ANALYSIS OF WAVE REFLECTION FROM STRUCTURES WITH BERMS THROUGH AN EXTENSIVE DATABASE AND 2DV NUMERICAL MODELLING

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INTRODUCTION

The problems associated with reflection of incoming waves from coastal structures and natural coasts are well recognised and include dangerous sea states close to harbours entrances and intensified sediment scour, which can lead to dramatic loss in beach material and structure destablization.
The reflection behaviour for various type of straight slopes has been analysed in depth by Zanuttigh and van der Meer (2006). The Authors prepared a wide reflection database and developed a new formula

- for all data types,
- representing physical bounds,
- based on the breaker parameter,
- validated for straight slopes in design conditions ($R_c/H_{si}\geq0.5$, $H_{m0}/D_{50}\geq1.0$, $s_o\geq0.01$);
- depending on the roughness factor γ_f (Van der Meer, 2002), a requirement that strictly relates overtopping and reflection performance.

The new formula is given by

$$K_r=\tanh(a\xi_o^{\,b}) \qquad (1)$$

where $a=0.167[1-\exp(-3.2\gamma_f)]$, $b=1.49(\gamma_f-0.38^2)+0.86$.
The agreement among data of straight slopes and Eq. (1) is shown in Figure 1.

AIMS

The objectives of the present research are:

- to develop a formula for the prediction of wave reflection in presence of composite slopes;
- based on the already developed formula for straight slopes, to identify parameters to modify the evaluation of the breaker parameter in presence of a berm.

To achieve these objectives, two methodologies have been selected:

- the analysis of the reflection coefficient for structures with berms through an extended the reflection database thanks to the inclusion of the wide dataset on berm breakwaters by Lykke Andersen (2006);
- numerical simulations with the 2DV COBRAS code developed by the University of Cantabria (Garcia et al., 2004; sample result in Fig. 2).

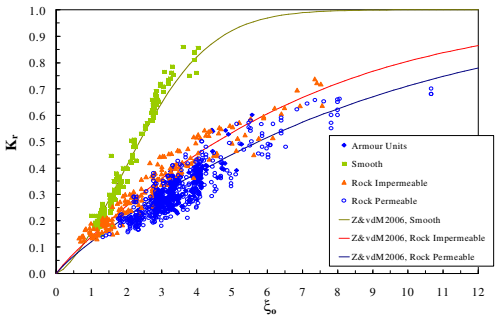

Figure 1 - Reflection for hardly overtopped slopes.

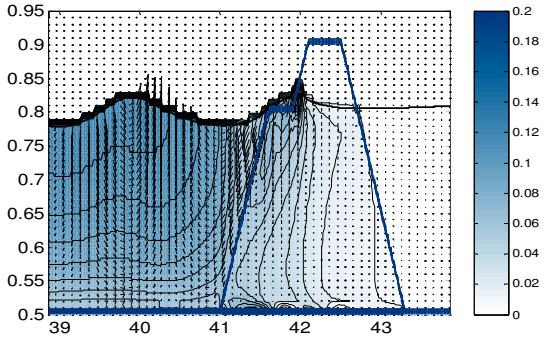

Figure 2 - Turbulence intensity (in colors) and velocity field (in vectors) from a simulation with COBRAS for a rock permeable structure with berm.

PRELIMINARY AND EXPECTED RESULTS

A preliminary analysis of the breaker parameter in presence of composite slopes has been carried by Zanuttigh and van der Meer, (2007). For overtopping and run-up the upper part of the structure is very important and often the structure is characterised by the average slope in the area +/-1.5H_{m0t}. For reflection the most relevant slope is that below swl. In case of a structure with a berm the use of an average slope seems insufficient to characterise the reflection from the structure and further analysis is required.
The systematic use of the 2D VOF numerical model COBRAS will allow:

- to check, in a more controlled environment, how the effects on reflection due to a berm are represented by physical and geometrical parameters;
- to get information on spectral changes induced by different seaward structure shape.

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