STABILITY TESTS OF GEOTEXTILE SANDCONTAINERS FOR MONOPILE SCOUR PROTECTION

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Monopile support structures for offshore wind turbines in areas with movable sand beds may be affected by local scour processes due to wave and current action. In order to investigate scour protection alternatives a research programme has been started. An innovative solution for monopile scour protection was proposed by using geotextile sand containers. In comparison to a rubble mound solution sand containers are made from soft materials minimizing the danger of cable and monopile damage during construction of the wind turbines on the sea.

Large-scale model tests have been performed in the Large Wave Channel (GWK) of the Coastal Research Centre (FZK). The tests were splitted into two parts: In the first part basic tests were performed with sand containers placed on a horizontal sand. The sand bed was covered with a geotextile filter layer which is normally used as sublayer for a scour protection with rubble mound or geotextile sand containers.

The sand containers were varied in weight and percentage of filling as listed in Table 1, which results in 12 different container sizes. The different container sizes were placed both as a single one and in a group of 8 containers in two layers, which results in totally 108 containers for each test. Furthermore the containers were placed inline and transverse to the wave approach direction (Fig. 1).

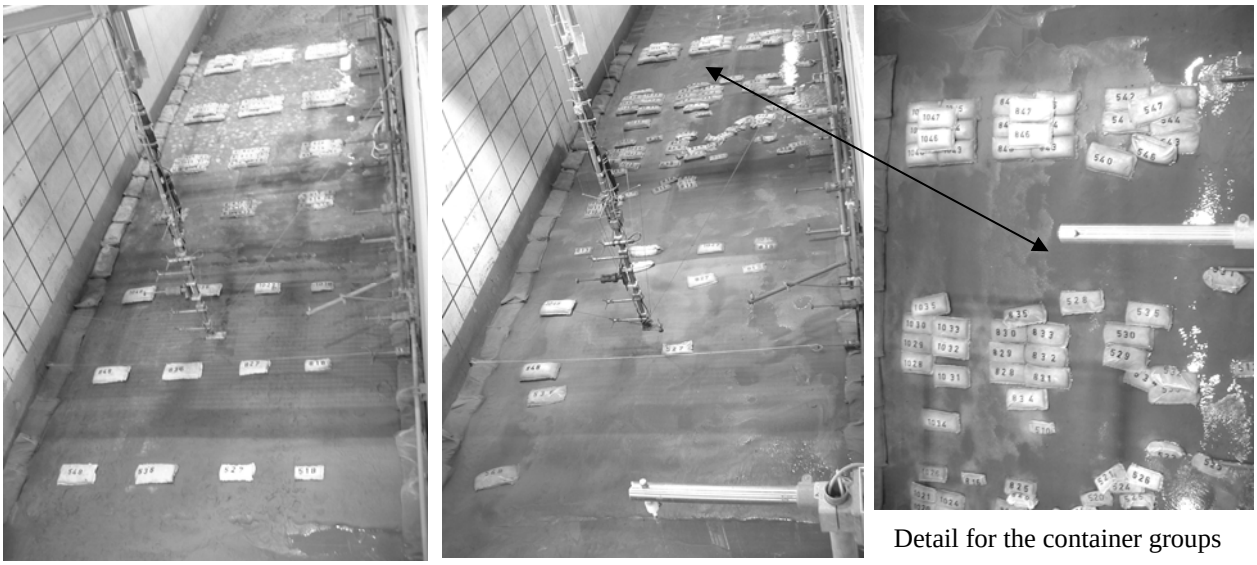
percentage of filling	56%	80%	100%
weight [kg]	1,71	2,44	3,05
	3,34	4,77	5,96
	7,23	10,33	12,91
	10,25	14,64	18,3

Table 1

The water depth was kept constant with 2.5m. Irregular wave trains (Jonswap-spectra) of 120 waves with wave heights between $H_{1/3}$ = 0.6m to 1.2m and a peak period of T_p = 5s to 6s were generated. Wave heights and wave periods were recorded as well as orbital velocities in a profile. After each test the GWK was drained in order to measure the displacements of each container (Fig. 1).

The displacements versus the wave heights $H_{1/3}$ are plotted in Fig. 2 for the test series with the containers placed transverse to the wave approach. For the container groups the solid lines stand for the mean displacements of all containers in a group and the dotted lines for the maximum displacements of a container in the group. From the results it comes out that besides the weight the percentage of filling has an important influence on the stability of the containers. The results of these basic tests will be discussed in detail in the proposed paper.

