

Seismic Evaluation of Multi-Plastic Hinge Design Approach on RC Shear Wall-Moment Frame Systems against Near-Field Earthquakes

Authors : Mohsen Tehranizadeh, Mahboobe Forghani

Abstract : The impact of higher modes on the seismic response of dual structural system consist of concrete moment-resisting frame and with RC shear walls is investigated against near-field earthquakes in this paper. a 20 stories reinforced concrete shear wall-special moment frame structure is designed in accordance with ASCE7 requirements and The nonlinear model of the structure was performed on OpenSees platform. Nonlinear 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 explored. The results 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 wall, even when designed and detailed for plastic hinging at the base only (according to ACI code).on the other hand, shear forces in excess of capacity design values can develop due to the contribution of the higher modes of vibration to dynamic response due to the near field can cause brittle shear or sliding failure modes. 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 wall. In this study, to investigate the implications of multi-design approach, 4 models with varies arrangement of hinge plastics at the base and height of the shear wall are considered. results base on time history analysis showed that the dual or multi plastic hinges approach can be useful in order to control the high moment and shear demand of higher mode effect.

Keywords : higher mode effect, Near-field earthquake, nonlinear time history analysis, multi plastic hinge design

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