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Behavior of RC Eccentric Corner Beam-Column Joint under Cyclic Loading: An Experimental Work

A. M. Basha [a*], Sabry Fayed [b]

[a] *Assistant Professor, Department of Civil Engineering, Faculty of Engineering - Kafrelshiekh University, Kafrelshiekh, Egypt.*

[b] *Assistant Professor, Faculty of Engineering, Kafrelshiekh University, Kafrelshiekh, Egypt.*

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Abstract

The present research investigates experimentally the behavior of the reinforced concrete BCJ joint under quasi-static cyclic loads for different mount of the shear reinforcement. The specimen consisted of two columns and two beams; one is a free end and the other is a fixed end. The shear reinforcement of the joint was 1Ø6 mm, 2Ø6 mm, and 3Ø6 mm. Three specimens were tested under quasi-static cyclic loading up to failure. The cracking loads, ultimate loads, deflection of the free end of the loaded beam, crack patterns and failure modes for BCJ were recorded and analyzed at each cycle. Also energy dissipation and stiffness degradation of all specimens were discussed. The experimental result indicates that the increase in the amount of the stirrups of the joint transmitted the main failure into the column far away from the joint. The increase in the amount of joint stirrups enhanced the joint capacity. The stirrups are most effective in is the middle third part of the BCJ than others two parts.

Keywords: Beam-Column Joint; Reinforcement of the Joint; Failure Modes; Crack Pattern; Deflection Behavior; Quasi-Static Cyclic Loading.

1. Introduction

The Beam Column Joints (BCJ) are one of the most important structural elements in concrete structures. This is due to their construction difficulty and its complicated design. In several structures subjected to earthquake, the BCJ was the main reason of its collapse. Kusuhara and Shiohara [1] tested a ten half-scale reinforced concrete beam-column joint sub-assemblages loaded up to failure by statically cyclic loading simulating earthquake loading, to obtain fundamental data including stress in bars after yielding and joint deformation. The cross-section of the beam is 300 × 300 mm and that of the column is 300 × 300 mm in all the specimens. Three sets of hoops of Ø6 were placed in the beam-column joints in all the specimens; the ratio of joint shear reinforcement is 0.3%. It was found that the story shear capacity of the specimen with transverse beams, in which the damage of the joint was severe, was improved. Also, in case of damage of joints were severe, bond actions of beam bars passing through the joints kept lower level than the bond strength. Poor anchorage length of beam bars in exterior joints led lower story shear capacity, yielding of column bars and severe damage in the joint.

Leslie M. Megget [2] tested four external reinforced concrete beam-column sub-assemblages under pseudo seismic cyclic loading. Two different forms of beam bar anchorage were tested, the normal 90-degree "standard hook" and the continuous U-bar detail. It was found that the maximum beam elongations between 2.7 and 3.8% of the beam depth were measured in all the units tested with 500E Grade beam reinforcing, about 35% greater than those measured for the

* Corresponding author: ealibasha@eng.kfs.edu.eg

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