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STUDY ON RESPONSE OF CSPSW AND SPSW TO NONLINEAR EXCITATIONS

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Recently, the application of Composite Steel Plate Shear Walls (CSPSWs) and Steel Plate Shear Walls (SPSWs) as anti-earthquake systems has been developed. These systems should be resistant enough, ductile, and stiffened to strengthen against different types of excitations. Steel Plate has main effect on providing strength of SPSW. In CSPSW, concrete cover is added to one or two sides of steel plate to avoid the buckling of steel plate. In this work, the seismic performance of these two systems is investigated under different near and far seismic inputs. Collapse capacity of systems subjected to near and to far field seismic records is also discussed. Strip elements (Thorburn et al., 1983) are employed to model the CSPSW and SPSW in SAP2000 as shown in Figure 1. An experimental result (Gao, 2007) of CSPSW is first verified as shown in Figure 2.

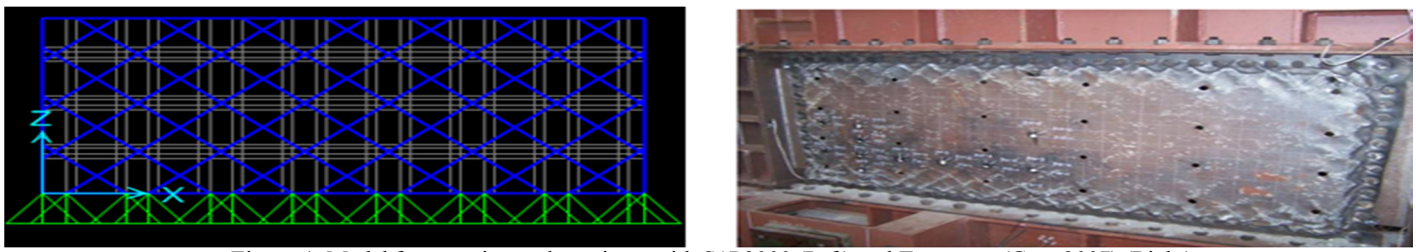

Figure 1. Model for experimental specimen with SAP2000 (Left) and Test setup (Gao, 2007) (Right)

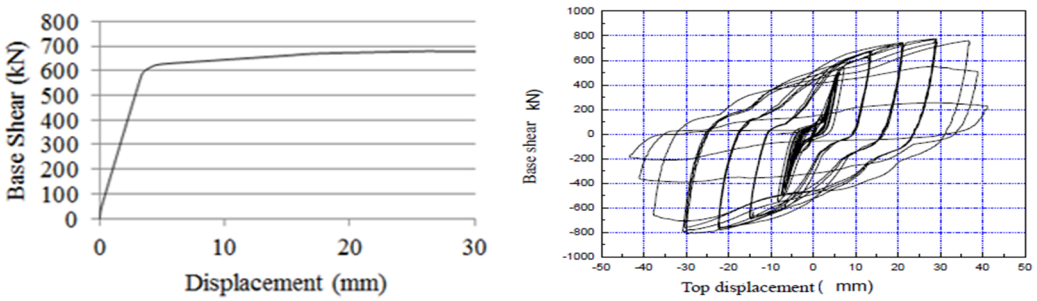

Figure 2. Validation of strip model (Left) and hysteretic curves of experimental tests (Gao, 2007) (Right).

A six story structure equipped with both systems is then modeled. Nonlinear Time History Analyses (NTHAs) are conducted based on different maximum ground acceleration levels. Figures 3 and 4, show that Immediate Occupancy (IO) performance level is reached for both systems under near field records while CSPSWs experience higher performance levels under far field records. Hence, appropriate seismic performance of CSPSWs can be clearly observed. More precisely, CSPSWs experience Life Safety (LS) performance level or at least Collapse Prevention (CP) performance level while SPSWs fully collapse.

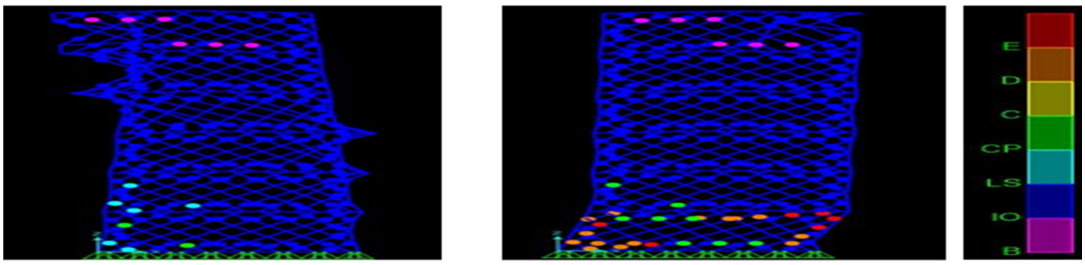

Figure 3. Response of CSPSW (Left) and SPSW (Right) subjected to Cape Mendocino far field input.

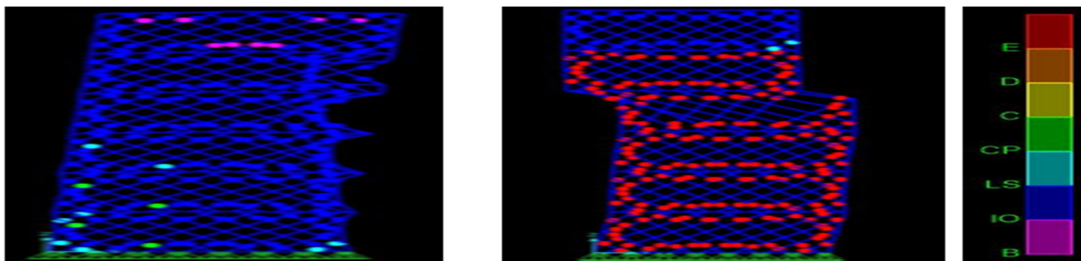

Figure 4. Response of CSPSW (Left) and SPSW (Right) subjected to Tabas near field input.

In addition, this study deals with the effect of CSPSW on moment frame through pushover analyses. Figure 5 shows that collapse intensity in lower stories is high.

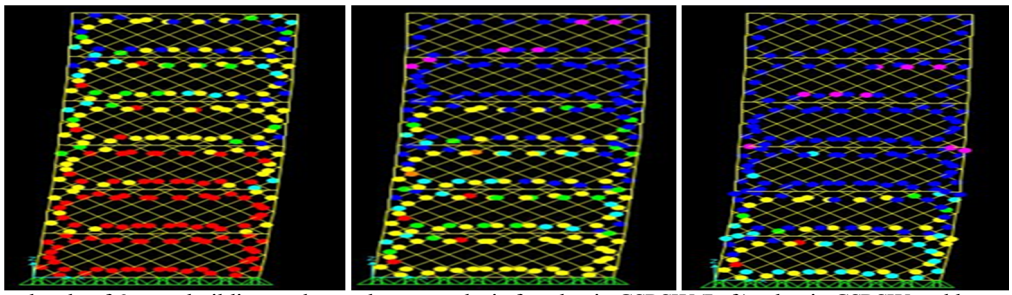

Figure 5. Performance levels of 6 story building under pushover analysis for plastic CSPSW (Left), plastic CSPSW and beams (middle) and plastic CSPSW, beams and columns (Right).

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