17th Symposium on Earthquake Engineering
November 14-17, 2022
IIT Roorkee, India
Paper No. 139

Numerical Simulation of Special Moment Resisting Frame with Reduced Beam Section Under Cyclic Load

Abhay Rangoonwala[1], Subhra Paul[2], Sajal Deb[3]

[1]Post Graduate Scholar, Dept. of Civil Engineering, IIT Guwahati
[2]Research Scholar, Dept. of Civil Engineering, IIT Guwahati
[3]Professor, Dept. of Civil Engineering, IIT Guwahati

Abstract

In this paper, seismic performance of steel Special Moment Resisting Frame (SMRF) with Reduced Beam Section (RBS) was evaluated. In this study, radius-cut RBS was considered for facilitating the formation of plastic hinge in the desired location in the beam because of its excellent performance during past experiments. Two 5 storied sample steel SMRFs, with and without RBS were designed as per IS 800. NPB and WPB sections from IS 12778 were used for the beam and column of the connection respectively. Beam and column of the frame was connected through welded connection. Each of the beam-column subassemblies was modelled using finite element software ABAQUS (Version 6.14-1). Moment-Rotation curves were then extracted after applying quasi-static cyclic load at beam tip as per AISC. This Moment-Rotation curves for each connection were then used to define plastic hinge properties in software SAP2000 (Version 22.0.0). First mode pushover analyses were then carried out for both conventional frame and frame with RBS. The yielding at the location of RBS was observed earlier than the yielding of beam at corresponding location in the conventional frame. Some reduction in strength was also observed in SMRF with RBS. Formation of plastic hinges observed to spread in all the stories in SMRF with RBS. Whereas in conventional SMRF, plastic hinge was concentrated in lower stories. Thus, SMRF with RBS satisfied strong column weak beam criterion and thereby ensured higher ductility and energy dissipation.

Keywords: SMRF, RBS, Beam-column connections, Finite element analysis, Pushover analysis