In the second part of the large-scale investigations a scour protection system around a monopile support structure are being tested. The scour protection system consists of multi layers of geotextile sand containers placed around a monopile structure (diameter 5.5m) with a diameter of 45m which was scaled down to 1:10 in the GWK. In the final version of the proposed paper results on the stability and recommendations for practical applications will be discussed in detail.



Sand containers placed transverse before tests

Displacements of sand containers after a test with $H_{1/3}$ = 1.0m. T_p = 5 s

Detail for the container groups

Fig. 1 : Model set-up of the sand containers placed on a horizontal sand bed covered with a geotextile filter layer

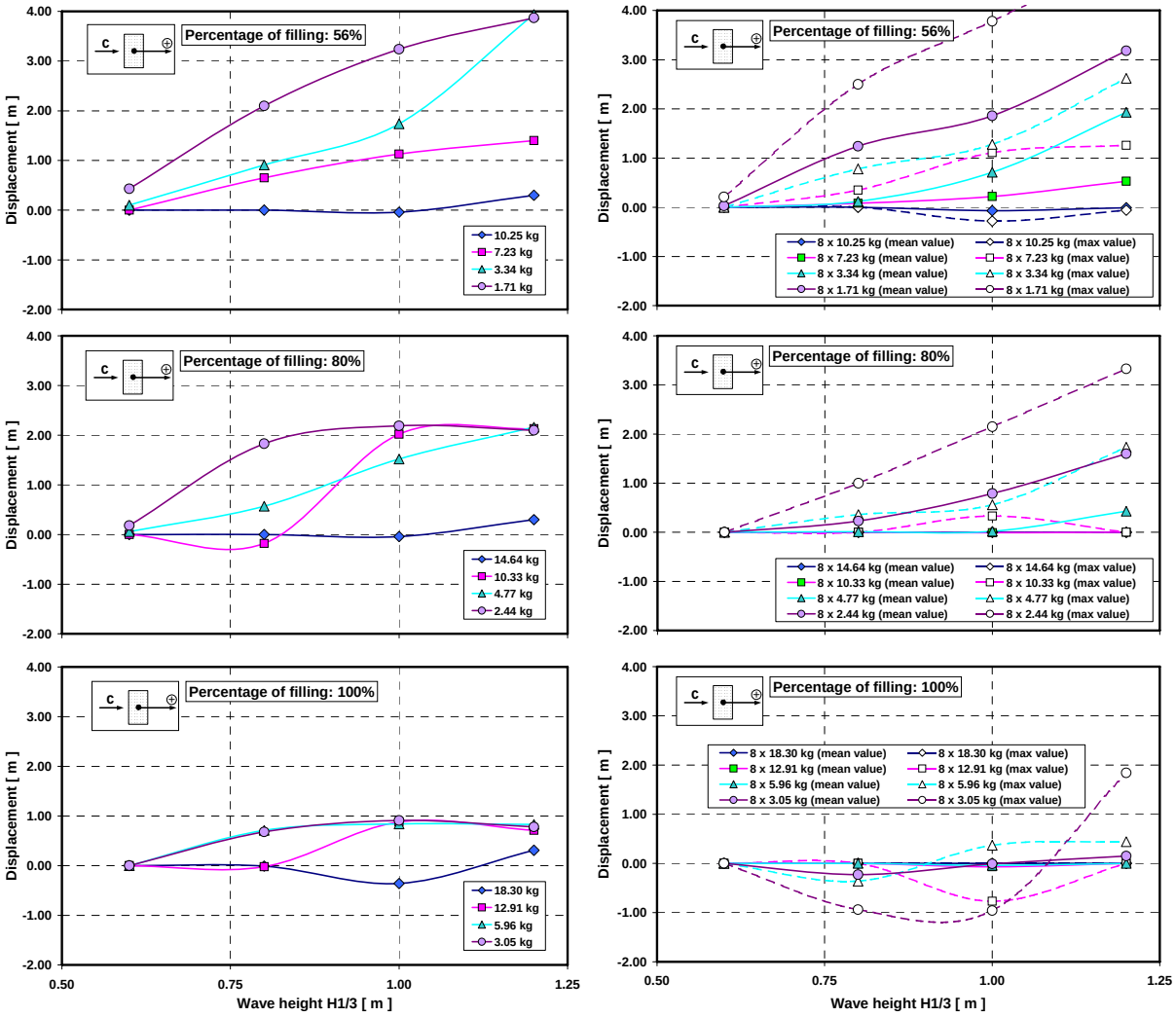


Fig. 2 :Displacements of sand containers versus wave heights $H_{1/3}$ for transverse placement and for different percentages of filling (left hand plots: single placed containers; right hand plots: container groups)