ABSTRACT

Lee, Jin Tae. Ph.D., Purdue University, December, 2008. Experimental Investigation of the Load Response of Model Piles Subjected to Combined Loads. Major Professor: Monica Prezzi.

Only a few experimental studies have been conducted to investigate the behavior of piles under combined loading, although, in practice, the loads applied on piles are often a combination of both vertical and lateral loads. In particular, the results available in the literature are inconsistent with respect to the effects of axial loads on the lateral response of piles. Therefore, the main objective of this research was to clarify the influence of axial loads on the lateral response of single piles in sands. In order to perform the pile load tests, an instrumented model pile, a soil tank, and a large-scale pluviator were designed and fabricated. A large number of axial, lateral, and combined load tests were conducted on model driven piles as well as on nondisplacement piles. The load tests were performed in soil samples prepared at different densities. The effect of driving energy on driven piles (i.e., the effect of hammer weight and drop height) was also considered. The results of the load tests performed on both driven and nondisplacement single model piles in sand under axial, lateral, and combined loading were compared with results from full-scale tests reported in literature and predictions from theoretical solutions. The model pile test results were in good agreement with the predictions. The combined load test results demonstrated that the bending moments and lateral deflection of the pile head increase substantially in the presence of the axial loads. Both driven and nondisplacement piles showed similar behavior, implying that it is unconservative to design piles assuming that there is no interaction between axial and lateral loads.