Improvement of the Bearing Capacity of Offshore Pile Foundations

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Full list of project partners includes Ambau, GUD, JBO, Pagel, TPH, WindMW

Summary
Pile capacity is widely discussed with respect to predictability, testing and eventual countermeasures. The possibility of a subsequent improvement of the bearing capacity of pile foundations after installation would be of great benefit for this type of foundation.

1. Motivation

An additional load capacity upgrade is in the focus of the research project for the development of smart offshore-foundation structures. Fig.1 addresses the two options

- Forming a plug inside the pile cross section at the bottom of the pile
- Compaction grouting at the pile shaft

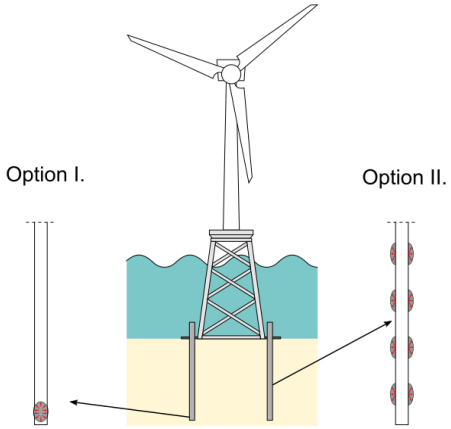

Fig. 1: Options for smart foundation concepts

These methods could help

- to upgrade bearing capacity as part of a modular foundation concept
- strengthening in case of insufficient bearing capacity (countermeasure)
- compensate eventual lower bearing capacity of piles driven by vibration.

2. Smart foundations: Research Focus

2.1. Plug forming

Two methods are investigated to enhance the axial load bearing capacity: Mechanical installation of a full displacement profile and chemical injection of a swellable resin. Both compact the soil in the pile near its bottom and form a plug to increase the cone resistance and increase the radial stresses and the shaft friction as already shown in model tests.

Fig. 2: Model tests with mechanical full displacement pile and excavated body after chemical injection

2.2. Grouting the pile skin

Grouting the pile skin can be achieved by selective compaction grouting of the soil at pile skin with a cement-binder based grout.
The purpose of this method of compaction grouting is an enhancement of radial stresses in soil. With higher radial stresses in soil the pile skin friction together with the axial bearing capacity of piles could be improved. Investigations are based on model tests and numerical simulations for an optimized grouting material and overall procedure.

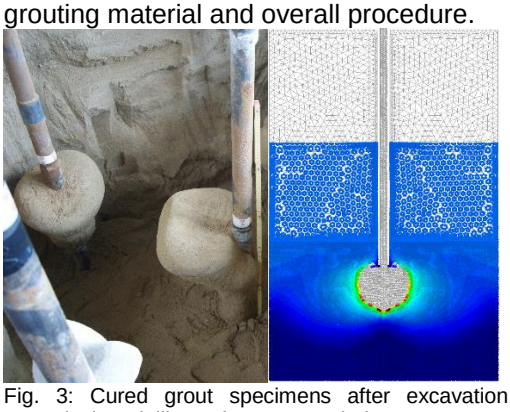

Fig. 3: Cured grout specimens after excavation and numerical modelling using MPM techniques

3. Acknowledgements

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