method isto avoid joint shear failure and to encourage beam flexural hinging.The size of the joint enlargement should be designed such that toincrease the joint shear capacity through increasing effective jointarea and to improve the anchorage bond of the beam longitudinalbar within the joint panel zone through increasing apparent columndepth. In this paper the design concept of retrofitted RC beam-column jointsby joint enlargement using prestressed steel angles is discussed with considering the load transfer mechanism in the beam-column joint sub-assemblages.

INTRODUCTION

Recent earthquakes, particularly the 22 February 2011 Christchurch, NZ earthquake, caused numerous fatality and financial losses due to the failure of reinforced concrete (RC) structures (Dizhur *et al.* 2011, Elwood *et al.* 2012, Kam *et al.* 2011). Post-earthquake inspections of damaged RC Buildings (Elwood *et al.* 2012, Kam *et al.* 2011, Norton *et al.* 1994) as well as Laboratory tests of non-seismic RC beam-column joints (Park 2002) were demonstrated that beam-column joints suffered serious damage because of deficient reinforcement details in the joint region. Because of the poor detailing of the reinforcement and the absence of capacity design philosophy, undesirable brittle failure mechanisms are observed at either the local level (i.e. shear failures in joints, beam or column members) or globally in the structure (i.e. soft-story mechanisms). The joint region is of particular interest in such systems, as it is likely to be the critical and possibly the weakest link according to capacity design or hierarchy of strength considerations (Paulay 1998).