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SEISMIC PERFORMANCE OF ROCKING CONCRETE SHEAR WALLS WITH INNOVATIVE ROTATIONAL RESILIENT SLIP FRICTION JOINTS

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With the prevalence of the concept of damage avoidance design, rocking walls were one of the primary solutions to minimize structural components' damage as well as decreasing the time and cost of building rehabilitation after severe earthquakes. In this study, in order to achieve a self-centring damage avoidance rocking system, a new generation of Rotational Resilient Slip Friction Joint (Rotational-RSFJ) has been employed as a shear link between reinforced concrete shear walls and their boundary columns.

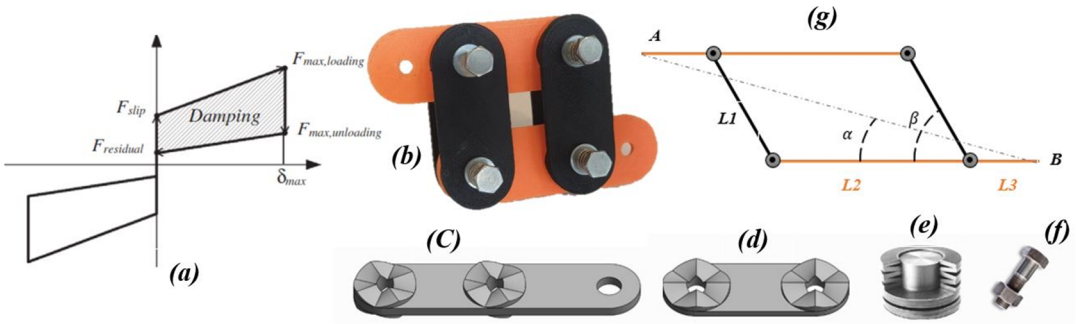

Figure 1. (a) hysteresis behaviour of RSFJ ;(b) R-RSF joint component; (c) middle plate; (d) cap plate; (e) conical disk spring; (f) high strength bolt; (g) simplified analytical model.

This type of friction damper dissipates energy through the rotational sliding of grooved surfaces pre-stressed using disc springs, which can also provide the required self-centering to restore the building to its original position without residual drifts. In this paper, initially the joint component has been analytically and numerically investigated, and then the results have been used to develop an analytical model for the performance prediction of the proposed rocking shear walls as a new lateral load resisting system. Such new self-centring system not only does not require post-event maintenance, but also attenuates the complexity of analyzing and implementing of conventional resilient rocking walls using post-tensioning tendons.

Eventually, a five-story prototype building using the proposed lateral load resisting system comprising of single and coupled rocking walls has been numerically analyzed. Besides, the effectiveness of such a concept has been investigated for rocking systems with multiple ductile joints in different stories. The results demonstrated the efficiency of the proposed system that is mainly attributed to high ductility, self-centring and the ability to dissipate energy of Rotational-RSFJs.

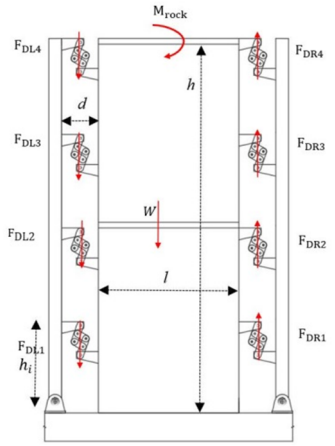

Figure 2. Schematic of single wall system.

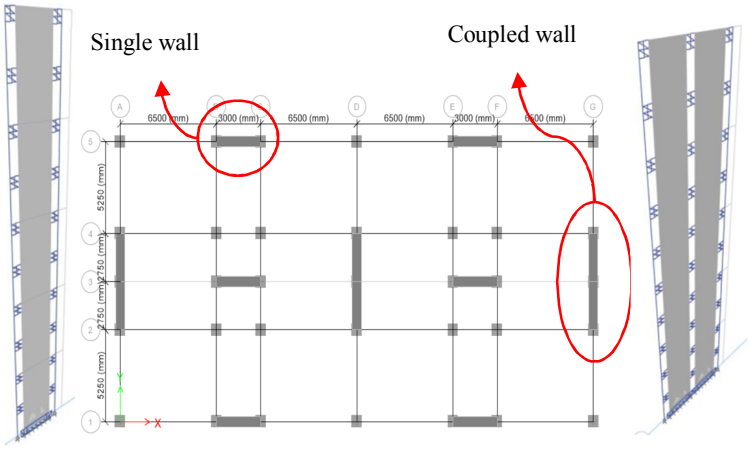

Figure 3. Plan view of prototype building.

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