

**EU Fifth Framework Programme 1998-2002
Energy, Environment and Sustainable Development**

RTD Project Proposal

**Environmental Design of
Low Crested Coastal Defense Structures**

**Inventory of the existing structures
on the French coast**

(FIRST DRAFT)

Report 101716

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1. SUBMERGED GROYNES

GENERAL CHARACTERISTICS

Immersed groyne being either a traditional structure (ripraps, concrete, sheeting piles, gabions) or not (work into geotextile, Stabilito) can be set up on bottom of beach and through the foreshore, entirely under the mean level of the sea or at the surface (sea without significant tide).

The passable groynes, emerged on the major part of their length, present, in their axis, interruptions (immersed portions, windows) where water and a certain quantity of sediments can cross the both sides of their low thresholds.

Consequently, both types of groynes have the advantage during the storms, not to be bypassed by the wave, with the known effect of removal of sand (digging) on the emerged beach. The surplus energy of the waves is partially dispersed on the two sides of groynes, parallel to the coast, before reaching the shoreline.

IMPACTS

The immersed groynes, moreover, have little or no visual impact on the natural beach. They can be visible only during low tide and in calm weather.

The effect of groyne, characteristic to all these types of works (the erosion of the beach on the side which is in the direction of the littoral transport of sediments during the heavy swells), is less strong than in the case of emerged groynes. This is because a significant part of sedimentary materials can cross their low peak, continuing their advance along the shore. Consequently, the impact of immersed (or passable) groynes onto not equipped adjacent beaches, is reduced.

EXPERIMENTS

Two long immersed groynes (100 m) on quite all their length were established (early in 1996) on the foreshore of Tamarissière (Agde, Mediterranean Sea), and combined with a beach nourishment.

Two passable groynes have existed for a rather long time (50's) in Palavas (Mediterranean Sea), to the East of the moles. The beach seems to be better preserved here during storm than more in the East.

2. BEACH THRESHOLD

GENERAL CHARACTERISTICS

Those are submerged structures directed parallel to the coast, as the artificial bars, which can ensure the maintenance of a beach, in general reloaded with sediments, avoiding sands leakage towards the open sea (especially finest). One often speaks about the beaches (emerged and immersed) maintained thus at a higher level than in the adjacent sectors under the name of "perched" or "suspended" beaches.

The works can have rather different structures : traditional (rocks, piles), or more innovating ("reef-thresholds" like Beachsaver or Sandgrabber, containers into geotextile, etc...).

These "beach threshold" are generally established at low depth, towards the outside zone where large wave break. Their influence in the transverse plan is more reduced than that of the riprap moles. Their peak is close to the surface of water.

EXPERIMENTS

A "beach threshold" was recently built (1995-1996) in Languedoc-Roussillon, in front of the strongly eroded beach of Tamarissière (commune of Agde, Mediterranean Sea). It is a structure established at approximately 100 m away from the shore, between 2 and 2,50 m of depth, on approximately 250 m long between the ends of two long immersed groynes. All that delimit a kind of semi-emerged rack, in which beach nourishment create a suspended beach. The mobility of the sediments is reduced (the groynes are used to avoid the side losses of sediments).

A suspended beach was built a long time ago in Monaco, at the back of a similar work, named "underwater berm".

INSTALLATION, MANAGEMENT, COSTS

The installation of such a work, if conventional materials are used, required usual techniques of coastal engineering. Additional nourishment of the beach could be considered, at less frequent intervals than on a beach without work.

The cost of this structure in Tamarissière, including two groynes, was initially estimated at 4,4 million Francs (671.000 Euros).

3. STRUCTURES INTO GEOTEXTILE

GENERAL CHARACTERISTICS

A technology developed in Mexico and that have been diffused in the world since 1971 is patented under the name of ODS (Operational Design System) and applies as well to the coatings and walls as to the groynes, piers and breakwater, under conditions of moderate hydrodynamic agitation. It is divided into three operational subsystems. Sandtex (Seditech, Denmark : same principle but with a more flattened shape (tube), Robusta (Géoconcept, France) and Géotube (Géomer, Marseilles) are alternatives of the same technology.

EXPERIMENTS

- * Bonne-Anse Beach in La Palmyre (Charente-Maritime) : groynes from 30 to 70 m length in Sandtex set up in a site eroded by tidal currents (tidal range of around 3 m, waves lower than 1,5 m). The tubes (in Robusta) were filled in with beach sand. It is mainly the vandalism which put an end to the experiment (burst tubes with knives blows).
- * Saint-Anne, Saline de Giraud (Bouches-du-Rhône) : an immersed mole, Géotube type, 3,2 m in diameter (work which could be comparable with a beach threshold) was installed in July 1992, 120 m off the shore, between 2 groynes of the pierheads.

4. ARTIFICIAL REEFS

GENERAL CHARACTERISTICS

The artificial reefs do not have precise characteristics. They can be manufactured with any heavy material ; their form in plan is less important than their volume and their dimensions (height, in particular). They can be laid out parallel to the shore to be protected, or form "fields" of more or less scattered reefs. Their influence on the bottom will be obviously significant, especially for reefs of fishing, supposed to form small islands of hard substrate on a movable bottom. Their common point is to be completely immersed at very variable distances from the shore, sometimes until depths where the action on the swell cannot be felt anymore.

The large variety of forms, dimensions, building materials and sites on the seabed differentiates the artificial reefs from the immersed moles, which are structures with more strictly defined parameters. When they are laid out in continuous line, these constructions could be rather comparable with foreshore underwater thresholds.

In Languedoc-Roussillon, prebuilt modules were immersed with relatively high depths (up to 30 m) : Palavas, Port La Nouvelle, Sète, Canet, Saint Cyprien, Sainte Marie, Gruissan, Agde, Marseillan...

5. ARTIFICIAL ALGAE

GENERAL CHARACTERISTICS

In general, the artificial algae are synthetic fibre ribbons provided with floats at the higher ends. They are fixed on bags into geotextile filled in with ballasted sand or tubes being used as anchoring in the depths of action of the swells and the currents they generate. The algae are laid out beyond the -2 m isobath as far as approximately 5 m depths through the zone where waves break. Their influence should be several tens of meters width on several hundred meters along the coast to ensure a certain effectiveness of attenuation of energy and sand dune phenomenon.

EXPERIMENTS

- * Saintes-Maries-de-la-Mer (Bouches-du-Rhône) : tests in 1978-79, positive result (stranding) but localised (base of works) ; not conclusive for a beach.
- * Carry-le-Rouet : experimentation of algae modules developed by the C.E.T.E. (Aix-en-Provence) with thin straps manufactured with industrial cover.