



## Experimental Investigation of RC Exterior Beam Column Connection with Eccentric Beam Subjected to Reversible Quasi Static Loads

Ahmed G. Asran<sup>a</sup>, Hassan H. EL-Esnawi<sup>b</sup>, Sabry Fayed<sup>c\*</sup>

<sup>a</sup> Prof. of Concrete Structures, Faculty of Engineering, Azhar University, Egypt.

<sup>b</sup> Associate Professor, civil Engineering Department, Faculty of Engineering, Azhar University, Egypt.

<sup>c</sup> Assistant lecturer, civil Engineering Department, Kafrelshiekh University, Egypt.

Received 18 February 2017; Accepted 20 April 2017

### Abstract

Insufficiency of the Beam Column Joint (BCJ) caused structures failures particularly in case of the earthquakes. In most of the buildings, the beam center line was not aligned with the column center line. So, the effect of the eccentricity of the beam was studied in this article. Behaviour of reinforced concrete (RC) eccentric beam-column joint under reversible cyclic loading was investigated experimentally. The experimental program is one specimen. The specimen consisted of column and beam. The column divided into symmetry two parts (upper and lower parts). The beam fixed in middle of the column and it was free end. The main parameter was the effect of the eccentricity of the beam center line about the column center on behaviour of RC BCJ. The specimen was tested under reversible ten cycles. The horizontal displacement for the column and the vertical deflection at free end of the beam were recorded at each cycle. The crack pattern of the tested specimen was studied at every cycle in details. It was noticed that the eccentricity of the beam has concentrated more stresses on the joint side close to the eccentricity. The failure took place at the joint due to its weakness.

*Keywords:* Experimental Work; Reinforced Concrete Beam Column Joints; Cyclic Loading; Crack Propagation.

### 1. Introduction

Behavior of RC BCJ is very important because most of the structures subjected to earthquakes failed in the connections between the columns and the beams. The eccentric RC BCJ has a dangerous effect more than the concentric the RC BCJ. This was because that the eccentricity transmitted more stresses on one side without the other side. So the American code (ACI 352R-2 [1]) recommended by studying of the eccentric connections subjected to cyclic loading. A case study on pre 1970s constructed concrete exterior beam-column joints was studied by Ravi Kiran and Giovacchino Genesio [2]. Angelo Masi and et al. [3] induced an experimental tests and numerical simulations that were carried out on an external RC beam-column joint under seismic loads. Cyclic tests carried out on full-scale joint specimens. The main parameter was effect the axial compression column load. It was noticed that the value of the axial load acting on the column can change the collapse mode.

The effect of eccentricity on the seismic behavior of exterior beam-to-column connections was studied by Burcu Burak and James k. Wight [4]. Three (3/4-scale) exterior reinforced concrete beam-column-slab connections were tested under reversed cyclic loading. Cyclic loading tests of six full-scale RC beam-column connections were investigated by Rajesh Prasad Dhakal and et al. [5]. Many researchers introduced a lot of papers that studied behavior

\* Corresponding author: [sabrielmorsi@yahoo.com](mailto:sabrielmorsi@yahoo.com)

➤ This is an open access article under the CC-BY license (<https://creativecommons.org/licenses/by/4.0/>).