



Seismic Analysis of Vertical Asymmetric RC Building

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Abstract

Urbanization is demanding multi-storied buildings to accommodate a large amount of population in a limited space. To accommodate the need of the occupants, soft-storey and green-roof buildings are becoming common. The parking demands are leading to the soft storey and green roofs or recreational roofs are leading to mass asymmetric buildings. Green roofs are becoming familiar for roof gardening so that sustainability can be maintained. Recreational roofs like swimming pools, and rooftop stadiums are also leading to mass asymmetric structures. These modern requirements are making the building vertically asymmetric by stiffness and mass. The multi-storied buildings with stiffness and mass asymmetry are vulnerable to external loads and critical under seismic vibrations. A dynamic analysis of vertically asymmetric RC structures under seismic loading is performed by developing a MATLAB program. The mathematical models of the structures are developed based on a single super-element (SE) model on each floor. The effects of lateral load-resisting (column and core) elements in a particular floor are equated with a single super element. Each SE model has displacements in longitudinal and transverse directions and rotation about the vertical axis as the degrees of freedom at each node. The natural periods are estimated for a plan asymmetric building with different eccentricities and found that the natural period is increasing with the increase in eccentricity. A unidirectional and bidirectional time-history analysis under seismic load is performed for vertical mass and stiffness asymmetric buildings. The Bhuj earthquake (2001) data is considered for the study. The analytical results shows, that the soft-storey building is relatively more sensitive to external vibration when compared with mass asymmetric building. Hence it is recommended to design and construct the buildings by avoiding soft storey at bottom floor.

Keywords: Free vibration analysis, Mode shape, Dynamic analysis, Vertical asymmetric building, Soft-storey building