STUDY OF THE WAVE PROPAGATION IN SHALLOW WATER THROUGH PROTOTYPE MEASUREMENTS

Introduction

When extending a harbour and planning modification works inside an existing harbour wave propagation inside the harbour needs to be examined. In Oostende a new harbour entrance will be designed to protect the entrance of the port and the inner harbour itself. Wave propagation inside the harbour area is investigated through numerical modelling.

To validate the numerical model results, prototype measurements of wave propagation in shallow water have been performed. The measurement site is located between the Zeeheldenplein and the Western pier (Fig. 1).

Methodology

A wave rider buoy, a vertical step gauge and four pressure sensors are used to determine the sea state parameters in the shallow water area.

From the numerical simulations it was found that high disturbance coefficients appear along the line DAB as drawn in Fig. 2. Most of the instrumentation is installed on or in the neighbourhood of the line DAB in order to study the high wave disturbance.

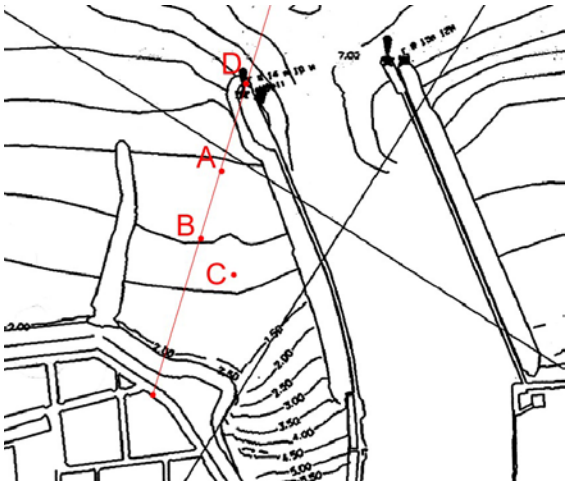

Fig. 2. *Positions of the prototype wave sensors at four locations A through D between Zeeheldenplein and Western pier.*

The **wave rider buoy** is situated east of the harbour entrance and measures surface elevations relative to the Still Water Level (SWL).

The **vertical step gauge**, developed by the Department of Civil Engineering, is installed at the end of the Western pier (point D in Fig. 2). This device detects water levels and is used to determine both the mean water level and the water surface elevations.

Fig. 1. *Waves propagating in the shallow water area between Zeeheldenplein (front) and Western pier (background), near the measurement site in Oostende.*

DEPARTMENT OF CIVIL ENGINEERING - GHENT UNIVERSITY
Technologiepark 904, B-9052 GHENT - BELGIUM ☎++32 (0)9 264 54 89 🖷++32 (0)9 264 58 37

Four **pressure sensors** A to D have been installed according to the positions drawn in Fig. 2. Sensors A, B and C are installed below low water level and at 0.5 m above bottom level. Sensor D is fixed at the lower end of the vertical step gauge, at the end of the Western pier.

The pressure sensors are used in a hostile marine environment. A titanium isolation diaphragm isolates the silicon measurement element from the sea water. Each sensor measures pressures relative to atmospheric pressure, within a specific pressure range.

Results

For the determination of the sea state parameters distinction has to be made between pressure measurements and the measurement of water levels.

The wave rider buoy and the vertical step gauge produce surface elevations which can be used directly for the determination of the sea state parameters.

The pressures measured with the pressure sensors need to be converted to surface elevations before calculating the sea state parameters.

Comparison between the two measurement techniques have been made at position D (see Fig. 2) where a pressure sensor as well as the vertical step gauge are installed. Fig. 3 shows a first comparison between the water surface elevations measured by the step (wave) gauge and calculated from the pressures measured with pressure sensor D.

Acknowledgements

The research carried out here has been funded by the Ministry of Flemish Community – Coastal Division (Belgium).

Contact

For more information, contact:
Cathy.Boone@UGent.be, or visit the home page of the department at http://awww.UGent.be.

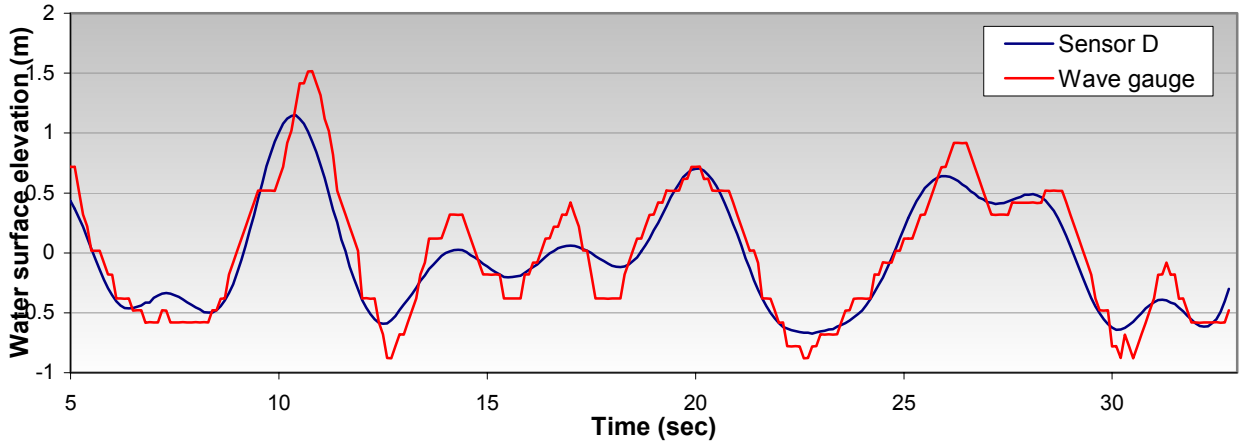

Fig. 3. *Time series of water surface elevations at location D, measured with the wave gauge and calculated from the pressures measured with pressure sensor D.*

DEPARTMENT OF CIVIL ENGINEERING - GHENT UNIVERSITY
Technologiepark 904, B-9052 GHENT - BELGIUM ☎++32 (0)9 264 54 89 ++32 (0)9 264 58 37