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The Effects of Placement and Cross-Section Shape of Shear Walls in Multi-Story RC Buildings with Plan Irregularity on Their Seismic Behavior by Using Nonlinear Time History Analyses

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Abstract : Environmental and functional conditions sometimes necessitate the architectural plan of the building to be asymmetric, and this result in an asymmetric structure. In such cases, finding an optimal pattern for locating the components of the lateral load bearing system, including shear walls, in the building's plan is desired. In case of shear walls, in addition to the location, the shape of the wall cross-section is also an effective factor. Various types of shear wall and their proper layout might come effective in better stiffness distribution and more appropriate seismic response of the building. Several studies have been conducted in the context of analysis and design of shear walls; however, few studies have been performed on making decisions for the location and form of shear walls in multi-story buildings, especially those with irregular plan. In this study, an attempt has been made to obtain the most reliable seismic behavior of multi-story reinforced concrete vertically chamfered buildings by using more appropriate shear walls form and arrangement in 7-, 10-, 12-, and 15-story buildings. The considered forms and arrangements include common rectangular walls and L-, T-, U- and Z-shaped plan, located as the core or in the outer frames of the building structure. Comparison of seismic behaviors of the buildings, including maximum roof displacement, and particularly the formation of plastic hinges and their distribution in the buildings' structures, have been done based on the results of a series of nonlinear time history analyses by using a set of selected earthquake records. Results show that shear walls with U-shaped cross-section, placed as the building central core, and also walls with Z-shaped cross-section, placed at the corners give the building more reliable seismic behavior.

Keywords : vertically chamfered buildings, non-linear time history analyses, l-, t-, u- and z-shaped plan walls
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