Young Members

Pressure Distribution under Multiloop Screw Pile: A Numerical Study

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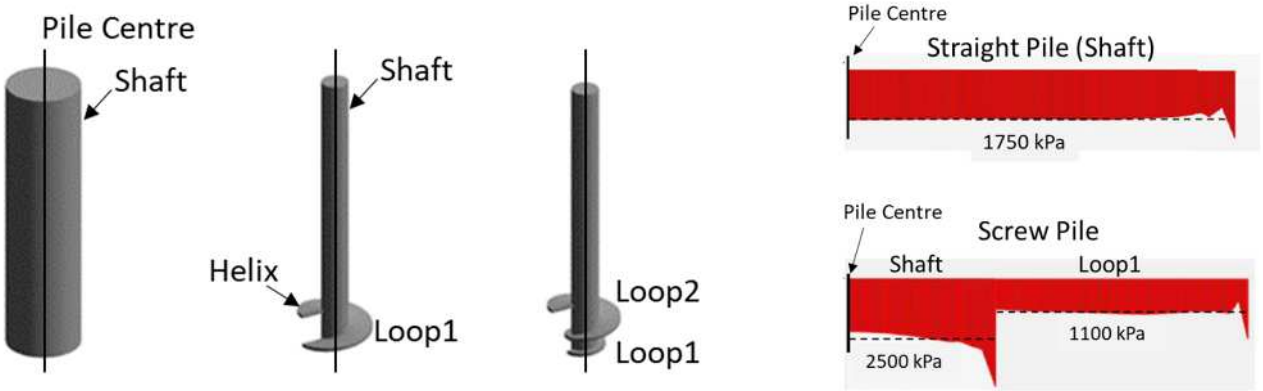
I am Kaung Htet, from Myanmar. I completed my Diploma in Civil Engineering from the Building and Construction Authority Academy (BCAA) Singapore in 2018. Currently, I am a final year bachelor's student of Civil Engineering at the Newcastle Australia Institute of Higher Education (a wholly owned entity of The University of Newcastle, Australia, in collaboration with BCA Academy). I have fulfilled all course requirements and will finish the industrial attachment shortly. After developing a strong interest in geotechnical engineering throughout my academic career, I ultimately decided to focus my final year project on geotechnical engineering under the supervision and guidance of Dr. Adnan Anwar Malik.

As the final year project of my bachelor's program, I conducted numerical studies on bearing response and pressure distribution under multiloop single helix screw piles. The finite element code PLAXIS 2D models were generated to simulate the various piles (straight pile, single helix screw pile and multiloop single helix screw piles) to gain a deeper comprehension of the load transfer mechanism and pile response under compressive pressures. The created model was validated with published experimental data conducted on a model scale. The pile installation effect was not considered in experimental and numerical studies so that only the effect of the multiloop helix can be investigated. Toyoura sand was used in the experiments to develop the model ground, and its mechanical properties are validated in the numerical model. The linear elastic model was considered for piles, whereas the hardening soil model with small strain was considered for the soil.



(a) (b) (c) (d)

Figure 1. 3D perspective of various piles and pressure distribution (a) Straight pile, (b) Single helix screw pile, (c) Multiloop single helix screw pile, and (d) Pressure distribution under pile tip based on Ho et al., 2022 study, https://doi.org/10.1061/(ASCE)GM.1943-5622.0002520

In terms of bearing response, it is observed that the performance of the straight pile is better than that of the screw piles (single/multiloop helix) under similar pile tip diameter. When comparing the bearing response of screw piles, i.e., single loop and multiloop, no significant difference was observed.

Regarding pressure distribution, the average pressure under the straight pile (Figures 1a, 1d) was uniform. Whereas the pressure distribution under the screw pile (Figures 1b, 1d) was not uniform, i.e., higher under the central shaft than the helix. When comparing the pressure distribution of screw piles, i.e., single loop and multiloop, multiloop screw pile pressure distribution was closer to the straight pile (Shaft ≈ 1750 kPa; Loop1 ≈ 1550 kPa; Loop2 ≈ 1300kPa), which is a more stable condition concerning helix bending. Further studies are required, especially the inclusion of installation effects, to fully investigate the effectiveness of multiloop single helix screw piles.