NED UNIVERSITY JOURNAL OF RESEARCH

EFFECTS OF STRUCTURE HEIGHT ON SEISMIC DEMAND OF MOMENT-RESISTING REINFORCED CONCRETE FRAMES CONSIDERING SOIL-STRUCTURE INTERACTION

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https://doi.org/10.35453/NEDJR-STMECH-2020-0006

Volume: **XVIII**

No: **1**

Pages: **15-32**

Date: **January 2021**

Abstract:
Forces and displacements induced in a building due to structural responses to earthquake excitation are called seismic demands which depend upon the input motion, structural characteristics, site effects and the interaction of structure with soil. Structural response of three laterally non-controlled moment-resisting reinforced concrete frame structures with three different soil conditions are have been investigated in this paper. The soil conditions include loose soil, medium soil and rigid ground. The soil-structure interaction of low-, mid- and high-rise frame structures with the above mentioned soil types was analysed by performing nonlinear response history analyses. A set of eleven earthquake motions was employed in the analyses and maximum structural seismic demands for the frame structures were calculated. It was found that pressure-independent relatively loose sandy soils are not very critical for low-rise structures. On the other hand, pressure-independent relatively loose sandy soils and pressure-independent medium sandy soils are highly critical for mid-rise and high-rise structures, respectively. Categorisation of the soils is performed based on the value ranges of a series of constitutive parameters. Further, fixity of the base is most effective in controlling storey displacements until approximately one-third of the structure height. Medium soil leads to highest maximum base shears in low-rise structures while fixed-base and medium cases, and fixed base state control the behaviours of mid-rise and high-rise structures, respectively.

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