Effect of plastic zone levels on the responses of concrete shear walls subjected to strong ground motions

hamid beiraghi[1], Mohammad Ali Kafi[2], and ali kheyroddin[2]

[1]Islamic Azad University
[2]Semnan University

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Abstract

Generally, in reinforced concrete (RC) core wall buildings, the formation of one plastic hinge at the base is preferred; this is referred to as the Single-Plastic Hinge (SPH) approach. This paper considers RC core walls of 30, 40 and 50-storey tall buildings, designed using a response spectrum analysis. Then, the SPH, Dual-Plastic Hinge (DPH), Triple-Plastic Hinge (TPH) and Extended Plastic Hinge (EPH) approaches are examined using fibre element models and using nonlinear time history analysis. The DPH and TPH approaches contain one and two plastic hinges at the upper levels of the wall, respectively, in addition to the base plastic hinge. The effect of the locations of the upper plastic hinges on the seismic response of the core wall is investigated. The results show that there is not a distinct level for the upper plastic hinge location to minimize the envelope of different demand quantities simultaneously. The curvature demand of the middle plastic hinge in the TPH cases is higher than the base curvature demands. Reducing the resistant moment at the wall base by reducing reinforcement ratio can help to balance the curvature demands along the height of the TPH model

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