SEISMIC ASSESSMENT OF CONTROLLED ROCKING STEEL BRACED FRAME

NavidRAHGOZAR
Department of Earthquake Engineering, Science and Research Unit, Islamic Azad University, Tehran, Iran
n.rahgozar@srbiau.ac.ir

AbdolrezaSARVGHADMOGHADAM
Assistant Professor, Structural Engineering Research Center, International Institute of Earthquake Engineering and Seismology (IIEES), Tehran, Iran
moghadam@iiees.ac.ir

NimaRAHGOZAR
Department of Earthquake Engineering, Science and Research Unit, Islamic Azad University, Tehran, Iran
nima.rahgozar@srbiau.ac.ir

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ABSTRACT

Enhancement of seismic resilience of structuresunder severe earthquake is attainable with various system such as controlled rocking self centering concentric braced frame, SC-WCBF-CR. This paper investigates the rocking effect in the SC-WCBF-CR system in comparition with conventional steel braced frame,WCBF_FBD time-history nonlinear dynamic analysis of 9-story SC-WCBF-CR and WCBF_FB seismic systems is conducted using two horizontal components ofrecords of far-fault scaled under DBE and MCE hazard level. The results of time history analyses of these systems are compared to each other. The results of seismic analysis show enhancement in performance of SC-WCBF-CR system in significant decrease in permanent drift and nonlinear deformations, and creation of damge concentration in fuse element in comparison with WCBF_FB system.

INTRODUCTION

Eatherton and Hajjar (2010) developed Controlled Self-centering concentric braced frame with PT cables and shear panels fuses system and conducted at Illinois University in Urbana-Champaign quasi- cyclic static test half-scale frame. The controlled rocking system is designed to rock upon its foundation during an earthquake, vertical post-tensioning strands that anchor the top of the frame down to the foundation, which brings the frame back to center and provide overturning resistance. Hall et al (2010)studied numerically the effective parameters on the behavior of the controlled rocking steel frame system. Ma, (2011) at Stanford University analyzed and examined shear steel yielding fuse dampers of the SC-WSCB-CR system. Ma, et al (2010)performed experiments shaking table test, 0.68 scale single self-centering frame at Japan's DefenseCenter. Etheron et al (2014) developed limites state design concepts of the system. The self-centering controlled rocking system consists of a steel braced frame, post-tensioned cable, and replaceable structural fuses to dissipate earthquake energy.

The mechanics of the system response are shown in Figure 1 .The flag shape response is characteristic of a self-centering system which is intuitive in that the displacement returns to near zero as the force is removed. The response of the combined system is defined by uplift of the frames, yield of the fuse, Arbitrary point of load reversal, fuse is at zero force and begins to load in the opposite direction , fuse yields in the opposite direction, frames set back down.