

# The French and Belgian Coast from Dunkirk to De Panne : a Case Study of Transborder Cooperation in the Framework of the Interreg Initiative of the European Community

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## Abstract

*The North Sea coast between the French town of Dunkirk and the Belgian sea resort of De Panne consists of sandy beaches bordered by dunes. A number of smaller sea resorts lie between these two towns. Problems of coastal protection are similar on both sides of the border; particularly the coastline is subject to beach depletion and erosion of the dunes.*

*The European Community (EC) has recently taken an initiative called "Interreg" which, among other things, promotes the joint execution of transborder programmes by the member states. The initiative permits a substantial financial contribution of the Community to those programmes which meet its objectives. In the framework of this "Interreg" initiative, the French and Belgian authorities have proposed to the EC the joint execution of detailed studies of coastal protection works in the border region. The proposal has recently been accepted by the EC.*

*The paper first briefly describes the similarity of the coastal morphology on both sides of the border and the solutions that have been applied in the field of coastal protection in both countries. Some difficulties also had to be solved before the joint study programme could be started up: e.g. the difference in chart levels and geodetic systems used on both sides of the border. The paper finally gives a summary of the studies which will be executed in the framework of the Interreg initiative.*

## Introduction

Until recently, contacts between French and Belgian authorities on aspects of the struggle against coastal erosion in their border region have been rather scarce.

Scientists and technicians have been experimenting and looking for solutions separately on each side of the border, although the southern North Sea coasts,

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whether Belgian or French, have a similar geomorphological structure and face the same kind of problems.

In 1990, two almost simultaneous events brought people, ideas and means together: the violent North Sea storms of 27-28 February 1990 eroded the beaches on both sides of the border (fig. 1); at about the same time, the EC was developing its incentive programme for Interregional Transborder Cooperation, the incentive consisting of financial support to joint operations on either side of the border having the same objective.

In 1990, links were established between a group of several French coastal towns (the Syndicat Intercommunal du Littoral Est de la Région de

Dunkerque [SILE]) and the Belgian Service of Coastal Harbours (Ministry of the Flemish Community) in order to discuss the common erosion problems and to initiate a joint study into the morphological processes and the coastal defence measures necessary to protect the coastal area. Since the mutual interest was evident, it was decided to submit a joint proposal to the EC in 1990.

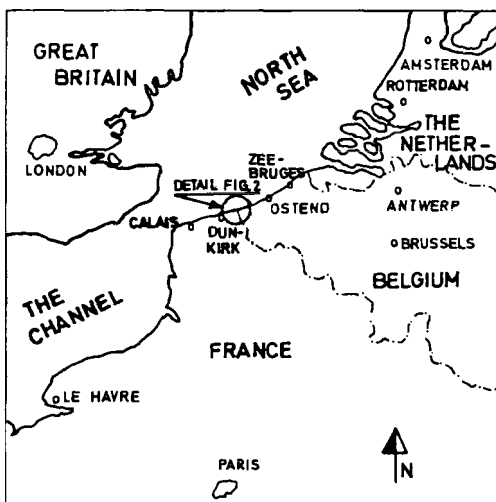


Figure 1: General situation of the study area  
Dunkirk - De Panne

### The "Interreg" initiative of the European Community (EC)

The Interreg initiative was decided by the European Commission in 1990. The objective was to prepare the frontier regions of the EC countries for the opening of the inner boundaries. The initiative distinguished between three types of actions:

- set-up of joint transborder programmes;
- measures favouring the relation between public institutions, private associations and voluntary organisations of the frontier zones;
- setting up joint institutional structures.

Operational programmes meeting the criteria of the Interreg initiative would be co-financed by the member states participating in the programmes and the European Community.

The French-Belgian project proposal consists of detailed studies of coastal protection works in the border region. Although each participating country is responsible for the execution of the necessary studies on its own territory, the preparation of these

studies has been carried out in joint consultation. The cooperation will be increased during the course of the studies.

