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Vulnerability Assessment of Vertically Irregular Structures during Earthquake

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Abstract : Vulnerability assessment of buildings with irregularity in the vertical direction has been carried out in this study. The constructions of vertically irregular buildings are increasing in the context of fast urbanization in the developing countries including India. During two reconnaissance based survey performed after Nepal earthquake 2015 and Imphal (India) earthquake 2016, it has been observed that so many structures are damaged due to the vertically irregular configuration. These irregular buildings are necessary to perform safely during seismic excitation. Therefore, it is very urgent demand to point out the actual vulnerability of the irregular structure. So that remedial measures can be taken for protecting those structures during natural hazard as like earthquake. This assessment will be very helpful for India and as well as for the other developing countries. A sufficient number of research has been contributed to the vulnerability of plan asymmetric buildings. In the field of vertically irregular buildings, the effort has not been forwarded much to find out their vulnerability during an earthquake. Irregularity in vertical direction may be caused due to irregular distribution of mass, stiffness and geometrically irregular configuration. Detailed analysis of such structures, particularly non-linear/ push over analysis for performance based design seems to be challenging one. The present paper considered a number of models of irregular structures. Building models made of both reinforced concrete and brick masonry are considered for the sake of generality. The analyses are performed with both help of finite element method and computational method.The study, as a whole, may help to arrive at a reasonably good estimate, insight for fundamental and other natural periods of such vertically irregular structures. The ductility demand, storey drift, and seismic response study help to identify the location of critical stress concentration. Summarily, this paper is a humble step for understanding the vulnerability and framing up the guidelines for vertically irregular structures.

Keywords : ductility, stress concentration, vertically irregular structure, vulnerability
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