SAFETY ASSESSMENT OF GRAVITY LOADS DESIGNED TEN-STORY RC BUILDINGS UNDER EARTHQUAKE LOADS

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Nowadays, ten-story reinforced concrete (RC) residential buildings are widespread along Nile valley in all Egyptian cities and villages too. Exaggerated RC cross-sections and high construction cost are expected when applying popular seismic procedure in which simple approach for estimating the fundamental time period and the conservative equivalent static load method (ESL) are used. Few of these buildings were built in illegal procedure without considering earthquake loads prescribed in the Egyptian Code of Loads (ECL 1993-2016). Not only recent buildings but also many of old multi-story buildings (that were built before 1992 earthquake) were designed under gravity loads only. However, these gravity loads designed ten-story buildings (GLDT) often comprise significant number of RC beams which form framing system with columns to resist earthquakes. Moreover, the reinforcement details of GLDT assure limited ductile behavior under lateral loads. This study provides realistic assessment for the safety of typical regular GLDT buildings under earthquake loads. ECL 2016 and the international building code (IBC 2015) were considered in the study. Three-dimensional finite element analysis was performed. The fundamental time period of GLDT building was calculated according to realistic approach. Moreover, the modal response spectrum method (instead of common conservative ESL) was utilized in order to provide optimal seismic forces. The results showed that retrofitting of some RC columns is essential to achieve complete safety under earthquake loads. The maximum story drift exceeded the ECL limit. Also, the results revealed the conservativeness of ECL compared with IBC.