Title Seismic Performance of Dual Concrete Buildings with Multiple Underground Structures

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Abstract

This thesis is devoted to inspect the seismic performance of moment-resisting frame RC buildings with shear wall (Dual System), with multiple underground stories resting on shallow foundations and to calculate and assess the existing common modeling theory of considering the seismic response of these buildings fixed at the ground surface level. The role of the SSI phenomenon in the seismic design of buildings was extensively reviewed form the structural and geotechnical prospective. The rocking behavior of shallow foundations can greatly affect the seismic response of the supported structures. Thus, it was one of the main objective of this thesis is to develop and validate a practical and reliable modeling approach suitable for analyzing the cyclic response of 3D shallow foundations with special attention to their moment-rotation behavior.

A parametric study that involved evaluating the nonlinear seismic response of five, ten and fifteen story moment-resisting frame steel buildings resting on flexible ground surface, and buildings having one, three and five underground stories was performed. It was found that SSI can greatly affect the seismic performance of buildings in terms of the seismic storey shear and moment demand, and the deformations of their structural components. Although most building codes postulate that SSI effects generally decrease the force demand on buildings but increase the deformation demand, it was found that, for some of the cases considered, SSI effects increased both the force and deformation demand on the buildings.

Keywords Soil-Structure Interaction (SSI), Shallow Foundations, Beam-on-a- Nonlinear Winkler Foundation Model (BNWF), Bounding Surfaces, Uniform Hazard Spectrum (UHS), Ground Response Analysis, Performance-Based Design (PBD), Seismic Design of Buildings, Underground Stories.