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COMPARISON OF PERFORMANCE OF MID HEIGHT STEEL BRACED ROCKING BUILDINGS WITH LOW RISE BUILDINGS

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Controlled-rocking braced frames are capable of reducing the drawbacks of conventional frames against seismic loading. Commercially available technologies are used to propose a system that is capable of damage control, elimination or reduction of residual stresses, collapse prevention (CP), and postearthquake realignment and repairs (PERR). The new approach was inspired by the current state of knowledge and the need to develop sustainable steel braced frame with rocking motion (Rahgozar et al., 2016; Eatherton et al., 2014). The purpose of this paper is to investigate the effect of seismic performance of 3 and 15 story buildings with and without rocking motion and appropriate placement of brace frame in steel braced buildings. In this paper, using nonlinear response history analysis, response parameters of two three-dimensional 3 and 15-story buildings are compared. The seismic behavior are studied under far-field earthquake records at two maximum PGA levels of 0.35 g and 0.7 g. These buildings are simulated and analyzed (SAP 2000V17.1.1). The three-dimensional symmetric version of models studied here are a model referred to in Report NSEL Report series-026, taken from Research Project SAC, which was examined (Hall et al., 2010). The arrangement of the rocking brace frame have been modified, and in a part of the study the number of story has been increased. For nonlinear response history analysis, seven far-field ground motion records have been used from the sets of 22 records presented in Appendix A of the FEMA-P695 report, the characteristics of which are shown in Table 1. The earthquake records are applied only horizontally in X direction.

Table 1. Specifications for records used in nonlinear response history analyses (FEMA-P695 report).

Record number	Earthquake	Station	M	Year	PGA (g)	Distance (km)
EQ1	Northridge, USA	Beverly Hills-Mulhol	6.7	1994	0.52	13.3
EQ2	Duzce, Turkey	Bolu	7.1	1999	0.82	41.3
EQ3	Imperial Valley, USA	El centro Array#11	6.5	1979	0.38	29.4
EQ4	Kobe, Japan	Akashi-Nishi	6.9	1995	0.51	8.7
EQ5	Kocaeli, Turkey	Duzce	7.5	1999	0.36	98.2
EQ6	Loma Prieta, USA	Gilroy array#3	6.9	1989	0.56	31.4
EQ7	Manjil, Iran	Abbar	7.4	1990	0.52	40.4

As shown in Figure 1, the buildings in each direction have two rocking braced frames, which the brace arrangement is different in each model.

The response parameters including; performance levels, drift, horizontal acceleration, vertical acceleration and the amount of uplift displacement of the columns base are compared. Horizontal acceleration at two maximum PGA levels of 0.35 g and 0.7 g for 3-story and 15-story models is shown in Figure 2.

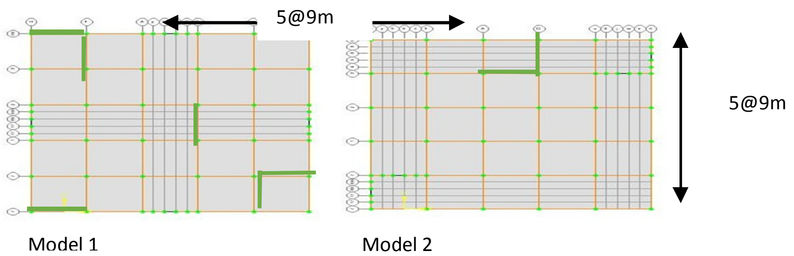


Figure 1. Plan of 3D studied models.

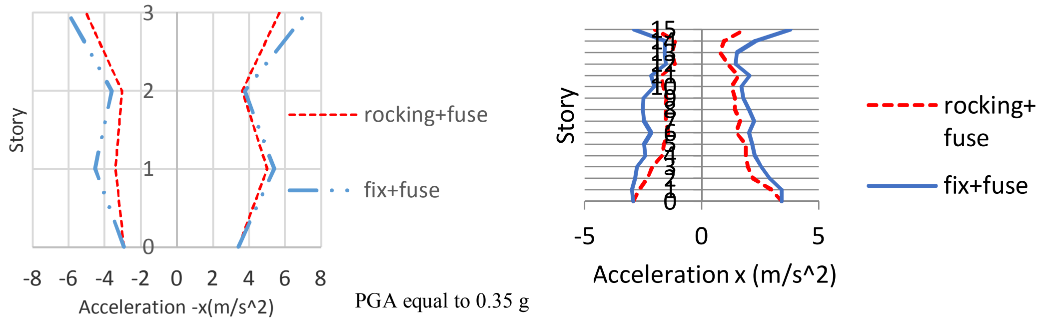
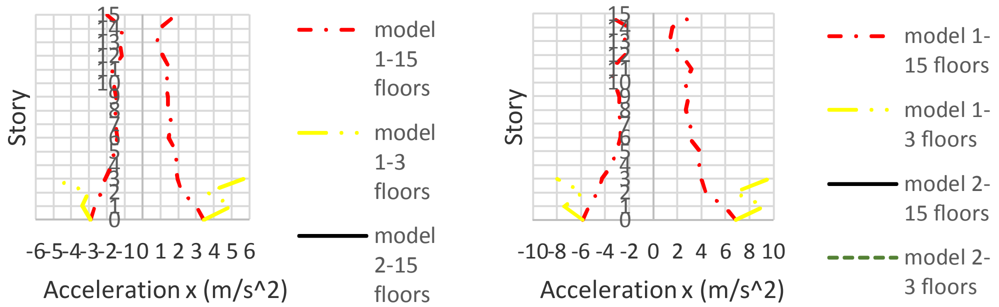


Figure 2. Horizontal acceleration in model1 subjected to earthquake No. 7.



a) PGA equal to 0.35 g b) PGA equal to 0.7 g

Figure 3. Horizontal acceleration in model1 and 2 subjected to earthquake No. 7.

Results of the investigation are compared in terms of performance level, the vertical and horizontal acceleration, the maximum inter-story drift and the amount of uplift displacement of the columns base. The main conclusions of the investigation are as follows:

1. In models of 3 and 15 floors, parameters such as the level of performance and horizontal acceleration (Figure 2) are improving for rocking models compare to fix models.
2. Both the 3-story and 15-story buildings with rocking motion that have braces in the corners of the building are better in all response parameters, although in 15-story buildings, the sensitivity of the responses to the braces location increases.

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