Abstract

This thesis presents a test of modified sub-standard beam-column joint in reinforced concrete interior frame under simulated seismic load. The effect of some important parameters is specially discussed such as the amount of horizontal joint transverse reinforcement, modified joint reinforcement details, anchorage bond of longitudinal beam within joint core, effect of discrete confinement and continuous confinement on seismic performance of the interior beam-column joint. The experiment consisted of five half-scale beam-column specimens, labeled JB, JD, JT, JP and JA. All specimens were modified from a typical non-ductile beam-column joint in mid-rise RC buildings constructed in low seismic zone. Dimension and reinforcing details of the beam and the column component of all specimens have similarities, both dimensions and details.

For first specimen JB, the bond between the concrete and longitudinal bars within the joint core only was completely removed initially, and no joint reinforcing bar supplement. In specimen JD, all longitudinal beam bars were bent to be z-shape within the joint core only and no joint reinforcing bar implement. In specimen JT, a substantial amount of horizontal joint reinforcements designed according to ACI provision for building in high seismic zone was provided in joint core. For specimen JP, the joint reinforcing detail is modified by using steel plate regarded as continuous confinement. Steel plate encompassed concrete core within joint component. In specimen JA, joint transverse reinforcement is provided within joint core by using two sets of spiral steel.

Based on experimental results, all specimens demonstrated elastic behavior up to only 0.5% drift level. The energy dissipation was comparatively low in all specimens due to pinching in hysteretic loops. The experiment showed that even though substantial amount of joint confinement reinforcement was provided according to ACI code, specimen JT and JA could not demonstrate ductile behavior. It was found that the initial unbonding of specimen JB did not cause a substantial reduction in strength and failure was classified as non-brittle, beam splitting failure. Combination between beam crushing and joint shear failure is observed in specimen JD and JP but specimen JP performs ductile flexural behavior while specimen JD revealed non-brittle failure.

Furthermore, this thesis proposes the interior beam-column joint model to assess the strength and failure mode. The main feature of this model can treat two dimensional reinforced concrete joint which is analyzed by sectional method. The mechanism of beam-column joint comprises of a softening strut mechanism, joint deformation, bond deterioration of longitudinal bar, splitting crack, beam and column capacity. This model has the capability to classify mode of failure such as joint shear, splitting or flexural failure and the highest strength. The accuracy and applicability of this program is satisfactorily proved with 28 experimental results of other researchers.

KEYWORDS: Beam-column joint, Deboded beam bar, Reversed cyclic loading, Joint shear failure, Diagonal strut mechanism, Special moment resisting frame.