

Influence of Existing Foundations on Soil-Structure Interaction of New Foundations in a Reconstruction Project

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Abstract : This paper describes a study performed for a project featuring an elevated steel bridge structure supported by various types of foundation systems. This project focused on rehabilitation or redesign of a portion of the bridge substructures founded on caisson foundations. The study that this paper focuses on is the evaluation of foundation and soil stiffnesses and interactions between the existing caissons and proposed foundations. The caisson foundations were founded on top of rock, where the depth to the top of rock varies from approximately 50 to 140 feet below ground surface. Based on a comprehensive investigation of the existing piers and caissons, the presence of ASR was suspected from observed whitish deposits on cracked surfaces as well as internal damages sustained through the entire depth of foundation structures. Reuse of existing piers and caissons was precluded and deemed unsuitable under the earthquake condition because of these defects on the structures. The proposed design of new foundations and substructures which was selected ultimately neglected the contribution from the existing caisson and pier columns. Due to the complicated configuration between the existing caisson and the proposed foundation system, three-dimensional finite element method (FEM) was employed to evaluate soil-structure interaction (SSI), to evaluate the effect of the existing caissons on the proposed foundations, and to compare the results with conventional group analysis. The FEM models include separate models for existing caissons, proposed foundations, and combining both.

Keywords : soil-structure interaction, foundation stiffness, finite element, seismic design

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