

THE SHORE-PARALLEL BREAKWATERS
AT SEA PALLING:
INTERACTION WITH TIDAL CURRENTS
AND THEIR CONTRIBUTION TO SAND TRANSPORT

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Abstract

The shore-parallel breakwaters at Sea Palling, completed as part of the Happisburgh to Winterton Sea Defences in 1997, have imposed significant modification to the local beach morphology. The region experiences a vigorous, longshore drift although most previous studies of sediment dynamics have concentrated upon wave driven processes and have ignored the effects of tidal currents.

The breakwaters allow a shore-parallel, southeastward tidal flow on the landward side of the structures during the high-water phase of the progressive wave tide, but the tidal tombolos which have developed behind, are effectively fully emergent for the remaining low-water, northwestward phase and block most of the longshore sand transport.

A combination of hydrodynamic modelling, using the finite-element, TELEMAC system, and field observation was used to determine bed shear stress generated; by tidal currents acting in isolation (currents alone) and when low-amplitude waves are applied (currents plus waves), stirring sediment into suspension. Established formulations were used to compute bedload, suspended load and total load sand fluxes over a Spring-Neap-Spring cycle. The predicted evolution of the tombolo during a tidal cycle is also computed. Fieldwork measurements provided model boundary conditions and verification of predicted sand transport and morphodynamic change.

Close agreement was found between predicted and observed sand fluxes, giving confidence in the results of non-intrusive, acoustic instrumentation deployed to make direct measurements of sand transport, in shallow water conditions.

An annual estimate for the magnitude of sand transport by the tidal currents and exported into the regional system of ca. $7,000m^3$ is suggested and a flux through the breakwater system during calm, low-energy, 'background' conditions of ca. $40,000m^3$ proposed. Whilst of modest magnitude when compared to the pre-construction flux, these newly identified quantities represent a continuing contribution to sediment transport along on this part of the UK coastline.

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