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Reducing the environmental geometrical impact of floating wind turbines by using pile foundations : centrifuge modelling of the behaviour of helical anchors

REDENV-EOL project

https://www.weamec.fr/blog/record_project/redenv-eol/



IFSTTAR

French institute of science and technology for transport, development and networks

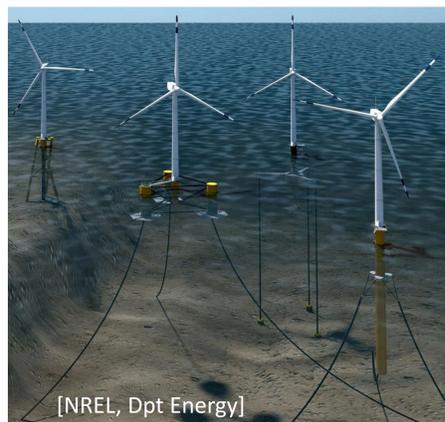


Région PAYS DE LA LOIRE



Abstract : The issue of floating wind turbine anchors is rarely addressed. Yet their nature and positioning is of interest, especially in terms of environmental and geometrical influence (e.g. navigability). In addition, wind turbine movements are transmitted to the foundations in the form of non-permanent cyclic solicitation. The purpose of this project is to gain a better understanding of the soil-anchor interaction under repeated load (tension) of certain deep foundation anchorages of different geometries: helical piles, but also driven piles or suction piles, depending on the nature of the seabed (sand or clay normally consolidated) and its possible variability, the inclination of the load.

To do this, a targeted campaign of experiments on physical models in centrifuge is under progress in order to observe and understand the behaviour of this type of anchoring system and to establish an experimental database. The results can be compared with existing sizing methods.



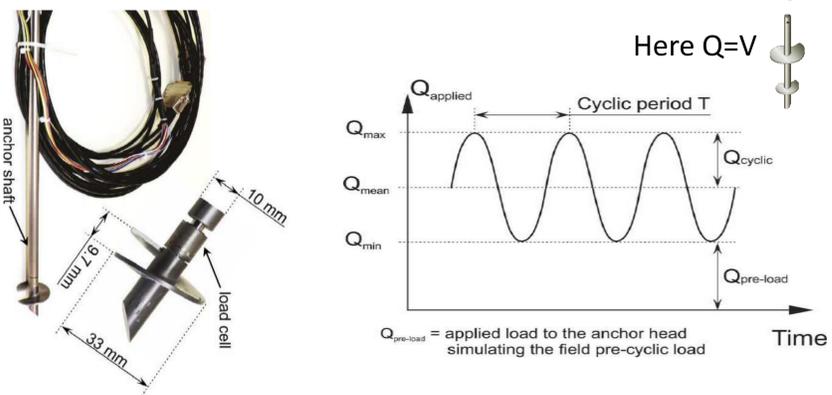
Anchoring line

- Catenary?
- Semi-taut?
- Taut

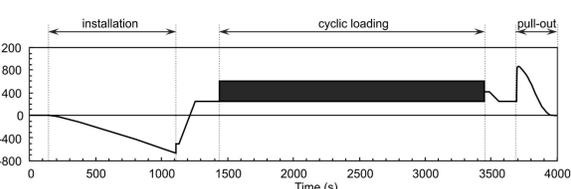
Ifsttar's Geotechnical Centrifuge



Small Scale Model of Helical anchor

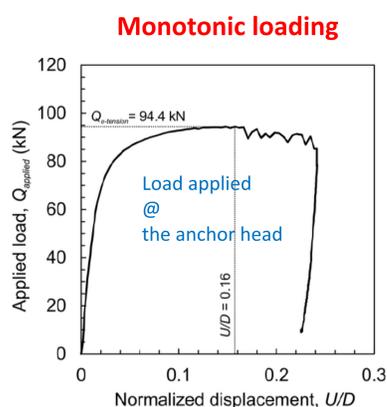


Instrumented Helical pile 1/10

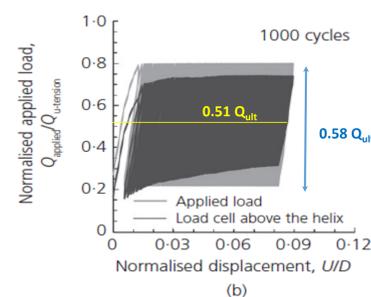


Sequences of a test

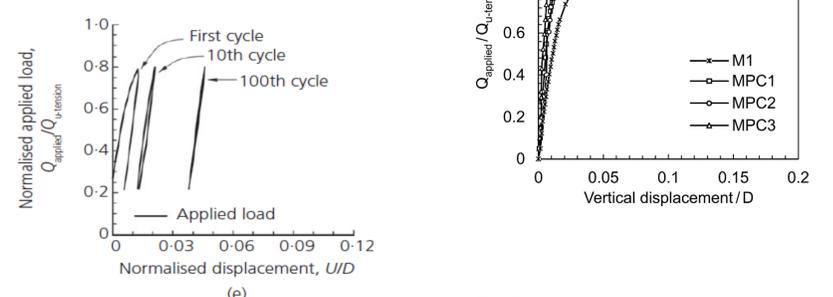
Cyclic loading



Cyclic loading



Post-cyclic loading



Test	Loading type	$Q_{mean}/Q_{extension}$	$Q_{cyclic}/Q_{extension}$	$Q_{pre-load}/Q_{extension}$	Frequency (model scale)	Number of cycles
M1	monotonic	-	-	-	-	-
C1	cyclic	0.41	0.20	0.21	1 Hz	2000
C2	cyclic	0.51	0.29	0.22	1 Hz	1000
C3	cyclic	0.59	0.34	0.25	1 Hz	300
MPC1	monotonic (post-cyclic)	-	-	-	-	-
MPC2	monotonic (post-cyclic)	-	-	-	-	-
MPC3	monotonic (post-cyclic)	-	-	-	-	-