

# How shore-parallel breakwaters affect coasts

Segmented shore-parallel breakwaters (SSPBs) have been widely used in the UK and abroad to protect coasts from flood and erosion. The UK applications include the breakwaters at Kings Parade in Wirral, Elmer in Sussex and Sea Palling in Norfolk. However, most current UK structures were designed a decade or more ago. How do these structures interact with waves, tides and shorelines? Can these structures still provide appropriate levels of flood and shoreline protection over their lifetime?



Breakwater scheme at Sea Palling, Norfolk  
(Courtesy of Mike Page)

The recently-completed LEACOAST2 project studied the impacts of shore-parallel breakwaters on large-scale coastal morphology. The project was funded by the EPSRC in collaboration with the Universities of Plymouth, East Anglia and Liverpool, Proudman Oceanographic Laboratory, as well as HR Wallingford and Halcrow.

The project was focused on the study area at Sea Palling on the Norfolk coast, where a group of shore-parallel breakwaters were built about fifteen years ago following the severe flooding to the area in 1953. The breakwater scheme has a total of nine breakwaters (sometimes called reefs), four of which are surface-piercing breakwaters (high-crested) and five over-topped breakwaters (low-crested).

The main objective of this research was to evaluate the generic effect of shore-parallel breakwaters in macro-tide conditions on coastal morphology over a spatial scale of kilometres and a temporal scale of months to years. A combined approach with field measurements during the storm events, long-term remote-sensing monitoring with video-cameras and x-band radar, regular beach and bathymetric surveys, and both deterministic and probabilistic morphological computer models was used. During the project, a large quantity of high quality field data was gathered and analysed, and advanced model approaches were developed.

The field measurements and computer model results obtained from the project revealed many details of the hydrodynamics and morphodynamics in such a dynamic and complex system. The impacts of SSPBs on sediment transport pathway, formation of

salients and tombolos, and short-to-medium-term morphology changes under the combined wave and macro-tide/storm surge conditions were extensively studied. The project also provided useful information for improving the current design guidelines for coastal defence structures, undertaken by HR Wallingford and Halcrow in a parallel project funded by EA and Defra.

Dr Shunqi Pan was awarded a Research Exchange through the China/India award from the Royal Academy of Engineering. The scheme enables engineering researchers at UK Higher Education Institutions to travel to a Chinese or Indian Institution, and China or India-based researchers to spend time at a UK Institution. The objectives of the scheme are to:

- promote collaboration between high qual-

ity engineering researchers in the UK and China & India;

- strengthen relations between leading partners in these countries and support the expansion of international Networks of Excellence in engineering research; and
- allow researchers to gain international experience and access world-class expertise.

Dr Pan was a member of the project team at the University of Plymouth.

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