SEISMIC EVALUATION OF DUAL HINGE DESIGN APPROACH OF RC SHEAR WALL IN DUAL STRUCTURAL SYSTEM CONSIDERING NEAR FIELD EARTHQUAKES

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With the development of earthquake and structure sciences, structure codes and seismic provisions are being updated, but there are still many aspects that are not fully understood due to the random nature of earthquake motions as well as the complex features of the response of reinforced concrete structures.

The paper examines the impact of higher modes on the seismic response of dual structural system in form of concrete moment-resisting frame accompanied with RC shear walls, against near-field earthquakes. A 20 stories reinforced concrete shear wall-special moment frame structure has been designed according to ASCE7 requirements. The nonlinear model of the structure was performed on the Open System for Earthquake Engineering Simulation (OpenSees) platform. Nonlinear static and time history dynamic analysis with 3 near-field records are performed on them .In order to further understand the structural collapse behavior in the near field, the response of the structure at the moment of collapse especially the formation of plastic hinges is investigated .

The results have shown that shear forces in excess of capacity design values can develop due to the contribution of the higher modes of vibration in the near field earthquakes to dynamic response Such higher shear forces can cause brittle shear or sliding failure modes.

The results also revealed that the amplification of moment at top of the wall due to higher modes the plastic hinge can form in the upper part of walls, even when designed and detailed for plastic hinging at the base only (according to ACI code) (Figure1).

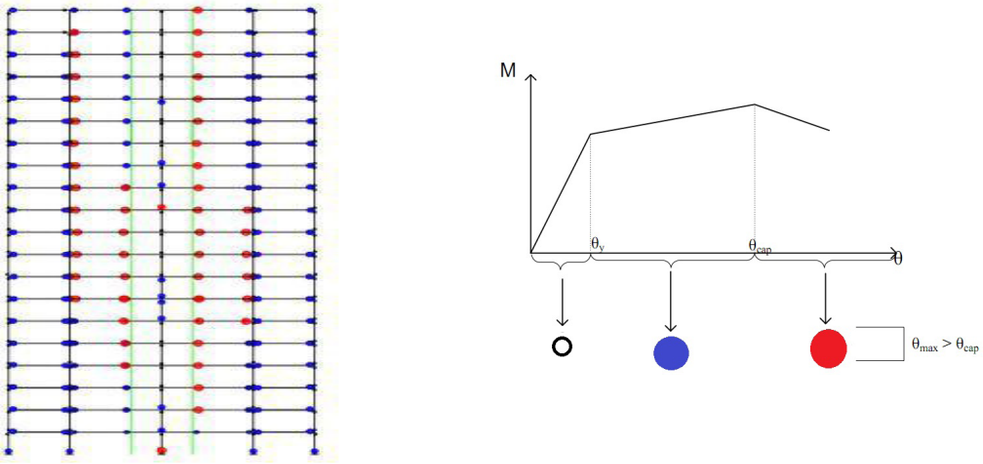

Figure 1. Formation of plastic hinges at the moment of collapse against superstition Hills record

The past investigation on shear walls clearly shows the dual-hinge design concept is effective at reducing the effects of the second mode of response. An advantage of the concept is that, when combined with capacity design, it can result in relaxation of special reinforcing detailing in large portions of the walls (Panagiotou and Restrepo, 2009).

In this paper, to investigate the implications of multiple design approach, 4 model has been considered. In the first model named SPH (single plastic hinge), one plastic hinge conforming to ACI-318 provisions is located at the base of the walls. in the two other models, another plastic hinge is added to the first model which is located at the 0.4 and 0.6 height of the wall, and the last model concluded these three plastic hinges .results base on time history analysis showed that the dual or multiple plastic hinges approach can be useful in order to control the high moment and shear demand of higher mode effect.

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