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Numerical analysis of full-scale dynamic lateral load tests of a 3 × 5pile group

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Numerical analysis for interaction between soil and pile group is performed using finite element method with 2D modeling. Upon conducting numerical analysis, model parameters for soils are taken from the field tests and investigations at the site. In 2D analysis response of middle 5 piles in the 3 x 5 pile group are simulated for a single pile and pile group. In the numerical analysis of the pile group, there are two cases. The first case is that dynamic loads without cycle static loads were sequentially applied to the pile group. The other is that a static load prior to dynamic loads like the field test was applied at the group pile controlled by the separated target deflections.

1. NUMERICAL MODEL

Two dimensional finite element analysis based on the multi–shear mechanism constitutive relationship, FLIP (Iai, et al. 1992), is employed to simulate the full–scale lateral–load tests of a pile group.

2. GROUP PILE STATNAMIC LOAD TEST

In the full–scale tests, the statnamic tests on the 15–pile group were conducted simultaneously with the static loading tests (FIG. 1). The statnamic tests were performed mainly as final loading cycles. The group pile was cyclically loaded up to certain target deflections after which the statnamic test was performed by loading the pile group to the same target deflection.

In Case 1, dynamic loads without cyclic static loads were sequentially applied to the pile group, i.e., for all target deflections, except for the 1st cycle of target deflection 89 mm. This preserves the simplicity and saves computational time in the numerical analysis. However, deflection levels after the second dynamic loading are evaluated smaller than measured ones. In Case 2, before the dynamic loading, numerical analysis considering static loadings was conducted separately controlled by the target deflections.

3. CONCLUSIONS

Dynamic behavior of a pile group is simulated by a two–dimensional finite element analysis. Results of the full–scale lateral–load tests of a 3 × 5 pile group conducted in the Salt Lake City International Airport site are compared with the simulation.

Overall load–deflection behavior of the pile group agrees well with the measured ones. When a numerical analysis includes static loadings before the dynamic loading (Case 2), the load-deflection curves were larger and agree better than Case 1. Numerical analysis overestimates the group effects in dynamic tests and some discrepancies are found on the bending moment profile. This calls up further improvement of a numerical modeling.

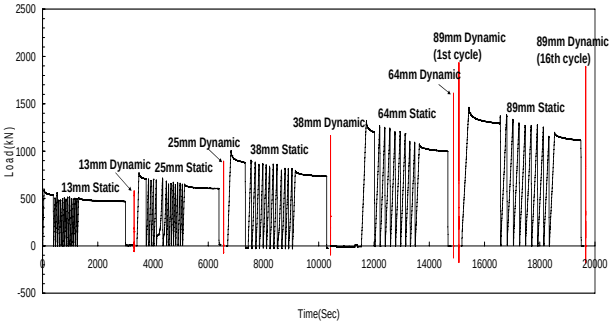

FIG. 1. Time histories of loads applied to the full-scale test.

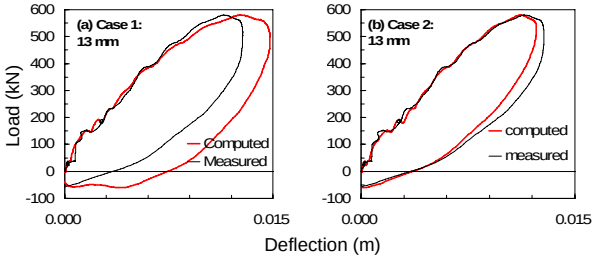

FIG. 2. Measured and computed load versus deflection curve