YIELDING-CURVED-BARS & HEMISPHERECORE ENERGY DISSIPATING DEVICE ASTHE CENTRAL SUPPORT OF REPAIRABLEBUILDINGS WITH SEESAW MOTION

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ABSTRACT

Design of repairable buildings, whose structural systems can be easily repaired after a major earthquake, instead of demolishing and rebuilding, havebeen paid great attention by some researchers in recent decade.In this paper a study in which specific attention has been paid to the behavior of the central support which has a main role in creating the possibility of seesaw motion in the building's structural system, as well as creating some capacity of seismic energy dissipation is presented.The proposed device can be called briefly Yielding Curved Bars (YCB) energy dissipater. The YCB energy dissipater can act as the central support under the central main column of the building at lowest level. The clipped hemisphere carries the vertical load of the central column of the building with seesaw motion, and transfer it directly to its concave bed, while the curved bars around the clipped hemisphere act as yielding elements during the seesaw motion of the building which causes the central column to incline, and this inclination causes the rotation of the YCB device around a horizontal axis, resulting in large plastic deformations of curved rods, and therefore, large amount of energy dissipation during earthquake excitations. The YCB device was modeled by a powerful finite element analysis computer program and its hysteretic behavior under the simultaneous effects of vertical and horizontal loads was obtained. To investigate the efficiency of using the YCB device in reduction of seismic response of buildings a multi-story regular steel building was considered once with conventional design and once equipped with the YCB device and some similar yielding energy dissipaters under all circumferential columns and the seismic responses were calculated by time history analyses, employing a set of selected three-component accelerograms. Resultsshow the high efficiency of the YCB devices in seismic response reduction of buildings.

INTRODUCTION

Design of repairable buildings, i. e. the buildings whose structural systems can be easily repaired after a major earthquake, instead of demolishing and reconstructing, have been paid great attention by some researchers in recent decade. Use of rocking mechanism of the building's structure (Azuhata 2004) and employing telescopic columns in buildings with rocking motion (Hosseini and NoroozinejadFarsangi 2012) are two samples of these researches. More specifically, using a multi-stud energy dissipating device as the central fuse for regular steel buildings with rocking motion (Hosseini and Kherad 2013) can be mentioned as a study in which specific attention has been paid to the behavior of the central support which has a main role in creating the possibility of rocking motion or seesaw motion (to be more precise) in the building's structural system.