LABORATORY INVESTIGATIONS OF WAVE TRANSMISSION THROUGH SUBMERGED AERIAL BARRIER

M. Paprota[1]

Paper topic: Laboratory and field observations and techniques

1. Introduction

The idea of construction of an aerial barrier as a breakwater appeared in 1907. It was secured by patent by American Engineer P. Brasher. This method was successfully applied to protect Standard Oil Company pier situated in El Segundo in California against wave action (Evans, 1955). This topic attracted attention of many researchers since then. The experimental study was performed by Evans (1955), Hensen (1955, 1957), Preissler (1960), Jasińska (1965), Wang et al. (2005) and Zhang et al. (2010). Theoretical models were derived by Taylor (1955), Bulson (1968), Brevik (1976), Liang (2006) and Zhang et al. (2010). The aim of the experimental and theoretical studies was to evaluate effectiveness of aerial barriers used as breakwaters, estimate the amount of air necessary for operation of pneumatic breakwater dumping waves of different parameters and identify processes responsible for wave energy dissipation. In the present study experiments were conducted in a wave flume for different water depths and wave regimes as well as parameters of the aerial barrier including air supply and number of pipes used to generate pneumatic curtains.

2. Experimental setup

The experiments were carried out in the wave flume of Institute of Hydroengineering of Polish Academy of Sciences. Perforated pipes were installed in various configurations on the bottom of the wave flume. The pipes were connected to a piston-type air compressor providing different amounts of air for experiments. The submerged aerial barrier was generated. Resistant-type wave gauges were installed in front of and behind the pneumatic breakwater model to measure free-surface elevation and in consequence evaluate the effectiveness of the pneumatic breakwater model. The experimental setup is presented in the Figure 1.

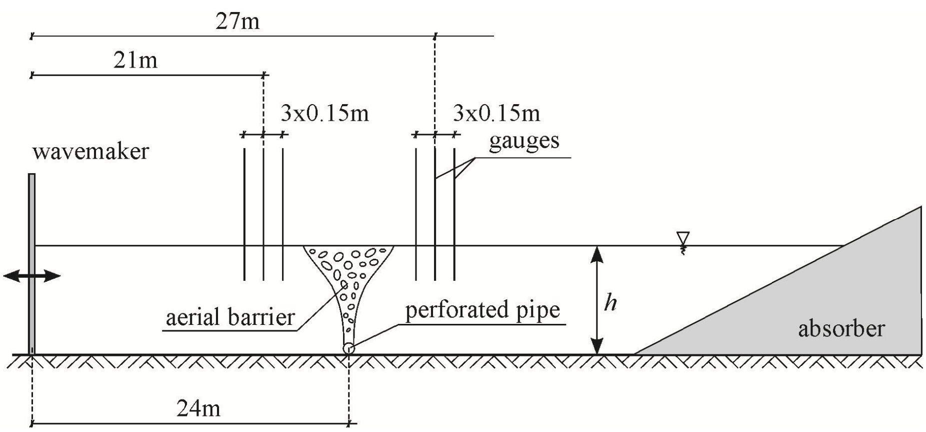

Figure 1. Experimental setup.

[1] IBWPAN – Institute of Hydroengineering of Polish Academy of Sciences, Kościerska, 7, 80-328 Gdańsk, Poland. mapap@ibwpan.gda.pl

3. Laboratory tests

Regular waves of fixed parameters (i.e. wave steepness, wavelength to water depth ratio) were generated by the wavemaker for three different water depths. The parameters of the aerial barrier were modified by changing the amount of air supplied by an air compressor and the number of perforated pipes. The system of wave gauges registered free-surface oscillations in front of and behind aerial barrier. Based on the measurements the effectiveness of the pneumatic breakwater in different wave conditions was analysed. The measured free-surface elevation for gauges installed on both sides of the aerial barrier for the deepwater wave case is presented in the Figure 2.

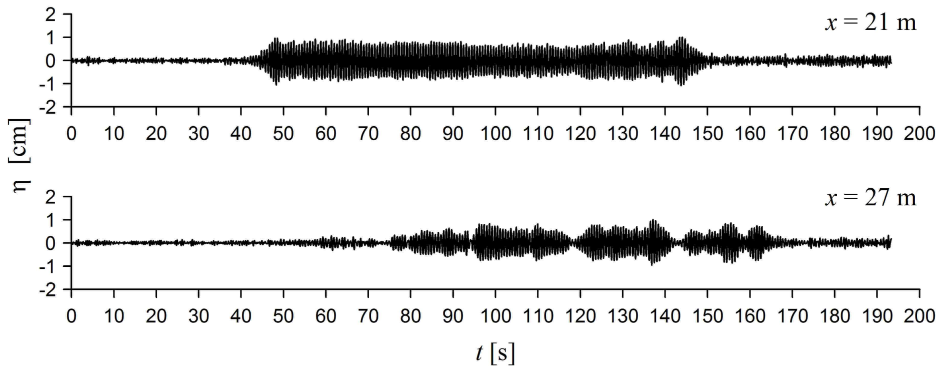

Figure 2. Free-surface elevation recorded in front of (x=21 m) and behind (x=27 m) the model of aerial barrier for the deepwater wave case (kh=3.0; h=0.3 m).

Acknowledgements

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