IMPROVEMENT OF KHORJINI CONNECTIONS

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Keywords: Steel Structures, Rigid Connection, Khorjini Connection, Finite Element, Strain Jump

ABSTRACT

The purposeof this researchis tostudy the behaviorof conventional and retrofittedKhorjini connections. Four plates, which were welded between the beams and column, added to the common details of the connection. Two, common and retrofitted, connections were tested under monotonic loading. The tested specimens were modeled by a finite element method, which verified with experimental results. Several models with different size of the connection components were investigated using the verified FEM. The results indicated that a main defect of the conventional connections is severe stiffness deterioration, while Initial stiffness in the improved connections is more than four times the common detailed connections and stiffness deterioration is not a case of concern. Moreover, a great proportion of beam moment in Khorjini connections are carried to the column through beam flange to angle welds. Also, high stress concentration occurs in the elastic phase of the critical weld in a short length of the weld, which yields to stain jump, when the connection fails. However, in the retrofitted connections, added plates transfer a great amount of the connection moment to the column, which yields to a considerable reduction in the maximum plastic strains and von mises stresses in the critical weld. Consequently Retrofitted connections never fails, until beams reach to their ultimate plastic moments.

INTRODUCTION

A special type of steel connections, which has been used for beam-to-column connections in Iranian buildings through past decades is Khorjini connection. In this system, two beams are passed next to the column continously and are connected to the column sides using two angles in the top and bottom of each beam. However the connection is used extensively because of its simplicity and economic advantages, but its performance in the recent severe earthquakes in Iran proved its vulnerability against seismic loads. Following numerous damages in the buildings with Khorjini frames, many attempts were made to investigate and improve the connection behavior. Arbabi (1998), investigated stiffness of the connection.Moghaddam and Alaei (2003) and Mostafaei and Mazroi (2004), experimentally studied the ultimate strength and rotation of the connection. AmiriHormozaki (2012) and Moghaddam and Pirayehgar (2009) surveyed cracking pattern in the connection welds. Specifying weaknesses of the connection, researchers proposed various methods to improve the connection behavior. Karami (1991), tested five improved connections with different details. Mirghaderi and DehghaniRenani (2008), utilizing continuous vertical plates instead of the connection angles, created a ductile rigid connection. Bolted Khorjini connections were tested by Mirghaderi et al. (2007), which indicated its ductility in the moment resisting frames.
In this research program, two Khorjini connections were tested under monotonic loading, one with conventional detailing and another with the proposed details. The experimental results were used for verifying the nonlinear three-dimensional finite element models. The objective of this research is to study the application of the proposed detailing in retrofitting the existing connections.