

## ABSTRACT

Firat, Günseli Yeliz, Ph.D., Purdue University, August 2006. The Effect of Bolted Frames on the Earthquake Resistance of Structural Steel Buildings. Major Professor: Judy Liu

Observations after the 1994 Northridge earthquake revealed the limited ductility capacity of welded connections. It has been established that typical welded connections are susceptible to abrupt stiffness and strength loss at rotations as low as  $1/10^{\text{th}}$  of their ductility capacity. Furthermore, variations in the ductility capacity of “improved” welded connections reflect the effects of inevitable variations in the weld quality. It has also been demonstrated that bolted frames originally designed for gravity loads retain their lateral load resisting capacity up to interstory drift ratios on the order of three percent. In this study, the possibility of improving the earthquake resistance of structural steel buildings by utilizing the stable and ductile response of bolted frames was investigated. Based on a satisfactory limit to interstory drift ratio set as two percent, the earthquake resistances of representative three- and nine-story steel buildings designed for high seismic risk were found to be inadequate. Reductions in the interstory drift ratios were obtained by increasing the lateral resistance of bolted interior frames. Ultimately, it was demonstrated that, subjected to equal ground-motion demands, buildings with bolted frames are more likely to sustain interstory drift ratios not exceeding two percent than comparable buildings with welded perimeter frames and bolted interior frames.