

Design Study Coastal Defence Scheme for the Belgian East Coast Knokke-Zoute



Financed by: Ministry of the Flemish Community, Administration of Waterways and Coast

Client: Ministry of the Flemish Community AWZ AWK

Date: 1997 – 2001

Budget: € 136 000

Location: Belgian East Coast, Knokke-Zoute

Partners: University of Ghent - Hydraulics Laboratory and Flanders Hydraulics Laboratory

Assignment:

In order to identify the drastic instability and the morphological impact on the coastal area of Knokke-Zoute, an extended research program is set up to explore a basic understanding of the local beach morphology and to support a sustainable coastal defence policy.

Based on the fundamental findings on the physical erosion processes a proper coastal defence system was designed.

Scope of Services:

- Technical Support of ICZM -policy
- Design of beach nourishment scheme
- Coastal defence schemes
- Identification morphological processes
- Integrated (hybrid) modelling of morphological development

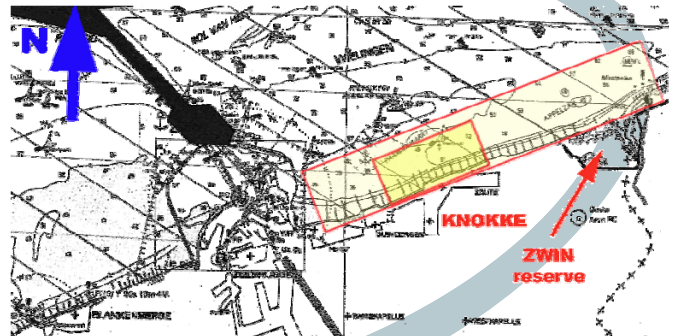
Technical Description:

Due to the high socio-economical, cultural, ecological and recreational value, the persistent regression of the coastline along the Flemish East Coast forms an acute threat forcing the coastal management to a continuous maintenance of the local beach area. Under incident wave attack, the natural shore profile transports its beach sand offshore, from where the longshore tidal flow gradient removes the foreshore breaker berm, inducing a gradually developed structural erosion problem of the Knokke-Zoute beaches.



The coastal area of Knokke (Belgian East Coast)

It is clearly identified that, due to this complex interaction of wave-induced on- and offshore transport, longshore tidal drift and the impact of the breakwater obstruction by the harbour extension of Zeebrugge, a traditional beach nourishment will not provide a complete and durable (i.e. sustainable) solution for the coastal defence of the Flemish East coast.



Study area along the Belgian East Coast

Detailed analysis of existing information clearly shows an exponential variation of the structural erosion rate: initially (1986-1987) an erosion rate of 100 m³/m/year was noticed, while a mean value of 40 m³/m/year over the last 13 years (1986-1999) is calculated.

Complex hydrodynamics of longshore tidal currents and cross-shore wave induced flow create an even more complex morphology with longshore tidal gullies and steep foreshore beach profiles.



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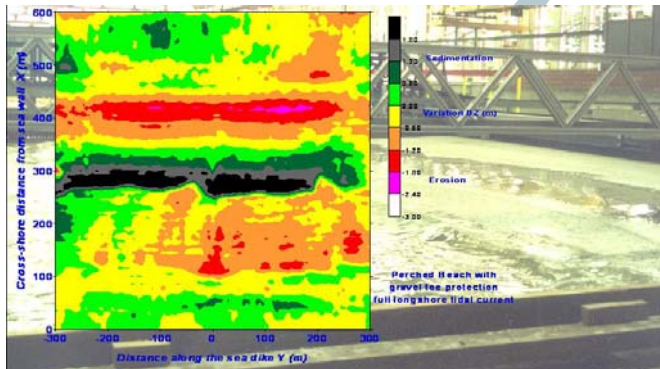
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The design of basic sand suppletion schemes as coastal defence system in the study area was based on an understanding of the fundamental physical erosion processes in the coastal nearshore area.

First, 2D physical scale model tests in a wave flume at the Flanders Hydraulics Laboratory qualify the beach nourishment stability as a cross shore unit.

Further in the basic research, an extended physical model in the 3D wave tank installation at the Flanders Hydraulics Laboratory provides not only a quite unique fully computer-controlled input (spatially and temporally variation) of incident waves, longshore currents and tidal water elevations; but also a stand-alone laserscan system to record the resulting bathymetries in the model.

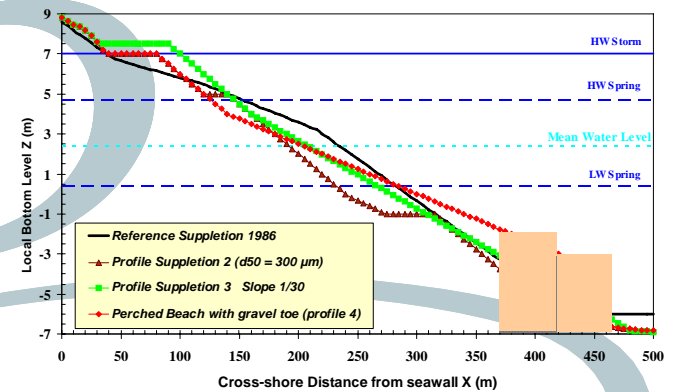


3D - Physical scale model

A good agreement between physical test results and the in situ data for the 1986-reference confirms the premised morphological processes in the area as the main cause of the local structural erosion problem.

Based on the research results of the complex morphodynamics of the Belgian east coast, a proper coastal defence system was designed.

A traditional beach suppletion profile was adapted towards a pending sand suppletion profile, protected with an offshore underwater support.



Beach nourishment design

Further numerical calculations with DHI software confirm the high potentials of this particular beach protection system in the complex Knokke-Zoute area.