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Response Reduction Factor of Open Ground Story Reinforced Concrete Buildings with and without Haunch.

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Abstract

The key feature of open ground storey (OGS) reinforced concrete (RC) framed building is to facilitate parking by keeping the ground storey open, without the use of infill walls. However, in the past, such framed structures have been found to perform poorly during seismic events. For instance, during the Bhuj earthquake in 2001, open ground storey type buildings were found to have failed the most. In open ground storey buildings subjected to earthquake loading collapse mechanisms are generally initiated due to higher flexible (soft)-storey behavior of ground storey than the storey above. Furthermore, the inability of the ground storey to not withstand horizontal motions during the earthquake drives this failure process. Therefore, the aim of this work is to propose a novel solution for open ground storey problems so that its seismic vulnerability can be reduced. In this study, a unique shape of column i.e., haunched shape column has been proposed which will provide good strength, stiffness as well as a good solution to open ground storey buildings problems without hampering the parking space in urban housing perspective. The open ground storey RC buildings having 3, 4, 5, and 6-storeys with and without haunches has been modelled and analyzed by adaptive pushover method in Seismostruct software. The analyses are carried out for open ground storey RC building models with and without haunches. It has been observed that the response reduction factor, overstrength factor and peak base shear of open ground storey RC buildings with haunches are significantly higher as compared to the buildings without haunches. It is also noted that the evaluated response reduction factors for open ground storey RC building with haunch are higher than the recommended value by BIS code.

Keywords: Open ground storey, Soft-storey, Adaptive pushover analysis, Pushover analysis, Response reduction factor, Overstrength factor, Ductility, Ductility reduction factor, Peak base shear