The effects of reduced beam section connections on seismic displacement demands in steel moment frames

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Summary

Following extensive damage to welded steel beam-to-column moment connections during the 1994 Northridge and the 1995 Kobe earthquakes, analytical studies showed that Brittle fracture is one of the problems of connections in steel structures. Reduced beam section (*RBS*) moment resisting connections are among the most economical and practical rigid steel connections developed in the aftermath of the 1994 Northridge and the 1995 Kobe earthquakes. Using this type of connection, the plastic hinge will be placed, in a conducted mode, in a specific area in the beam. Among the types of *RBS* connections, is the *RBS* connection with reduced by radius section which will be analyzed in this research. Regarding the high impact of drift on building's damages, we have proceeded with analyzing the effect of reducing the stiffness of *RBS* connections on the increase or decrease of the frame drift. So we have proceeded with a comparison between this type of connection with cover plate. The results of analysis indicated that the fabrication of *RBS* connection will increase the global story drift angle, in comparison with cover plates connections, but as for the inter story drift angle the trend will not be the same and in different stories different behaviours will be observed. For analysis the SAP 2000 software were used and time history analyses were used for investigation.

Keywords: RBS connection, cover plate connection, stiffness, plastic hinge.

1. Introduction

During the 1994 Northridge earthquake, the bolted web-welded-flange (*BWWF*) moment connections in steel moment-resisting frames suffered unexpected brittle failures in and near the heat-affected zones [1, 2, 3]. Rigorous post-earthquake investigations have revealed many factors contributing to the failures. The high stress concentration at welded flanges and vulnerability of the connection to large ductility demand are considered to be two critical factors causing such failures. A natural way to solve the problem is to reduce ductility demand on the welded areas and alleviate stress concentration level. Many modifications have been proposed for post-Northridge earthquake new construction and retrofit of steel moment frames [1]. One of these is the reduced beam section (*RBS*) configuration. Portion of beam flanges near beam-to-column joint is cut to form a plastic hinge away from the joint so that much of ductility demand on beams may result from the *RBS* instead of the welded beam-to-column interface. Limited experimental studies have shown significant improvement in the overall ductility capacity of the beam-to-column assembly with *RBS*

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