

Influence of Loading Pattern and Shaft Rigidity on Laterally Loaded Helical Piles in Cohesion-Less Soil

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Abstract : Helical piles are widely used as axially and laterally loaded deep foundations. Once they are required to resist bearing combined loads (BCLs), as axial compression and lateral thrust, different behaviour is expected, necessitating further investigation. The objective of the present article is to clarify the behaviour of a single helical pile of different shaft rigidity embedded in cohesion-less soil and subjected to simultaneous or successive loading patterns of BCLs. The study was first developed analytically and extended numerically. The numerical analysis was further verified through a laboratory experimental program on a set of helical pile models. The results indicate highly interactive effects of the studied parameters, but it is obviously confirmed that the pile performance increases with both the increase of shaft rigidity and the change of BCLs loading pattern from simultaneous to successive. However, it is noted that the increase of vertical load does not always enhance the lateral capacity but may cause a decrement in lateral capacity, as observed with helical piles of flexible shafts. This study provides insightful information for the design of helical piles in structures loaded by complex sequence of forces, wind turbines, and industrial shafts.

Keywords : helical pile, lateral loads, combined loads, cohesion-less soil, analytical, numerical

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