

# ARTIFICIAL BEACH NOURISHMENT PROJECTS IN ITALY

Renzo Valloni<sup>1</sup> and Mattia Barsanti<sup>2</sup> \*

<sup>1</sup> Department of Earth Sciences, University of Parma, 43100 Parma, Italy

<sup>2</sup> ENEA Marine Environment Research Centre, 19100 La Spezia, Italy - mattia.barsanti@santateresa.enea.it

## Abstract

The first results of the University of Parma-Enea La Spezia survey on artificial beach nourishment projects in the 8000 km long Italian coasts are shown. The state of the art in 2002 is represented by 72 projects, a database sufficiently large to allow the discussion of the principal types and the main sedimentologic characteristics of the projects.

*Keywords* : Beach, Coastal Engineering, Erosion, Sediments.

## Introduction

The social-economic consequences of coastal erosion in the Mediterranean coasts are extremely important. Nowadays artificial beach nourishment is a common remedial measure to beach erosion, particularly effective in Spain and Italy [1].

The database discussed below rely on survey data aimed to classify the relevant information on artificial beach nourishment [2]. The preparation of the data-form benefits of the contributions of several investigators from the Enea Centre of La Spezia, the Consortium *Venezia Nuova* and the Regione Emilia-Romagna.

## Rationale

This work considers all significant nourishment projects and only part of the fills of relatively small volume. These latter are commonly executed by private beach concessionaires and not always officially recorded. The rationale of the survey is as follows.

- 1) Simplicity of formulation in order to guarantee reliability and homogeneity of the information collected;
- 2) The placement of material in the same coastal stretch in separate years with specific financing of the interventions is attributed to distinct projects and recorded on distinct data-forms;
- 3) Survey of all relevant projects with no temporal limit to the survey given although in Italy significant artificial nourishment works only initiated in the eighties.

## Survey data

Data-forms are filled in co-operation with local Administrators. The collected information is presented in the following.

### 3.1 Project identification

- Municipality, Province (*Prefecture*) and local Administration (*Regione*);
- Aim of the artificial beach nourishment;
- Denomination of the project and year of construction;
- Additional aims pursued by joint projects (e.g. restoration of the dune system).

### 3.2 Technical information

- Length (m) of the restored reach of shore;
- Width (m) of the restored beach;
- Volume (m<sup>3</sup>) of fill;
- Total cost of the fill;
- Fill material: sand, gravel and mutual percentage in case of combined use;
- Source of borrow material: land, sea, estuary/port dredging;
- Protective structures: groin, submerged barrier.

### 3.3 Renourishment

Modality of execution and cost of periodic nourishment and monitoring of the restored beach performance.

## Discussion

The 72 projects catalogued so far allow some statistically meaningful treatments; a first set of relevant parameters is defined referring to the example of the Poetto project construction in Cagliari (Sardinia).

- Length of restored shore = (L) = 2.500 m
- Average width of restored beach = (W) = 55 m
- Volume of fill = (V) = 370.000 m<sup>3</sup>
- Total cost of the fill = (C) = 3.098.741 Euro.

The parameters above provide the following characteristic indices.

- Length-width ratio L/W = 45,4
- Volume of fill per unit length V/L = 148,0 m<sup>3</sup>/m
- Cost per cubic meter of fill C/V = 8,4 Euro/m<sup>3</sup>.

Characteristic values of V and L separate two basic categories of

artificially-placed beach materials here named *Fills* (V < 100.000 m<sup>3</sup> and L < 1800 m) and *Nourishments* (V ≥ 100.000 m<sup>3</sup> and L ≥ 1800 m).

Actually among *Fills* a group of minor interventions characterised by a length-width ratio (L / W) < 20 and a volume (V) < 40.000 m<sup>3</sup> can be distinguished. These projects cannot be considered as real beach replenishments but simply as local sediment pourings.

From the cases considered here the existence of two fundamental categories of artificial Nourishments is shown as a function of the volume of placed materials for unit distance of the restored shore (V/L). Characteristic values are from 10 to 50 m<sup>3</sup>/m and from 80 to 400 m<sup>3</sup>/m, here named *Surface* and *Volume* Nourishments, respectively.

## Conclusion

Up to year 2002 a total number of 72 Italian beaches has been artificially restored. By project number the ranking of Administrative Regions is Emilia-Romagna (30), Latium (11) and Tuscany and Marche (10). By volume the most important projects are Venice-Pellestrina (4.000.000 m<sup>3</sup>) and Venice-Cavallino (2.000.000 m<sup>3</sup>), Paola (1.000.000 m<sup>3</sup>) in Calabria and Ostia-Levante (950.000 m<sup>3</sup>) in Latium.

The purpose of the beach reconstruction projects can be classified in the following four categories: (1) Beach widening for recreation, (2) beach restoration for protecting buildings and roads, (3) beach restoration for protecting parks and natural heritage, (4) removal of groins for realising one of the previous soft restoration projects.

Only projects where the volume of fill is > 100.000 m<sup>3</sup> and the length of restored shore is > 1800 m belong to the generally recognized artificial Nourishments. On the base of the fill Volume-Length ratio these latter can be distinguished in two types named *Surface* and *Volume* Nourishments.

An example of *Surface* Nourishment is the Cecina project in the Province of Livorno (V/L = 26 m<sup>3</sup>/m). The highest value of the V/L ratio is provided by the Venice-Pellestrina *Volume* Nourishment (V/L = 400 m<sup>3</sup>/m).

The costs detected here per cubic meter of fill are very informative. They turn out to be particularly low (within 6 Euro/m<sup>3</sup>) when the source of borrow material is from dredging an adjacent estuary or port. For the remaining, in most cases the unit costs vary between 10 and 20 Euro/m<sup>3</sup>.

## References

- 1 - Van Der Salm J., Ünal Ö., 2001. *Towards a Common Mediterranean Framework for Potential Beach Nourishment Projects*. Proceedings of the Fifth International Conference MEDCOAST 01, Hammamet Tunisia 23-27 October 2001, 1333-1346.
- 2 - U.S. Corps of Engineers, 1984. *Shore Protection Manual* (Fourth Edition). Department of the Army, Coastal Engineering Research Center. U.S. Government Printing Office, Washington D.C., 20402. Two volumes.