



Guidance for outline design of nearshore detached breakwaters on sandy macro-tidal coasts

Project Summary SC060026/S1

This study has developed guidance for the outline design of a nearshore detached breakwater scheme for beach erosion control on a sandy coast subject to large tidal ranges. It is intended for use by experienced coastal engineers at the option appraisal stage for a new breakwater scheme. The guidance is based on detailed mathematical modelling studies of the effect of breakwaters on beaches, supported by site observations.



Need for the guidance

Nearshore detached breakwaters are often considered an option for beach erosion control as part of coastal defence schemes.

One of the limitations of existing design guidance for determining the geometrical layout of breakwater schemes is that it is designed for beaches with small tidal ranges (less than 2m). But more than 75% of the UK coastline is exposed to larger tidal ranges (more than 2m) and existing guidance is therefore not applicable.

To bridge the gap the joint Environment Agency/Defra Flood and Coastal Erosion Risk Management Research programme commissioned Halcrow and HR Wallingford to model how the layout of breakwaters affects the formation of salients and tombolos on beaches with large tidal ranges. The findings of this modelling study have been used to develop specific guidance for appraising breakwater schemes to protect these types of beaches.

Findings of the modelling study

The primary conclusions from the modelling study are:

- if the breakwaters are not submerged and the gaps between them are fixed, the response of beaches with small tidal ranges depends on the relationships between the length of the breakwater, its distance from the shoreline and the distance from the shoreline to the point where the waves break. In this case, larger salients and eventually tombolos are generated by longer breakwaters that are closer to the shore.
- larger tidal ranges can act to reduce the length of the salients.
- The salient length reduces for lower breakwaters as a result of water washing over them.
- The models' predictions were broadly supported by observations of the effects of a system of breakwaters at Sea Palling on the Norfolk coast, which led to the formation of a combination of salients and tombolos. These observations were made as part of a project funded by the UK Engineering and Physical Sciences Research Council (EPSRC).

Project outputs

Based on these findings, the researchers have generated specific guidance for the outline design of a breakwater scheme for controlling beach erosion on a sandy coast subject to large tidal ranges.

It is envisaged that coastal practitioners will use this guidance at the option appraisal stage to help evaluate the effect of nearshore breakwaters on the shoreline and compare with alternative beach management approaches.

The results of the modelling study and the guidance are presented as two separate reports. As well as describing the modelling work, the scientific report includes eight short papers detailing the main results of the EPSRC project. The guidance document, entitled *Guidance for outline design of nearshore detached breakwaters on sandy macro-tidal coasts*, includes two design graphs for determining the effects of tidal range and breakwater height on salient length and a step-by-step block flow chart supported by two worked examples.

This summary relates to information from project SC060026, reported in detail in the following output(s):

Report: SC060026/R1

Title: Guidance for outline design of nearshore detached breakwaters on sandy macro-tidal coasts

ISBN: 978-1-84911-178-2

February, 2010

Report Product Code: SCHO0210BRYO-E-P

Report: SC060026/R2

Title: Modelling the effect of nearshore detached breakwaters on sandy macro-tidal coasts

ISBN: 978-1-84911-181-2

February, 2010

Report Product Code: SCHO0210BRYN-E-P

Internal Status: Released to all regions

External Status: Publicly available

Project manager: Eleanor Heron, Evidence Directorate

Theme manager: Geoff Baxter, Sustainable Asset Management (SAM)

Research Contractor(s):

Halcrow Group Ltd., Burderop Park, Swindon, Wiltshire, SN4 0QD,

Tel: +44 (0)1793 812479; Fax +44 (0)1793 812089

HR Wallingford Ltd., Howbery Park, Wallingford Oxon OX10 8BA,

Tel: +44 (0)1491 835381; Fax: +44 (0)1491 832233

This project was commissioned by the Environment Agency's Evidence Directorate, as part of the joint Environment Agency/Defra Flood and Coastal Erosion Risk Management Research and Development Programme.

Email: fcerm.evidence@environment-agency.gov.uk.

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E: enquiries@environment-agency.gov.uk.

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