

ABSTRACT

Choi, Yoon Seok. Ph.D., Purdue University, December 2012. Investigation of the Load Response of Pile Groups Subjected to Combined Loads. Major Professor: Monica Prezzi.

Very limited experimental test data are available on the response of pile groups under the combined action of vertical and lateral loads. The current design practice for piles is to consider the vertical and lateral loads independent of each other. In addition, piles are often arranged in groups, and the behavior of a pile group may differ substantially from that of a single pile. In this research, tests were performed on model pile groups subjected to both axial and lateral loads in order to evaluate the effects of pile-pile interaction in pile groups and to study the influence of axial loads on the lateral load response of pile groups in sands. The model pile groups tested consisted of 2×2, 1×2, and 1×3 piles. The model piles were driven into sand samples prepared at different densities using a large pluviator. The piles were then connected by a solid steel pile cap placed above ground level. The ultimate load (base and shaft) for a pile cap displacement of 10% of the pile diameter was first obtained from axial load tests. For all the model pile groups tested in dense sand, the group efficiency was a little less than unity, while in the case of the pile groups tested in medium dense and loose sand values of group efficiency higher than one were measured. The results of the lateral pile load tests were presented in terms of the lateral load-pile head displacement response of the model pile groups, the load experienced by the individual piles in the groups, and the bending moment profiles of the individual piles. The lateral load carried by each pile was obtained from strain gauges that were attached to the shaft of the piles 10cm below their head. The results showed

that the leading piles experienced larger loads and bending moments than those experienced by the trailing piles due to the more intense pile-pile interaction. The combined load tests were performed for axial loads of 0% (pure lateral load), 25%, 50%, and 75% of the ultimate axial loads of each of the pile groups tested. The results of the combined load tests demonstrated that the bending moments and lateral deflections of the pile head increases substantially in the presence of axial loads with antifriction devices which provide minimal restraint to the lateral movement of the test piles.