

Application and Validation of Practical Tools for Nonlinear Soil-Foundation Interaction Analysis

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Practical guidelines for characterization of soil-structure interaction (SSI) effects for shallow foundations are typically based on representing foundation-soil interaction in terms of elastic impedance functions that describe stiffness and damping characteristics. Relatively advanced tools can describe nonlinear soil-foundation behavior, including temporary gap formation, foundation settlement and sliding, and hysteretic energy dissipation. We review two tools that describe such effects for shallow foundations and that are implemented in the computational platform OpenSees – a beam on nonlinear Winkler foundation (BNWF) model and a contact interface model (CIM). We review input parameters and recommend parameter selection protocols. Model performance with the recommended protocols is evaluated through model-to-model comparisons for a hypothetical shear wall building resting on clay and model-data comparisons for several centrifuge test specimens on sand. The models describe generally consistent moment-rotation behavior, although shear-sliding and settlement behaviors deviate depending on the degree of foundation uplift. Pronounced uplift couples the moment and shear responses, often resulting in significant shear sliding and settlements. Such effects can be mitigated through lateral connection of foundation elements with tie beams.

INTRODUCTION

The vast majority of structural design is performed under the assumption that the structural elements are fixed at the foundation level against translation, settlement, and in

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