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Effectiveness of DDBD Procedure for RC Frame Buildings

Yash Deshpande[1], Ratnesh Kumar[2], Onkar G Kumbhar[3]

[1]M.Tech. Student, Dept. of Applied Mechanics, VNIT Nagpur
[2]Professor, Dept. of Applied Mechanics, VNIT Nagpur
[3]PhD. Student, Dept. of Applied Mechanics, VNIT Nagpur

Abstract

The main cause of damage to structural members during a seismic event is relative displacements and thus damage to the structure can be controlled by controlling the same. The Direct Displacement-Based Design (DDBD) procedure estimates the required stiffness of the structure by approximately correlating the inelastic displacement of the actual structure and its equivalent linear Single-Degree-of-Freedom (SDOF) structure for an anticipated seismic hazard level. The framework of the prevailing DDBD is primarily for regular buildings however, actual buildings possess some irregularity. Further, various national codes like IS 1893(1):2016, EC-8 and ASCE-7 also allows some limited irregularity in the building. The presence of irregularity in the building alters its dynamic behaviour which also depends on the type and location of irregularity. Amongst all types of irregularities, the mass and stiffness irregularity are very common in buildings. Therefore, the present study attempts to check the efficacy of the prevailing DDBD procedure in designing RC frame buildings with IS 1893(1):2016 code-compliant mass and stiffness irregularity. Three, six and nine-storey buildings representing low, medium and high-rise buildings have been considered in the study. A comparative assessment of the nonlinear seismic performance of regular buildings and the corresponding irregular buildings have been performed. It has been observed that variation in dynamic characteristics and base shear distribution is higher in building with nominal mass irregularity compared to building with nominal stiffness irregularity. From the non-linear analysis, it has been observed that building with nominal mass irregularity designed by the DDBD procedure has altered performance than the regular building.

Keywords: Direct displacement-based design, IS 1893(1):2016, Mass irregularity, Stiffness irregularity, RC frame buildings, Non-linear analysis