STUDY OF THE STABILITY OF A SEA DIKE BY WAVE IMPACT THROUGH PROTOTYPE MEASUREMENTS

Introduction

During the period 1998 – 2000 restoration works have been performed on the sea dike in Oostende. These restoration works contained the filling of the holes directly underneath the dike revetment.

As part of these works, special measurements have been carried out to determine the existing pressures on the revetment.

The sea dike revetment consists of pointed blue stones. Sometimes rubble stones can be found directly underneath the revetment.

Methodology

On the sea dike 13 pressure sensors have been installed through 2 installation ducts (Fig. 1): one to fix 9 sensors *on top of* the revetment and the other one to lead 4 sensors *under* the revetment.

The positions of the sensors are well-defined. On the one hand pressures at both sides of the revetment are required to investigate the **stability of the revetment**, especially at the bottom of the slope. On the other hand pressures are determined over the whole slope in order to investigate the **structural strength of the revetment**. Fig. 2 shows the positions of the sensors 0 to 12 along the slope of the sea dike.

The pressure sensors are used in hostile marine environments. 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.

Fig. 1. *Installation ducts at the measurement site in Oostende.*

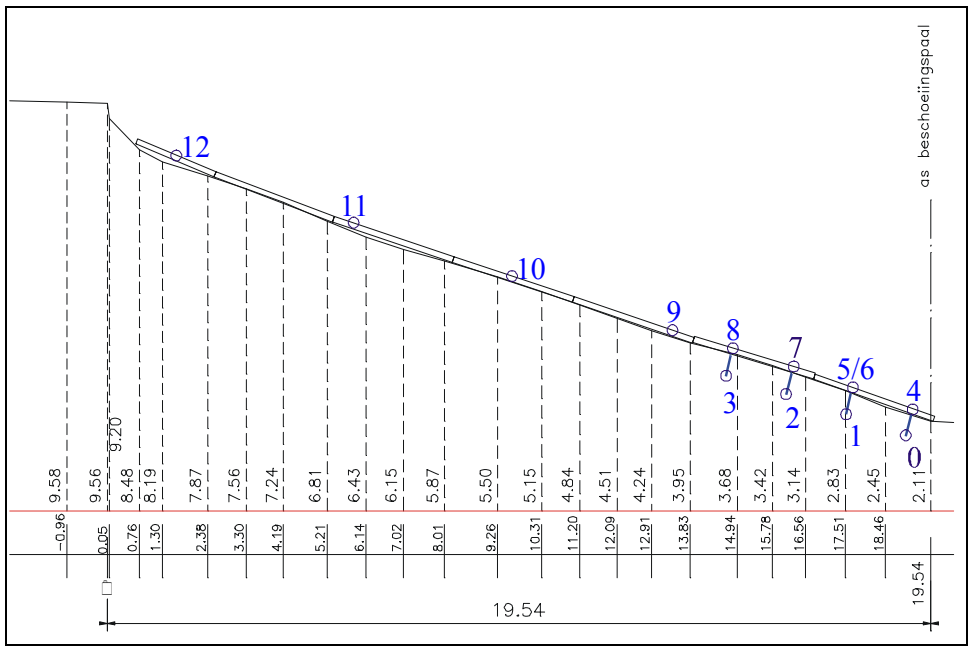

Fig. 2. *Cross section of the measurement site and position of the 13 pressure sensors.*

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Results

The stability of the revetment is determined on the one hand by the **loads on the block** of the revetment and on the other hand by the **strength of the blocks**.

The loading on the blocks is the difference in water pressure above and underneath the blocks and is measured by the pressure sensors. Upward water pressure appears when the pressure under a block is higher than the pressure above the revetment.

The strength of the blocks exists of 4 factors:

- the weight of the blocks
- the friction between the blocks
- the inertia of the blocks
- the flow of water under the blocks

Fig. 3 shows time series of the upward water pressures in mwc (1 mwc = 10 kPa) on a block during 15 seconds for the sensor pairs 0-4, 1-5, 1-6, 2-7 and 3-8. The magnitude of the upward water pressure decreases with increasing level of the position of the pressure sensor. When taking into account the weight of the blocks (ca. 1 mwc), additional upward pressures still exist.

Inertia of the block and friction between the blocks still need to be considered. The inertia of a block depends on the time that the upward water pressure is higher than the weight of the block and the friction between the blocks and on the relation between the allowed displacement of the block and the thickness of the block. The value of the friction depends whether the blocks are fixed or not.

Upward water pressures clearly higher than the weight of the revetment blocks have been measured but no blocks have been pulled out. This indicates that the strength of the blocks is higher than the measured upward water pressure on the blocks.

Acknowledgements

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Contact

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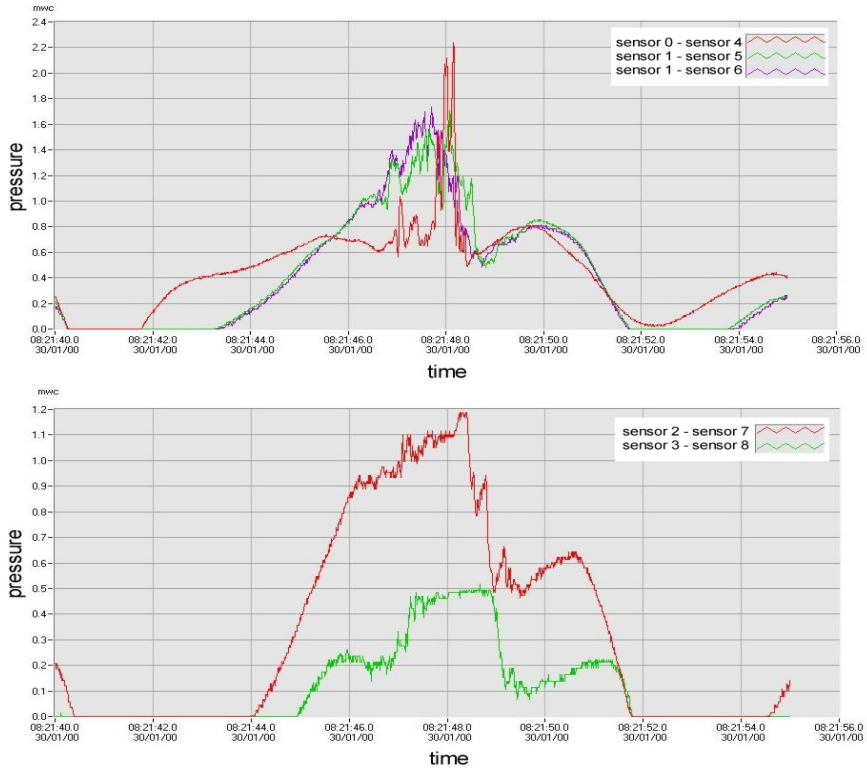

Fig. 3. *Time series of upward water pressures on the dike revetment.*

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