

MUTUAL EFFECTS OF UPLIFT AND SOIL-STRUCTURE INTERACTION ON NONLINEAR DYNAMIC RESPONSES

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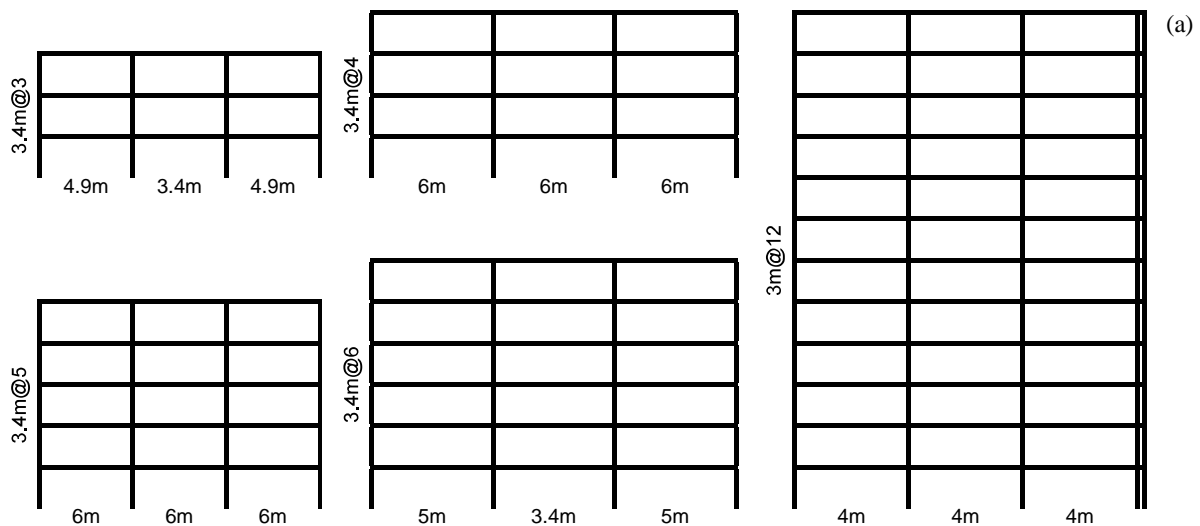
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Keywords: Uplift, Soil-Structure Interaction, Nonlinear Dynamic Response

A common assumption when analyzing a structure for earthquake forces is that the building is positively attached to a rigid ground so that it can sustain possible tensile forces without being detached, or uplifted, from its bearing points. Considering the facts that almost no tension can be transferred between a surface foundation and soil, and that soft soils interact with the supported structure during earthquakes, in this research the effects of uplift and soil-structure interaction (SSI) on nonlinear seismic response of structures are evaluated. Several reinforced concrete and steel structures under different suits of consistent ground motions are considered (Figure 1). The base of the buildings is modeled with vertical no-tension springs nonlinear in compression. The total SSI system is modeled within Opensees and the seismic behavior is evaluated using nonlinear dynamic analysis (Opensees, 2007 & 2014). The nonlinear force and deformation responses of buildings are determined and compared between three cases of fixed-base, flexible-base without uplift, and flexible-base with uplift. The cases for which uplift in conjunction with SSI should be considered are identified. Also, a simple procedure for recognition of cases susceptible to uplift and how to account approximately for uplift in fixed-base models is presented.



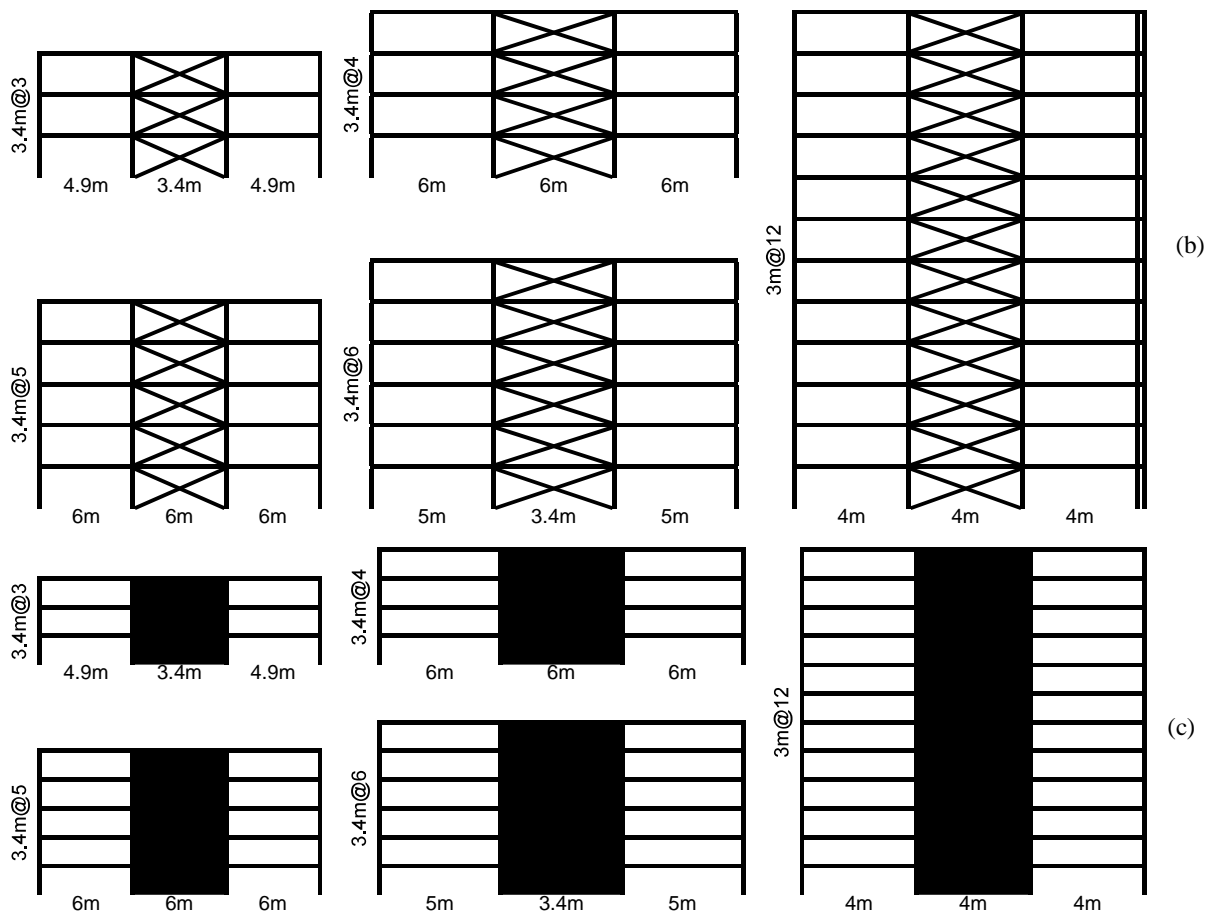


Figure 1. Schematic view of the structures studied. (a) Moment frame, (b) braced frame, (c) shear wall systems

One of the main findings of the research is that while sum of the absolute values of maximum plastic rotations decreases in the whole structure on a soft base, the story-based summation increases in the lower stories of such systems compared to same structures on a rigid base. It is shown that the seismic uplift intensifies this phenomenon.

REFERENCES

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