

## **Beach Nourishment With Nearshore Sediments in a Highly Protected Coast**

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### **Abstract**

Approximately 7 km of beaches at Marina di Massa are experiencing severe erosion as a consequence of the construction of an industrial harbor at Marina di Carrara in the early 1920's. The new structure intercepts the southward longshore sediment transport, inducing a sedimentary deficit to downdrift beaches.

Different types of hard structures, such as seawalls, breakwaters and groins, were built in the study area in order to protect the seaside resort and the coastal highway from shoreline retreat. A submerged breakwater connecting the offshore end of the groins was later added in order to decrease beach sediment loss. As a result, each kilometer of coastline is now protected by 1.4 kilometers of hard structures, and the coastline is subdivided in many adjacent artificial cells.

Nevertheless, beach erosion proceeded and tourist industry is now suffering from this retreat. A low-cost coastal restoration project financed by bathing establishment owners and the local authority was undertaken in June of 1997 inside one of the artificial cells. Approximately 4,125 cubic meters of sand (15 cubic meters/meter of coastline) were dredged offshore the submerged breakwater and dumped on the beach. Native beach sediment's mean grain size is approximately 1.7 phi (0.31 mm), in contrast with the nearshore borrow material's mean grain size, which is approximately 2.25 phi (0.21 mm).

A morphological and sedimentological beach monitoring was performed by the authors to evaluate the effectiveness of the project. A total of five surveys were carried out between June 1997 and June 1998. Data show that approximately 66% of the borrow material was lost within one year, most of which between July and October. This is to be ascribed to the unsuitable borrow material texture. In addition, beach quality had worsened due to fine sediments that made the beach dusty. A benefit-cost analysis of the project, together with an evaluation of the opportunity of such a work, was also performed.