This study investigates the inelastic response of yielding structures coupled with rocking walls. This topic is of major significance in the design of tall moment-resisting buildings, since during recent major earthquakes several tall, moment-resisting frames that had been designed in accordance to the existing seismic code provisions, exhibited a weak-story failure. Utilization of this structural system can help reducing maximum story drifts, prevents weak story failure and minimize residual deformation of the structure. This study first examines different configurations of both stepping rocking walls and pinned rocking walls that have been reported in the literature. Next, effect of additional vertical tendons or vertical damping devices in maximum response of the system is investigated. This research first derives the nonlinear equations of motion of a yielding oscillator coupled with a rocking wall and the dependability of the one-degree of freedom idealization is validated against the nonlinear time-history response analysis of a 9-story moment-resisting frame coupled with a rocking wall. This research finally concludes that, stepping wall suppresses peak and permanent displacements, with the heavier wall being most effective. In contrast, the pinned rocking wall increases in general the peak inelastic displacements and the permanent displacements. While, the coupling of weak building frames with rocking walls is an efficient strategy that controls inelastic deformations by enforcing a uniform interstory-drift distribution, therefore, avoiding mid-story failures, the study shows that even for medium-rise buildings the effect of vertical tendons on the inelastic structural response is marginal, except for increasing the vertical reactions at the pivoting points of the rocking wall. Additionally, The SDOF idealization presented in this paper compares satisfactory with finite-element analysis of a 9-story steel SAC building coupled with a stepping rocking wall; therefore, the SDOF idealization can be used with confidence for preliminary analysis and design.

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The public is welcome to attend.