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EXPERIMENTAL STUDY ON THE SEISMIC BEHAVIOR OF STEEL BEAM TO BOX-COLUMN MOMENT RESISTING CONNECTIONS WITH DIFFERENT COLUMN STIFFENERS

Kianoush PEYKARI
M.Sc. Student, Shiraz University of Technology, Shiraz, Iran
k.peykari@sutech.ac.ir
Mohammad Amir NAJAFGHOLIPOUR
Assistant Professor, Shiraz University of Technology, Shiraz, Iran
najafgholipour@sutech.ac.ir
Seyed Mehdi DEHGHAN
Assistant Professor, Shiraz University of Technology, Shiraz, Iran
smdehghan@sutech.ac.ir

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Steel Moment Resisting Frames (MRFs) are known as a common structural system employed in buildings with different heights and occupancies. The observations of destructed buildings in last earthquakes, where several types of damages in the beam-column connections of the steel MRFs have been reported (Chen et al., 2018), confirm that beam-column moment connections have a crucial role in global seismic performance of the steel MRFs. The lessons from the performance of the buildings in each seismic event make the governments, researchers and engineers to revise the building codes with the aim of modifying their weak points.

Regarding the importance of the steel moment connections and their effects on the seismic performance of steel MRFs, numerous experimental and numerical studies have been established to evaluate their behavior under cyclic loads (Jahanbakhti et al., 2017; Chou et al., 2010).

Employing built-up steel box columns in MRFs with special level of ductility is permitted in some design codes for steel structures, such as AISC 341-16 (AISC/ANSI 341-16). Built-up box section is commonly used to fabricate columns in regions where appropriate hot rolled steel sections such as wide-flange or box-sections are rarely produced. A welded steel I-beam to box-column moment resisting connection is schematically illustrated in Figure 1-a. The mechanism of transferring internal actions in the joint region is shown in Figure 1-b.

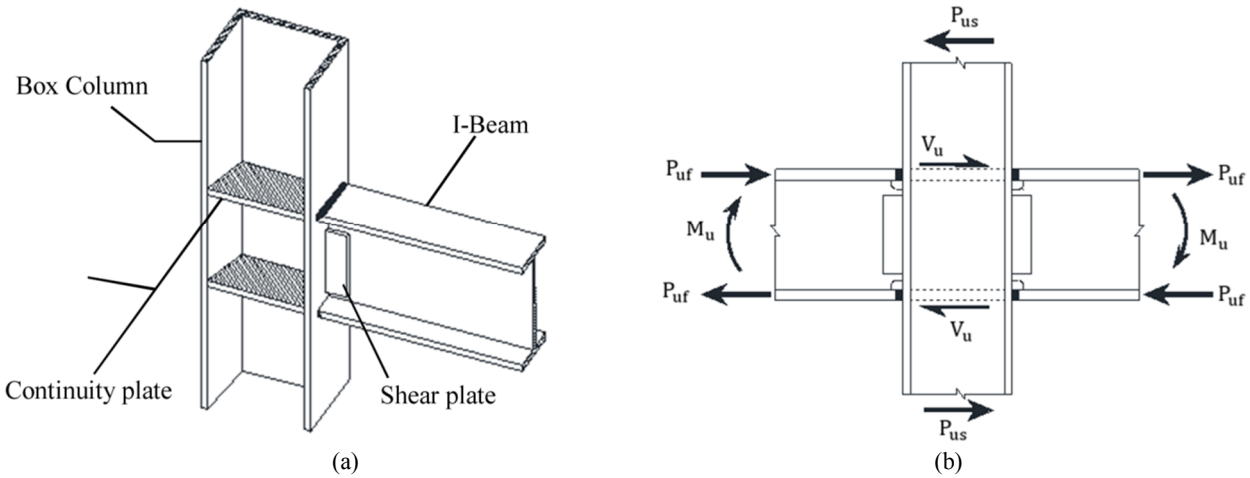

Figure 1. Steel welded I-beam to box-column moment connection, a) schematic view of the connection, b) moment transfer mechanism in the joint.

Regarding the complicated welding of continuity plates in box-columns due to lack of accessibility, a number of researchers have proposed some alternatives for continuity plates in box columns.

In this study, to eliminate the commonly used continuity plates in steel I-beam to box-column moment connections, an alternative detail is proposed. In the proposed technique, a vertical stiffener on column axis along the beam web is employed instead of the continuity plate. Therefore, the column section becomes similar to a wide-flange boxed section in the joint region. The seismic performance of the I-beam to box-column moment resisting connections with the proposed detail is assessed through an experimental program. For this purpose, cyclic tests were performed on two full scale exterior moment resisting connections, one joint with continuity plates in the panel zone and another one with a vertical stiffener as an alternative technique.

Finally, the test results in terms of hysteresis moment-rotation curves, observed damages, and measure strain in the critical stations, revealed that similar to the joint with common continuity plates, the connection with vertical stiffener in the joint panel, could satisfy the criteria of the special moment connections specified in AISC 341-16 (AISC/ANSI, 341-16).

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