SCALE MODEL TESTS OF A MOORED TANKER AT LEIXÕES PORT WITH BREAKWATER´S EXTENSION

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ABSTRACT
This paper describes the physical model, experimental setup and tests performed to study the motions and forces of a ship moored to the pier A at the Leixões oil terminal, following the breakwater's extension at 300m, for different sea states.

The Leixões port layout was implemented at scale 1:80, Figure 1, with the detailed model similar to the prototype bathymetry and surrounding structures. The moored ship is a scale model of an oil tanker with a total length of 3.43 m and 0.135 m draft, Figure 2.

Measuring equipment, Figure 3, included a set of resistive wave gauges to measure free-surface elevation and wave direction. The wave velocities at the entrance of the harbour were measured with an acoustic Doppler velocimeter. Motions of the moored ship were measured with the OptiTrack™ motion capture system. And finally, forces on fenders and mooring lines were measured with load cells attached to a spring system developed by Marcos-Rita, M. (1984).

Figure 1 - Experimental Set-up

Figure 2 - Ship's model with moorings instruments and optical point trackers
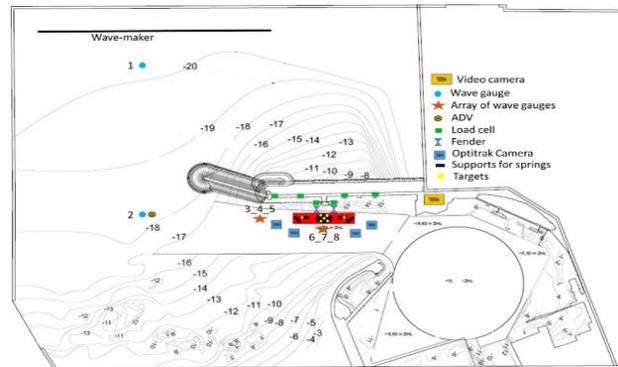

Figure 3 - Measuring equipment layout

Several tests were carried out for a number of incident sea states characterized by a JONSWAP spectrum, with different significant wave heights and peak periods. The measurement, analysis and results obtained for the incident wave conditions are presented and discussed in this paper. Additionally, these results are compared with a previous study (Rosa-santos 2010) for the actual length of the breakwater.
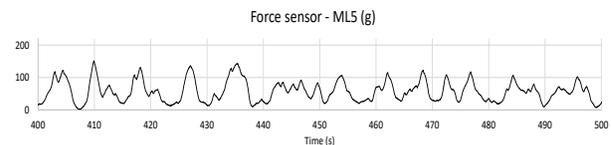

Figure 4 - Time series of mooring loads.

REFERENCES
Marcos-Rita (1984). On the behaviour of moored ships in harbors: Theory, practice and model tests. Thesis, LNEC, Lisbon.
Rosa-Santos, Veloso-Gomes, Taveira-Pinto, Brògueira-Dias (2010). Physical Modelling of Leixões Oil Terminal - Portugal, Conference of Harbour Infrastructure Seminar (PIS), Delft, Netherlands.