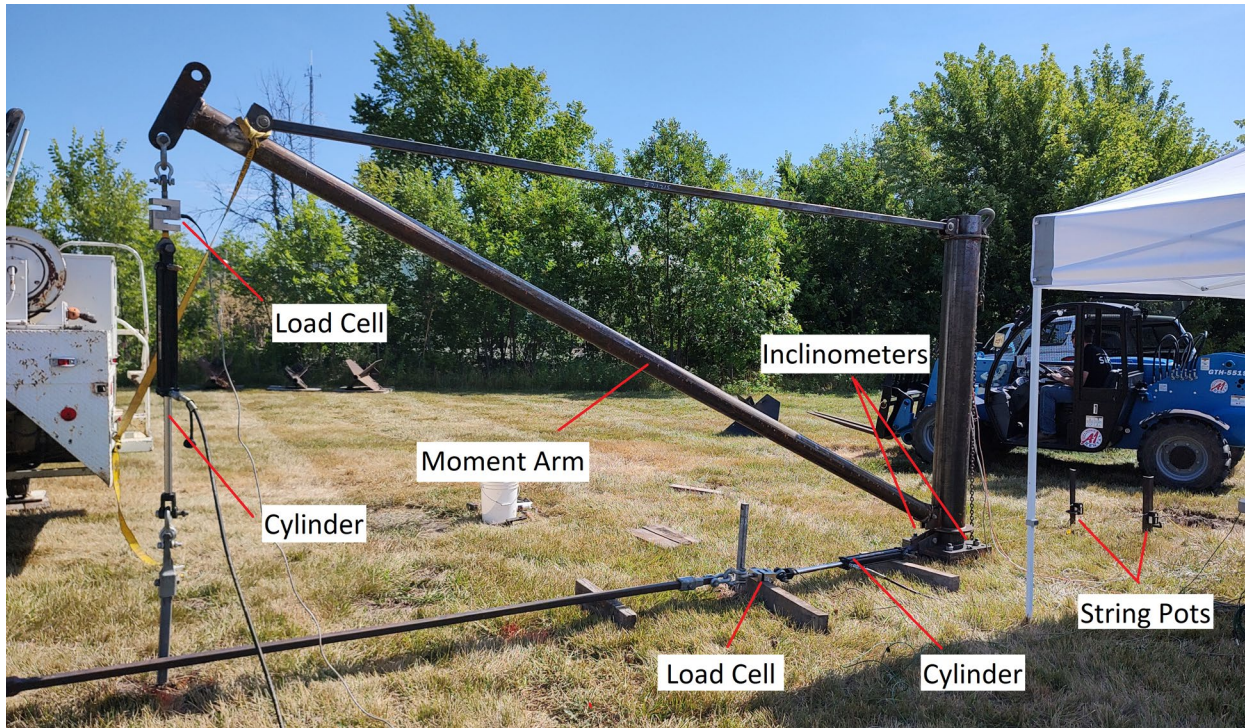


Response of Modified Helical Piles with a Collar Vane Subjected to Overturning Moment

Camilo J. Fernandez-Escobar, Dr. Aaron Gallant, Department of Civil and Environmental Engineering, University of Maine

Abstract

Lightweight transportation structures such as roadside signs are typically supported by reinforced concrete shafts as recommended by The Departments of Transportation (DOTs) across the US. The construction of such foundation elements needs various resources, and it is a time-consuming procedure. Modified Helical Piles with a Collar Vane (CV) could be an alternative and efficient foundation solution for sign structures as these keep the well-known advantages of helical piles (e.g., cost-effectiveness and easy installation), while their lateral (shear) and torsional capacity is enhanced by using a CV [1]. However, the foundation design of roadside signs is typically controlled by the overturning moment due to the wind. In this study, the response of modified helical piles with a CV subjected to overturning moment is investigated and compared to the typical shafts recommended by DOTs to support single-post mounted roadside signs. For this, a series of full-scale field tests were conducted in Centralia, MO. Modified helical piles with five different CV sizes were installed and tested in medium-stiff clay. Two different reinforced concrete shafts were built and tested in the same site. A moment arm was employed to independently apply a constant shear force and variable overturning moment at the pile head to simulate different sign panel heights. Helical piles were instrumented with strain gauges to measure bending strain. The applied loads and pile head deformations were measured for all the tests. Results indicate that modified helical piles can yield comparable performance to the traditional recommended shafts. Moreover, the bending moments along the helical pile are notably reduced when using a CV. Finally, it was observed that the capacity of the CV to reduce the bending moment on the shaft increases with its size. Based on these results, it could be concluded that modified helical piles are suitable to withstand typical overturning moment demands acting on roadside sign structures and offer practical advantages compared to conventional foundation shafts.



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References

[1] Carvajal Munoz, Juan Sebastian, "Performance of Helical Piles Retrofitted with a Novel Collar Vane Under Lateral and Torsional Loads" (2023). Electronic Theses and Dissertations. 3758. <https://digitalcommons.library.umaine.edu/etd/3758>