The proposed project has been accepted by the guidance group of the Interreg programme. The administrative dossier of the project is now (end 1992) going through its last phases.

### Coastal morphology of the French-Belgian border area

The general character of the French Flemish coastal area, i.e. the seashore between Calais and Dunkirk, is very similar to that of the Belgian Flemish coastal area. The coastline of the Flemish plain is oriented WSW-ENE; in France it stretches for 54 km from Calais onwards, and in Belgium for another 65 km (fig. 2). A morphological description of this sandy coast is amongst others given by Houthuys *et al.*, (this volume). The coastal zone of the border area, often located some two metres below mean high water level, is protected from inundation by the sea by natural dunes and man-made constructions, usually seawalls: 46 km out of 65 km in Belgium, 18 km out of 54 km in France.

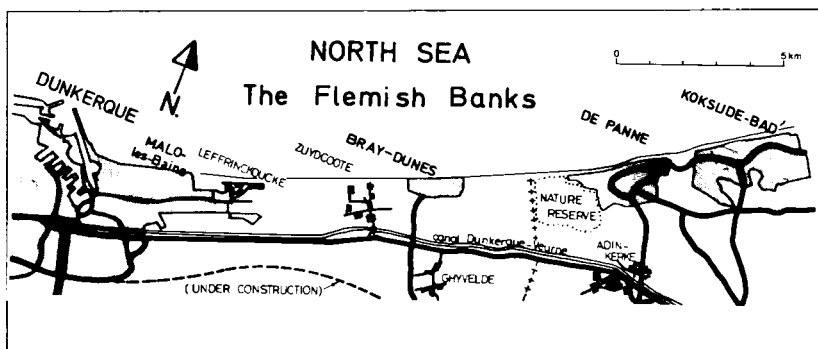


Figure 2: Generalized map of the border area Dunkirk - De Panne.

### French territory

In the French border territory there is a trend towards beach accretion in the area stretching from Calais to Dunkirk and a trend towards erosion on the 14 km stretch between Dunkirk and Belgium (Lepetit *et al.*, 1980; Corbeau, 1991). Some of the heavy military defence works erected on the dune tops by the Germans in 1939-45 are now found on the beach, at 25 or 30 m from the foot of the eroded dune.

Throughout history, the coastal area is heavily affected by storms. On February 1st, 1953, a violent storm broke the dike of a drainage canal. At high tide, sea water entered the canal and flooded large residential districts of Dunkirk. In 1973/74, 1983 and 1987, the beaches and seawalls were damaged by severe storms. At several occasions, the seawalls were repaired at great costs.

During the violent nocturnal storms of February 27th and 28th, 1990, the whole seashore between Dunkirk and the Belgian border suffered damages of a magnitude unknown so far. The NNW winds had generated frontal waves which lowered the

backshore sand level by more than 3 m at several locations, thus altering the beach profile. Dikes collapsed and several dunes were undermined by the sea over a width of 30 m. Twenty million French francs were necessary to undertake the urgently needed protection works and the subsequent repairs.

The damage caused by the sea to the shores to the east of Dunkirk has never been a serious threat to the inhabited areas until so far. However, the beaches are strongly affected: at high tide, there is hardly any space left for the tourist. For this reason, the French local authorities have been searching for solutions since 1974.

### **Belgian territory**

The Belgian part of the study principally aims at defining coastal protection works at the nature reserve between the French border and the outskirts of De Panne, and at De Panne (a seaside resort of 10,000 inhabitants) itself. It is however necessary to widen the study area to the east, and to include the coastal resort of Koksijde (15,500 inhabitants) so as to evaluate the mutual impact of planned coastal protection works.

Regression of the coastline west of De Panne was illustrated in 1997/05 by the fact that, during the removal of the Atlantik Wall (a military defence line built at the foredune during the second World War) several parts were found some 30 to 40 metres seaward of the 1970/75 dunefoot.

