Form 2

Dissertation Abstract

Report no.	(Course-based) No.996	Name	ADNAN ANWAR MALIK
Dissertation title	Effect of Helix Bending Deflection on Load Settlement Behaviour of Screw Pile in Dense Sand(密な砂地盤中の羽根付き杭の荷重沈下挙動に羽根の曲げ変形が及ぼす影響)		

Abstract

It is always desirable to utilize the maximum available bearing capacity of the ground through any type of piling system. However, the available ground capacity is often reduced due to soil disturbance during pile installation or deformation of pile itself. Similarly, like other piling systems, screw pile can also disturb the ground conditions and reduce the bearing capacity of the ground if torque and pushing force is not properly monitored. However, the end bearing capacity still can be reduced even if the installation of screw pile is done properly without any serious soil disturbance or pile deformation in dense ground. This reduction in the bearing capacity of the ground is due to the bending deflection of the helix during the pile loading.

In the present study, effect of helix bending deflection (during loading phase) on the load settlement behaviour and ultimate end bearing capacity of single helix screw pile under dense ground condition were closely examined to develop an empirical relationship for the estimation of helix thickness with respect to ground strength. The prediction capability of simple extrapolation methods such as Chin-Kondner and Decourt were also evaluated by using pile load test data of deformed and non-deformed screw piles. The end bearing capacity of screw pile was also compared with the straight pipe pile with similar pile tip area and ground conditions. Model scale of pile load testing was used to achieve the set objectives. Dry Toyoura sand was used to develop the dense (relative density 70, 80 and 92%) model ground. The effect of increasing stress level (overburden pressure) on the load settlement behaviour of screw pile was also considered in this study.

The experimental results indicated that if the bending deflection of helix (wing plate) was more than critical helix bending deflection then it affected the load settlement behaviour and reduced the available bearing capacity of the ground. The estimated range of critical helix bending deflection from the test results was 0.42 – 0.80mm. An equation was proposed based on the critical helix bending deflection to estimate the critical thickness of helix with respect to ground strength.

It was observed from the test results that the Decourt method of plotting could indicate the helix plate deformation. A modified approach was proposed in Decourt method of plotting to estimate the helix limit load. It was also observed from the prediction analysis that it would be better to select the ultimate end bearing capacity from the predicted model curve at settlement equals to 10% of helix diameter. A reduction factor based on load test results is proposed so that the prediction of extrapolation methods at 10% of helix diameter can be controlled.

It was also observed that the straight pipe pile load settlement curve plunged downward (without increase in load) around settlement equals to 10% of pile tip diameter, whereas, in case of screw pile, the load settlement curve plunged around settlement equals to 15% of pile tip diameter. Moreover, the screw piles having helix to shaft diameter ratio 2 to 4.1 showed 2 to 12 times higher end bearing capacity than straight pile piles with similar pile shaft diameter. It was also observed from the test results that the end bearing capacity of single helix screw pile was 18.5% (average) less than straight pipe pile having similar pile tip area and ground condition.