Testing of Model of Exterior R.C Beam-Column Connection under Cyclic Loads[1]

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Abstract

In this paper, we know that the maximum stresses in the columns and beams, especially the one resulting from bending-moment due to earthquake loads, concentrate in joints, which makes them the most critical areas in the concrete frame. That's why any disorder in the behavior of joints has a direct influence on the behavior of the whole frame. Proceeding of the above mentioned point and with the many difficulties to determine the behavior of the structure during earthquakes, the joints have been handled in a reverse way by allocating some specific weak points in the frame, in which the non elastic activities are concentrated, when the building undergoes large deformations, which allows the rest of the structural members of the frame to keep its elastic behavior. The principle of the strong column and weak beam was adopted, under the following condition: The sum of the resisting moments in the columns in any joint divided by the sum of the resisting moments of the beams is bigger than the specified safety factor (1.2) according to the Syrian Code, and thus if a structure is exposed to a non elastic displacement, the plastic hinges occur in the beams and the columns keep its elastic behavior.

A test model of an exterior connection (column- beam) of a multi-story frame structure was designed, in a scale factor (1:2) according to the Syrian Code for buildings resisting earthquakes.

[1] For the paper in Arabic see pages (95-133).

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This test model was used to examine its non linear behavior under the influence of periodical loads, simulating the earthquake loads. The aim was, first to study the joint under cyclic loads till to the occurrence of a plastic hinge in the beam and not in the column, while the plastic hinge allows large rotations in its cross section. These rotations absorb the energy produced by earthquakes, without loosing its stiffness or its resistance, which represents the failure mechanism. Second, finding the moment–curvature hysteresis response curve, which shows the quantity of dissipated energy and the possibility of using the structural damage (cracks and plastic hinges) as earthquake energy dissipation mechanism.

The samples were tested in laboratory models fixed on metal frame. Five connections are tested (exterior beam - column). Details about the model tests and the properties of the used materials were explained in the research. The loads were applied through a loading curve attached to a computer with periodical displacements on the free edge of the joint, changing in a range from 5 mm to 50 mm, as a simulation of the earthquake loads. All necessary measurements were taken in order to know the linear and non-linear behavior of these samples.

Keywords: plastic hinge, Exterior R.C Beam-Column Connection under Cyclic Loads