The Koksijde beach has also been suffering continuing erosion. The first seawalls were erected here in 1949 and 1951 over a total length of 188 m. After the extremely severe 1953 storm, the seawalls were extended with another 924 m between 1953 and 1957. Further extensions with 189 m of seawalls were added in 1966.

During the 1976 storm the sea breached the first dune ridge west of De Panne in four places and entered the nature reserve. Shortly after this breaching a dune foot protection was constructed, running over 1295 m all the way to the French-Belgian border. This dune foot protection was destroyed in the January 1978 storm. It was rebuilt in 1978-1979 following a firmer design and extended to a length of 2095 m. The early 1990 storms once again caused heavy damage to the dune foot protection: through a 10 m wide gap the waves could reach and erode the dunes, and immediately to the east of the dune foot protection wall a dune foot regression of 10 m occurred. As a consequence, the dune foot protection once again had to be extended further eastward so that its present total length is 2370 m.

During the recent early 1990 storms the beaches between the French border and the seaside resort of Koksijde suffered a heavy loss of approximately 270,000 m<sup>3</sup> of sand. However, as no important storms have occurred since, the beaches have been able to recover more or less, and the remaining loss is now in the order of 50,000 m<sup>3</sup> of sand.

The Koksijde beach has to be renourished annually in order to allow exploitation for tourism; since 1982, a total of approximately 138,000 m<sup>3</sup> of sand has had to be supplied.

From this short overview it is clear that continuous efforts are needed to maintain the western stretch of the Belgian coastline. It is also clear that solutions for the coastline between Dunkirk and Koksijde can only endure if the solutions adopted at both sides of the border are adjusted to each other.

### **Solutions used so far**

#### **French territory**

In the 1970s it was decided to build six breakwaters in front of Malo-les-Bains. Two of these submerged breakwaters were built in 1978. At the same time 250,000 m<sup>3</sup> of sand was added to the beach through nourishment. The third breakwater was constructed in 1988, accompanied by a beach nourishment of 165,000 m<sup>3</sup> of sand. Although the breakwaters appear to be effective for protection, they resulted in an increase of erosion at the lee-side (east). The three breakwaters planned in addition to the ones already existing have therefore not been built.

Following the storms of 27 and 28 February 1990, the "soft" solution of mechanic beach scraping has been adopted for the stretch of coast from the easternmost French breakwater to the Belgian border. During these storms, the backshore was lowered by 0.8 m near Dunkirk to 3.5 m near the Belgian border. Beach scraping resulted in the redistribution of sand on the beach: sand was replaced from a 50 m wide strip at the low waterline to a similar strip near the high waterline. In the absence of storms since early 1990, the beaches have almost attained their original profile.

#### **Belgian territory**

For an overview of coastal protection works on the Belgian coast, see De Moor and Blomme, 1988. On the particular stretch of coastline east of the French border, the main protection works included :

- the construction of a seawall at Koksijde, from 1949 to 1966, with a total length of approximately 1,300 m. In 1966 and 1977 additional toe protections were provided;
- the reprofiling of the top of the beach at Koksijde in 1977 and 1979 over a length of 835 m immediately west of the seawall;
- the construction of a dune toe protection starting from the French border over a length of 2370 m in 1976, 1978, 1979 and 1992;
- the construction of six groynes on Koksijde beach in 1956. In the same area four additional groynes were built in 1969. In 1986-88 the length of two of these groynes was increased from 120 to 400 m;
- beach scraping combined with the supply of 138,000 m<sup>3</sup> of sand at Koksijde beach over the last 10 years;
- the placing of osier hedges above the high-water mark to trap wind blown sand. They have proved to be very effective.

It is noteworthy that no seawall or dune foot protection has been built over a coastlength of approximately 2.5 km at De Panne. The beach in this area is very wide (350 m to the low-water mark) and has provided adequate protection until now.

## Description of the Interreg project

The Interreg project defines morphological studies and evaluations in the French as well as the Belgian border area. Both countries are responsible for the studies in their own territories.

