Effect of vertical irregularity on the seismic performance of existing RC buildings in Egypt

Abstract:

Irregular buildings represent considerable portion of urban structures. Irregularity of buildings can exist due to architectural, functional, and economical constrains. Past experience showed that considerable damage may occur to irregular buildings due to earthquakes. Recently, vertical irregularities in buildings have gained a lot of interest in seismic research investigations. The main objective of this research is to evaluate the seismic performance of these irregular reinforced concrete buildings. Only one source of irregularity in vertical stiffness of buildings is considered; that is the story height. The effects of irregularity in the vertical stiffness distribution, of these buildings, on the base shear and seismic drift as well as the capacity curves are assessed. Two models of RC buildings are analyzed to evaluate the seismic performance. The first model represents an old RC building designed according to past generations of design practices (E.C.P., 1991). The second model conforms to the current earthquake design code (E.C.P., 2008). A parametric study is conducted to investigate the effects of variation of story height on the seismic performance. Nonlinear Pushover analysis and dynamic time history analysis are employed in the evaluation process of the two models using the software Zeus-NL (Elnashai et al, 2004). The results of the parametric study indicate that, buildings constructed according to the new code have better seismic performance and more strength than old buildings. The results prove, as well, that the irregular buildings are more vulnerable than the regular ones. The variation in heights of the different stories of a building has major effects on its seismic performance. Moreover, the results show that the change of the lower floor height has more significant effects on the seismic behavior of the building than those resulting from changing the upper floor heights.