COMPARISON OF TWO WAVE OVERTOPPING CALCULATION TOOLS BASED ON NEURAL NETWORK ANALYSIS

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1. Introduction

The recent development of wave overtopping calculation tools based on neural network analysis (NN) resulted in a new method to predict wave overtopping for a wide range of sea defense structures. These tools estimate the mean discharge (q_{NN}) that overtops the structure's crest for a certain incident wave conditions relying upon the results produced by dozens or even hundreds of NNs. As each NN is based on results from physical model tests (q_{PM}), the direct application of the calculation tools is restricted to configurations of the structures and wave characteristics considered in the development of these NNs.

The objective of this study is a comparison of the results obtained from two NN overtopping tools for a stretch of the west breakwater of Sines harbor, Portugal (Figure 1), with 2D physical model data collected at LNEC. The stretch, with a highly complex cross-section, directly protects berth 2 and it is characterized by a two-layer irregular placement of 900 kN Antifer blocks below CD and a two-layer regular placement above, it has a curved concrete superstructure with its crest at +19.0 m (CD) and a 20 m crest wide at +18.0 m (CD).

2. Application of calculation tools

Two calculation tools NN_OVERTOPPING2 (Coeveld et al., 2005) and Overtopping (Verhaeghe, 2005) were applied to estimate overtopping. Whatever the calculation tool used, there are only two input parameters that describe the structures' slope: slope of the structure downward of the berm and slope of the structure upward of the berm. Moreover, only one value of the coefficient γ_f. concerning the roughness and permeability of the armour layer can be input in each calculation. However, the studied cross-section (Figure 1) has different slopes in the active zone of the armour, it does not have a berm and the Antifer cubes placement method is different above and below the CD (regular and random placement, respectively), which leads to a different value of γ_f for each section. In order to solve the first difficulty, a "fictitious" berm was adopted to allow the consideration of two different slopes (above and below the berm) of the armour. To combine the effect of different sections of the slope with different roughness/permeability coefficients, $\gamma_{f,i}$, an empirical method recommended by Pullen et al. (2007), which weights the various factors $\gamma_{f,i}$ by including the length L_i of the corresponding sections, was used to enable an estimation of the resulting influence factor γ_f.

3. Analysis of results

To examine the results produced by the NN tools, wave overtopping data obtained from 2D physical model tests carried out at LNEC (2008) were used. Figure 2 shows some of the obtained results. The paper will contain further results and their discussion.

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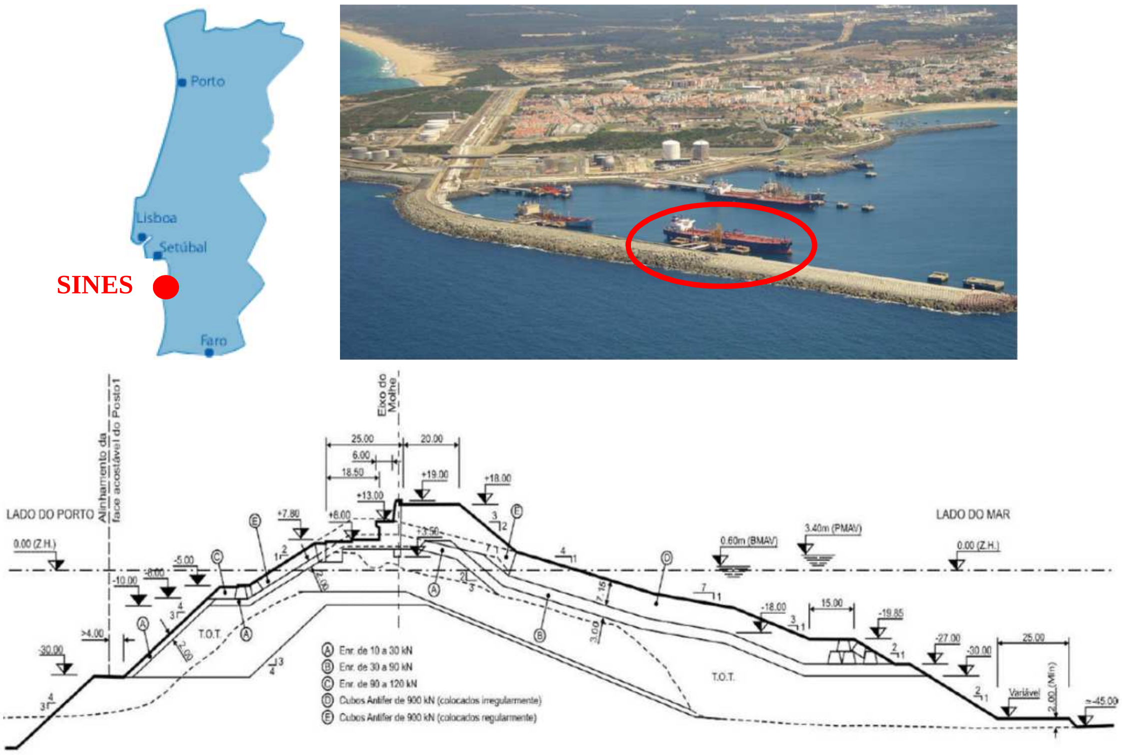

Figure 1. Sines harbor: Location, aerial view and cross-section of the west break water directly protects berth 2.

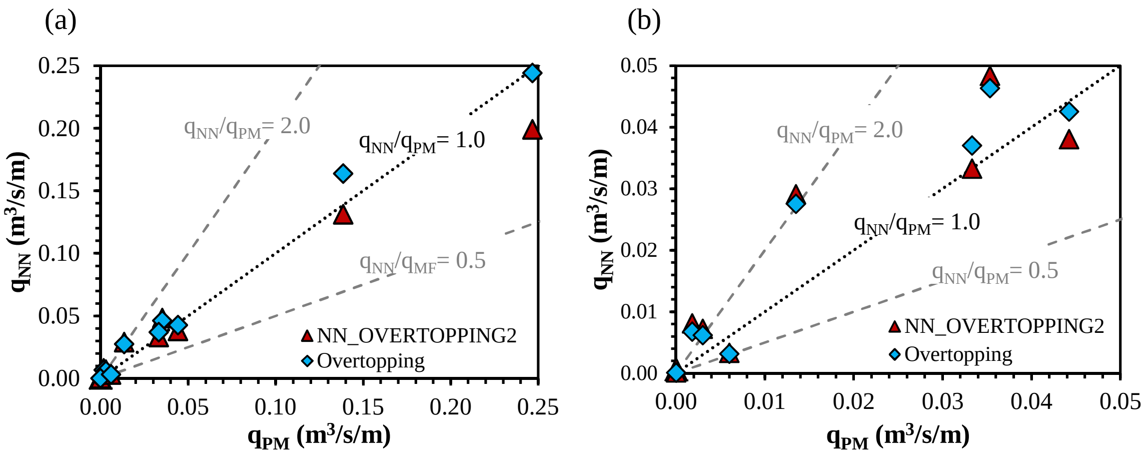

Figure 2. Comparison of results from NN_OVERTOPPING2 and Overtopping tools and physical model tests: (a) all results; (b) values lower than 0.05 m^3/s/m.

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