Title Effects of Opening Configurations on Nonlinear Dynamic Response of Reinforced Concrete Walls

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Abstract

To provide good resistance and stiffness against lateral loads, RC walls can be used in medium to high rise buildings. Commonly openings are present in RC walls for prerequisite of services doors and windows. These openings may affect the behaviour of the wall especially under earthquake loads.

This study is conducted to investigate the effects of opening configurations for nonlinear dynamic response of RC walls. Five walls with different opening configurations are selected. These are walls without openings, regular openings, irregular openings, staggered openings and openings with overlaps with two different numbers of stories (10, 20). Furthermore this study also investigate the effects of opening variations according to the wall area with three different percentage of reinforcement (0.5%, 0.8%, 1%) and opening sizes (10%, 20%,30% of wall area).

Nonlinear layered shell element modeling technique has been used to capture the nonlinear behavior of these walls. Then the analysis results of all these walls are presented in terms of base shear, top displacement, envelops of inter story shear, moment and displacement. And then all these structural response are compared together to find out the desirable and undesirable opening configurations in RC walls. From the analysis result it is obtained that increasing the size of the opening greatly affects the strength and drift of the walls under seismic loading. Larger the size of the openings will give less shear demand and more displacement value in the structural walls. Increasing the amount of the reinforcement in 10 story walls with different size and arrangement of opening may increase the shear demand but not significantly

Keywords RC walls with regular openings, irregular opening, staggered openings, opening with overlaps, nonlinear layered shell elements, nonlinear direct integration time history analysis.