

Design of Sand Suppletion Scheme as a proper Coastal Defence System for the Coastal Reach Middelkerke-Oostende



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

Client: Ministry of the Flemish Community, Administration of Waterways and Coast

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Location: Belgian West Coast, between Westende and Oostende

Partners: DHI Software

Assignment:

Starting from a risk and safety analysis of the actual sea wall system, a beach nourishment scheme in front of the sea wall is designed as a proper coastal defence system.

Morphological impact of the sand suppletion is validated in a series of numerical model simulations.

Finally, a new TAW-based analysis assesses the "safe" condition of the designed coastal defence line.

Scope of Services:

- Safety analysis of coastal defence system
- Updating of coastal defence by beach nourishment design
- Design of sand suppletion
- Beach nourishment as coastal defence system
- Numerical morphological modelling
- Safety analysis, according to the current TAW-methodology, of the coastal defence system

Technical Description:

As a spatial extension of the coastal defence programme of the city of Oostende, the westward coastal reach between Middelkerke and Oostende was evaluated. Since this reach is currently protected by a seawall, a seaward beach suppletion extension was foreseen as potential defence system.



Sea wall in Middelkerke

The design of the beach suppletion between Middelkerke and Oostende in front of the Belgian Coast is developed in two consecutive stages. Based on a full GIS-based inventory of all relevant input data (sedimentology, hydrodynamics, hinterland,...), an initial safety analysis of the existing coastal defence system is explored in accordance to the current TAW-methodology. From that and checked by a multidisciplinary steering committee, a series of boundary conditions and objectives are identified as a solid base for the technical design of sand nourishment schemes, as part of the coastal defence system in the studied reach.



Sea wall in Mariakerke (Oostende)

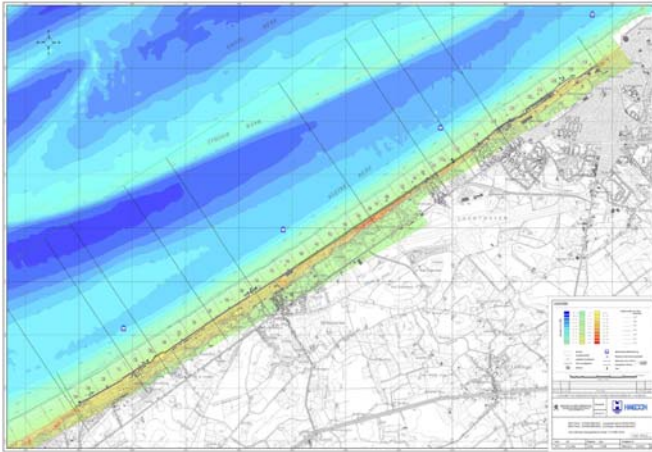


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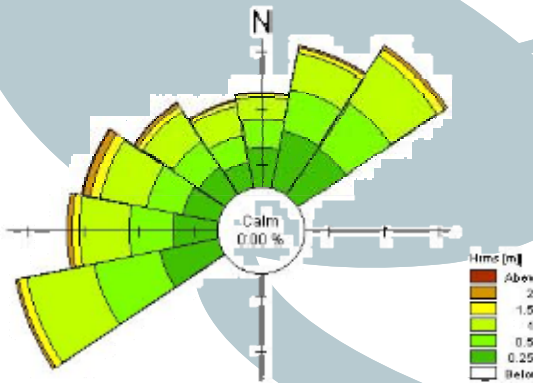
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GIS-based plan of the coastal study area Westende-Oostende

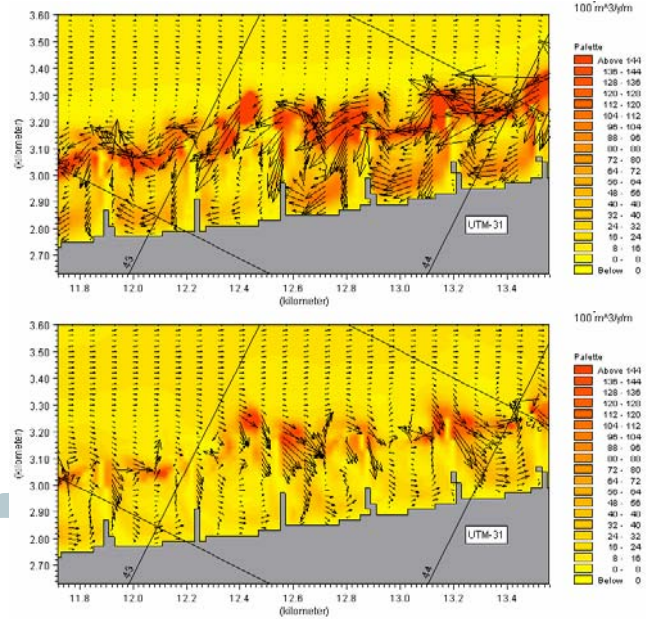
In the GIS-based inventory special attention is given to the statistical analysis of the hydrodynamic forces acting on the sea defence system. Both tidal driven currents and wave climate are intensively analysed. Together with these hydrodynamics, a systematic description of the whole sea defence system (consisting of sea wall, beach and foreshore) is given.



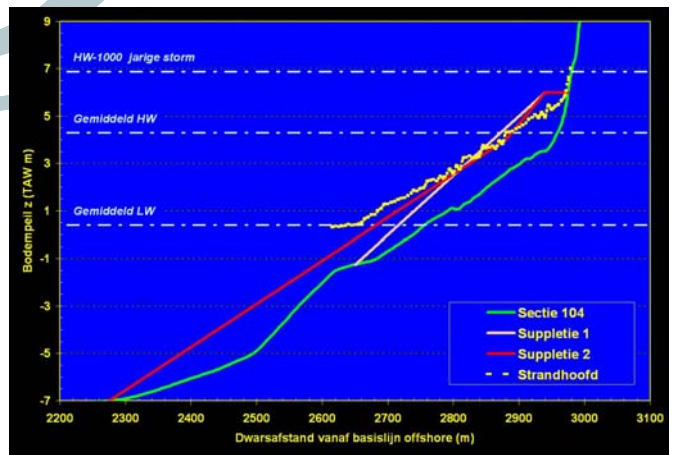
Statistically analysed nearshore wave climate

The beach suppletion design is checked through a series of numerical morphodynamical model simulations. Cross-shore evolutions (Litprof), longshore development (Litline-Litdrift) and fully 2D-modelling (MIKE 21) provide a quantitative evaluation of the morphological development of the coastal study zone, both under normal long-term hydrodynamical impact and singular extreme storm conditions.

Basically, the suggested sand suppletion scheme consists of a horizontal beach tableland in front of the existing sea wall with a uniform beach slope 1/30 towards mean HW-level and a uniform foreshore 1/55 towards the nearshore longshore tidal gully "Kleine Rede". This beach nourishment scheme is adopted to local conditions, by taking into account groyne configuration, sea wall lay-out, hinterland connections (dunes, building,..)



MIKE 21 - Morphodynamic modelling



Beach suppletion design

Finally, the sand suppletion design in front of the coastal reach between Westende and Oostende is validated as coastal defence unit by deploying a new safety analysis in accordance with the current TAW-methodology. Both a combination with buildings at the landside of the sea wall and dunes as hinterland are checked as coastal defence system, with respective risk and safety levels. A thorough analysis of the wave run-up and overtopping on the combined beach suppletion-sea wall system under the prescribed design hydrodynamical storm conditions indicates a "safe" condition all over the length of the project reach.