Boskalis

M.Sc. THESIS PROJECT

Deformation of underwater gravel bed under GBS and Caisson placement

Introduction. In the marine and offshore construction industry GBS's (Gravity Based Structures) and Caissons are usually placed on a foundation of stones and gravel. These are often very large concrete structures, like LNG terminals, foundations for wind turbines, breakwaters and quay-walls.

Base slab diameter	m	31
Bottom cone diameter	m	20,8
Shaft diameter	m	6.5
Wall thickness	m	0.4 to 0.6
Base slab thickness	m	0.5 to 1.4
Height	m	48 to 53,97
Reinforcement steel	kg/m^3	220
Post-tensioning	kg/m^3	37 (for walls)

Designers often state a very precise tolerance that the gravel foundation bed must meet, in the order of just a few centimeters. This requires huge investments to develop high accuracy tools and it is time consuming and costly to perform so-called touch-ups to achieve such narrow tolerances. However, in practice it appears that such close tolerances are not always necessary. On the contrary, larger fluctuations in height allow redistribution of gravel and limit aquaplaning.

Assignment. There is the urgent need for a software application in which the deformation of a gravel foundation bed under the pressure of a GBS/Caisson can be modeled.

The intended outcome is a working and calibrated model in which the deformation of a gravel bed under plate loading can be predicted. This model can then be used in practice to calculate the deformation of an actual gravel bed and determine the final position of the GBS/Caisson. A possible extension of the study includes optimization of the design.

The study will include (some of) the following components:

- Literature study on the deformation of a gravel bed under plate loading.
- Study cases of GBS/Caisson gravel beds and their requirements (via Boskalis).
- Research and validation of existing and new numerical approaches, e.g. Material Point Method at Deltares and Discrete Element Method at UTwente.
- Set up scale model to support the validation process.

The work will be conducted in close collaboration with Boskalis, Deltares and TU/Delft.

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