

Lateral and Torsional Resistance of Modified Helical Piles using a Novel Collar Vane

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Abstract

Helical piles (screw piles) are lightweight and relatively inexpensive deep foundation elements designed to support only axial loads [1-3]. However, structures like mast arm traffic signs, signal poles, piers and bridges, commonly experience torsional or lateral loads due to wind, waves or high-speed travel. To overcome helical pile's limitation to this type of loading condition, a novel easy-to-install Collar Vane (CV) is installed near the helical pile head with the objective of enhancing the lateral and torsional resistance of helical piles. Field tests were performed at Hubbell Power Systems Inc. headquarters in Centralia, MO. with the objective of: (i) test a new Collar Vane prototype which consists of a "single-piece" enhanced Collar Vane; (ii) install and test helical pile with CV in cohesionless soil; (iii) perform cyclic loads in both cohesive and cohesionless soils. The testing pile consists of a full-scale 88.9-mm shaft diameter and 3-m long helical pile attached with nine different geometries of Collar Vanes. Preliminary results suggest that Collar Vane: (i) CV effectively increases helical pile's geotechnical resistance by increasing the lateral passive resistance; (ii) strain gauges installed to measure bending strain suggest that Collar Vane reduces the amount of bending by limiting lateral displacement and thus reducing the need for a larger diameter pile shaft; (iii) Analysis of the HP internal forces suggest that the CV carries up to 90% of the applied load. (iv) torsional resistance provided by the Collar Vane fins was increased and results will be compared with simple tractable models which includes classic (adopted by Departments of Transportation) and CPT-based methods. Ultimately, is envisioned to develop simplified models to predict lateral and torsional response of helical piles with the novel Collar Vane for different soils conditions.

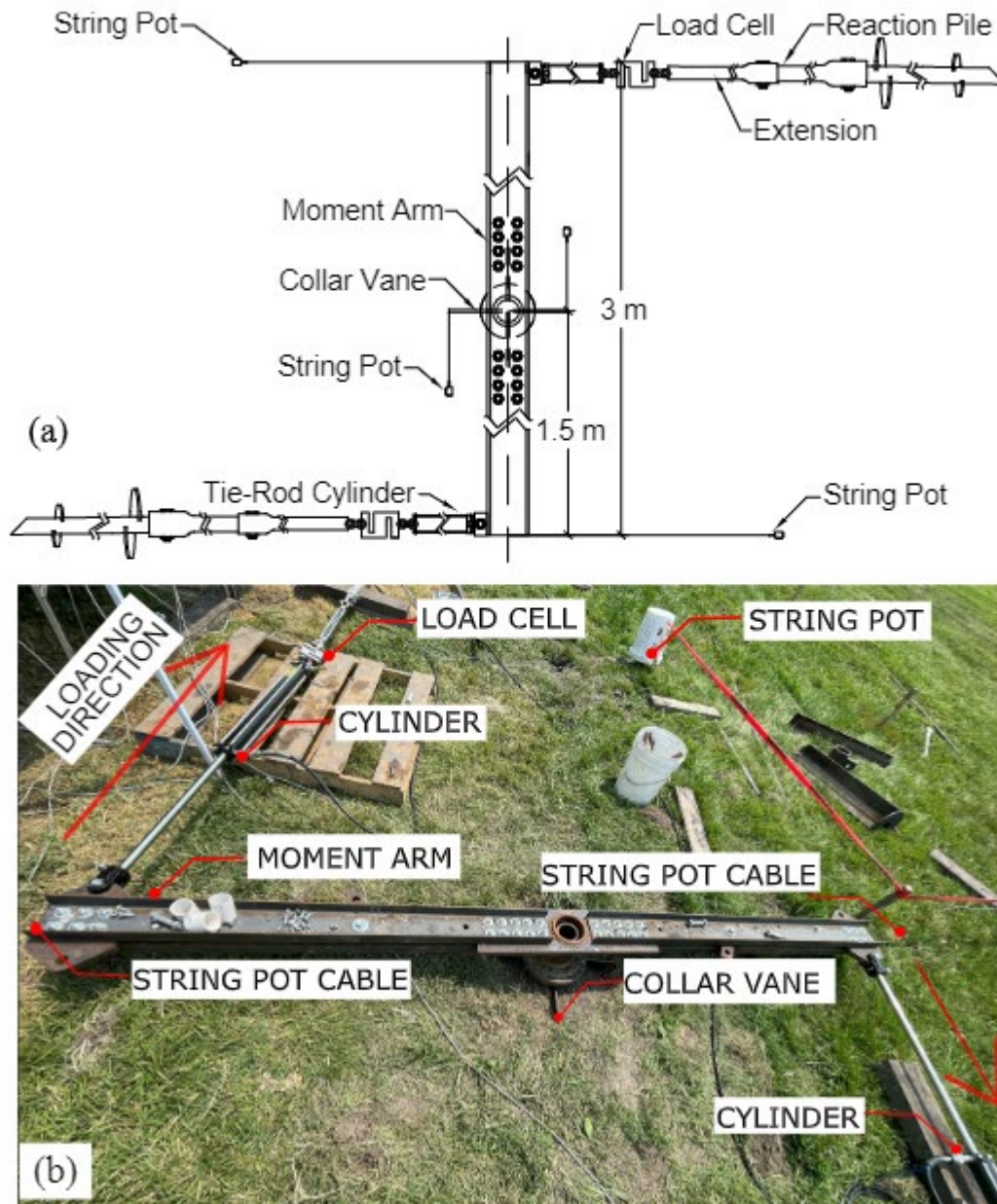


Figure 1. Torsional frame test setup: (a) schematic from top view; (b) field photo.

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References

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