



Seismic behavior of extended end plate moment connections considering construction imperfections

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Abstract

Extended end plate moment connection is one of the most commonly used types of beam connections. Despite their ease of erection and economical advantage, typical defects can be observed in steel frames built with such connections which require comprehensive studies on the classification of errors and their impacts on the seismic behavior of structures.

This paper evaluates effects of common construction imperfections on the seismic behavior of extended end plate moment connections. Some of these problems such as incomplete contact of end plates, widening of the bolt holes for erection purpose and inadequate fastening of the nuts are measured through field inspection. The corresponding amounts have been used in numerical modeling of the connection. Seismic behavior of the connection considering these defects was studied through nonlinear finite element analysis. Results show that such defects may cause a considerable reduction in stiffness and bending moment capacity of the joints which consequently increases the lateral drift of structure due to seismic load.

Keywords: Extended End Plate, Moment Connections, Construction Error, Steel Structure, Seismic behavior.

1. INTRODUCTION

Detailed examination of the connections in steel structures is particularly important, as Inaccuracy in design and execution of the steel Structure connections, not only leads to its failure to connection, but also will have devastating effects on structural members. Therefore, full understanding over structural behavior of connections and proper information of how their force transmits through the connection, is necessary to design a secure and economic connection.

Connections in steel structures can be classified in terms of their rigidity, more than 90 percent grade rigid connection, less than 20 percent grade Simple Connection and between 20 to 90 percent Semi-rigid Connection.

In all types of beam to column connections, using end plates is one of the conventional methods for constructing of rigid connections, especially in prefabricated steel structure. In end plate connection, beam is connected to end plate through groove weld in flanges and fillet weld in web with proper control. Whole beam and end plate were joined to column flange with high strength bolts.

2. RESEARCH PURPOSE

As variation of design parameters in bolted extended end-plate moment connections such as incomplete contact of end plates, widening of the bolt holes for erection purpose and inadequate fastening of the nuts have great effects on the seismic performance of structures, a full understanding of consequent impacts over changing the behavior of the connection parameters helps the designer to choose the type of connection. For this, the connection modeling with finite element software and nonlinear analysis was conducted, imperfection effects on connection rigidity were investigated and seismic behavior of structure has been evaluated by using modified connection rigidity.