The French and Belgian studies will receive a 50% funding from the European Community. In France the remaining part is financed jointly by the national government and the by the local authorities through the "Communauté Urbaine de Dunkerque" (CUD) and SILE. The Belgian study is financially backed by the Ministry of the Flemish Community.

### French study programme

The French study, with an estimated cost of 7,000,000 French francs, started in september 1991 and will last for 4 years. It will cover the coastal stretch between Dunkirk and the Belgian border and will include the dune, beach and shallow shoreface areas (to a water depth of -15 to -20 m).

The study consists of four main phases:

- Phase 1 (1991-92) includes the collection, representation and analysis of already existing data (information on morphology, hydro-meteorology, sedimentology), as well as the establishment of a numerical wave refraction model and of a sediment budget for the Dunkirk coast;
- Phase 2 (1992-1994) involves field surveys relating to the waves and currents situation, sediment, coastal retreat, fore- and backshore morphology;
- Phase 3 (1994) consists of an integrated mathematical model study, following the analysis, synthesis and evaluation of the existing and measured data;
- Phase 4 (1994-95) will include, if this is deemed necessary after Phase 3, a physical model study of selected areas of 2 to 3 km wide. The simulations will allow to refine the design of the works and to examine local impacts.

### Belgian study programme

In 1987 a study was commissioned by the Belgian authorities to define adequate measures to fight erosion at Koksijde beach. This study led to the following proposal (Verslype et al., 1990): (1) to dredge the northern flank of a tidal channel situated close to the shore and deviate the strong flood currents responsible for the offshore erosion; (2) to re-use the dredged sand for a beach nourishment at Koksijde; (3) to lengthen existing groynes.

The results of this particular study will of course have to be taken into account in the more integrated study executed in the framework of the EC Interreg project.

Since 1983, a detailed monitoring programme of the beach and dune evolution of the westernmost coast has been commissioned by the Belgian authorities (De Wolf *et al.*, this volume). The monitoring programme includes:

- a twice yearly photogrammetric survey of foreshore, backshore and dune foot area;
- an airborne remote sensing based survey of dune topography and vegetation every three years;

- since 1986, a yearly hovercraft-based bathymetric survey of nearshore and adjoining sea floor, carried out using the BEASAC® (Belfotop Eurosense Acoustic Sounding Air Cushion) platform.

The programme further includes offshore hydro-meteorological measurements from a number of measuring piles and wavebuoys; moreover, since several years a great number of current measurements have been performed along the Belgian coast.

A lot of information is thus already available at the start of the Interreg study. The cost of the Belgian part of the study is estimated at approximately 9 million Belgian francs. The study will consist mainly of three parts:

- coordination between the Belgian and French studies;
- cooperation with the French studies and exchange of relevant measurement data;
- design of coastal protection works at De Panne and the nature reserve west of De Panne.

### **The problems of geodetic and altimetric reference systems**

It is obviously very important that the bathymetric soundings and the topographic surveys planned in the Belgian and French studies can be compared; actually the Belgian and French geodetic and altimetric reference systems are totally different.

A preliminary matching has been performed during the first months of 1992 by a team of Belgian and French specialists. By convenience, it has been decided to choose an international projection system, i.e. the UTM system (Universal Transverse Mercator).

For altimetry, a direct high-precision levelling has been performed between Belgian and French benchmarks. This allowed to determine exactly the offsets between the different datums, and the Belgian levelling system has been used for the sea bottom levels during the bathymetric soundings.

Among other things, it was necessary to establish an initial sea bottom map from De Panne to Dunkirk. This task has been performed by the BEASAC® platform, which is currently used to survey the Belgian nearshore.

### **Conclusion**

The Interreg initiative of the European Community has provided a powerful impulse in bringing together the coastal regions situated at both sides of the French-Belgian border to coordinate efforts in their fight against the sea. The studies executed by the Belgian and French partners will permit in the short and middle long run to define an efficient strategy for coastal protection in the border region. In the long run these studies will be the basis for an ongoing cooperation under the form of a permanent exchange of information and scientific data, and of the coordination of future works and investigations.

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