

Influence of Foundation Size on Seismic Response of Mid-rise Buildings Considering Soil-Structure-Interaction

Authors : Quoc Van Nguyen, Behzad Fatahi, Aslan S. Hokmabadi

Abstract : Performance based seismic design is a modern approach to earthquake-resistant design shifting emphasis from “strength” to “performance”. Soil-Structure Interaction (SSI) can influence the performance level of structures significantly. In this paper, a fifteen storey moment resisting frame sitting on a shallow foundation (footing) with different sizes is simulated numerically using ABAQUS software. The developed three dimensional numerical simulation accounts for nonlinear behaviour of the soil medium by considering the variation of soil stiffness and damping as a function of developed shear strain in the soil elements during earthquake. Elastic-perfectly plastic model is adopted to simulate piles and structural elements. Quiet boundary conditions are assigned to the numerical model and appropriate interface elements, capable of modelling sliding and separation between the foundation and soil elements, are considered. Numerical results in terms of base shear, lateral deformations, and inter-storey drifts of the structure are compared for the cases of soil-structure interaction system with different foundation sizes as well as fixed base condition (excluding SSI). It can be concluded that conventional design procedures excluding SSI may result in aggressive design. Moreover, the size of the foundation can influence the dynamic characteristics and seismic response of the building due to SSI and should therefore be given careful consideration in order to ensure a safe and cost effective seismic design.

Keywords : soil-structure-interaction, seismic response, shallow foundation, abaqus, rayleigh damping

Conference Title : ICEGE 2015 : International Conference on Earthquake and Geological Engineering

Conference Location : Tokyo, Japan

Conference Dates : May 28-29, 2015