SEISMIC ASSESSMENT OF CONTROLLED ROCKING STEEL BRACED FRAME

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Enhancement of seismic reversibility of buildings against earthquakes with the aim of functionality and protection of the health of the human resources after earthquake is attainable in a various ways such as self centering concentric braced steel system with controlled rocking (SC-WCBF-CR).

The main contribution of this study is investigating the effect of uplifting in self-centering controlled rocking structural system in comparison with conventional steel braced frame (WCBF-FB). The self-centering controlled rocking system consists of a steel braced frame, post-tensioned cable, and replaceable structural fuses to dissipate earthquake energy.

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. 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.

2D time-history nonlinear dynamic analysis of SC-WCBF-CR and WCBF_FB seismic systems is conducted using two horizontal components of 22 records of far-fault scaled to two goal seismic hazard level: design earthquake and maximum probable earthquake. The results of engineering responses and processed results of time history analyses of archetypes of SC-WCBF-CR system are compared to each other; and its behavioral performance is compared to WCBF-FB system. 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 damage concentration in fuse element with comparison to WCBF-FB system.

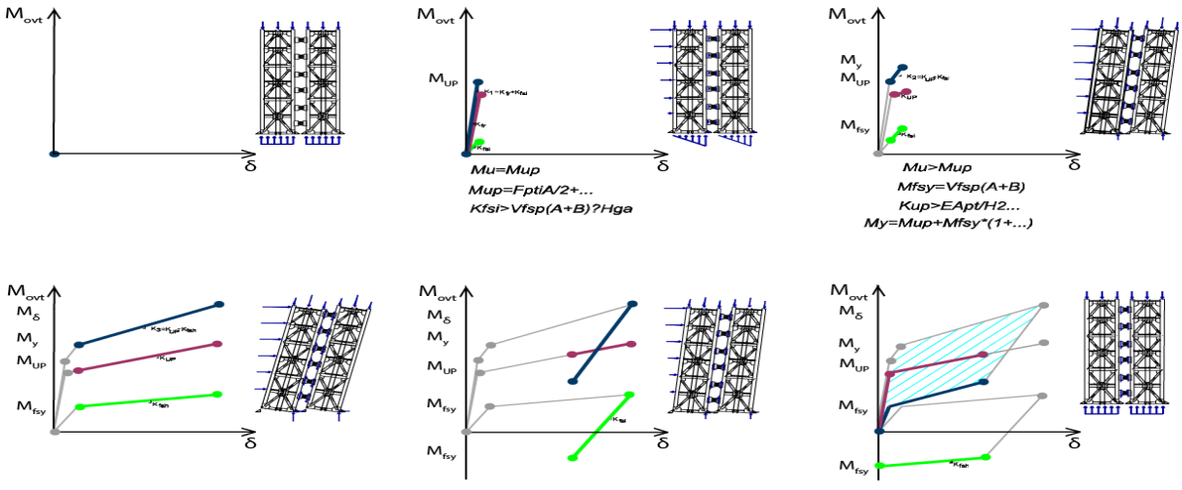

Figure 1. Response of Self Centering Frames