Implementation of the integrated Master Plan for Coastal Safety in Flanders [1]

The Flemish coast is intensively used by many actors. A safety test of the coastal defences showed that about one third of the coastline together with parts of the harbours are not sufficiently protected against severe storm events, being minimally for a 1000-year event under current conditions and when taking into account a sea level rise of 30 cm in 2050. In 2007, the Flemish Government started the elaboration of an Integrated Master Plan for Coastal Safety that was eventually approved by the Flemish Government in June 2011.

Case Study Description

**Challenges:**

Flemish coastline is 67 km long and consists mostly of sandy beaches. The coastline is intensively used including ten coastal towns and cities, protected with a sea wall. Among these, Zeebrugge and Oostende hosts important commercial ports with connected industrial areas. The same cities, together with Nieuwpoort and Blankenberge, are also the location of important recreational marinas. Besides human activities, Flemish coast also includes valuable natural areas, such as the tidal inlet at the border with the Netherlands, called the Zwin. Moreover, low-lying polders in the hinterland form a 15 km wide flood prone area where about 400,000 people live.

A study conducted by the Coastal Division (part of the Agency for Maritime Services and Coast – Flemish Government) identified vulnerable points in the coastal defence and showed that about one third of Flemish coastline is not sufficiently protected against severe storm events (i.e. those with a probability of 0.1% per year). Sea level rise and other climate change related effects (such as change in storm and precipitation intensity and frequency) can exacerbate this vulnerability.

**Objectives:**

Improve defences of the Flemish coastline to the level of protection against extreme storm events at 1:1000 years return period, including under a +30 cm sea level rise by 2050, together with a sustainable management.

Include societal participation and involvement of stakeholders to find balances in environmental, economic, social, cultural and recreational objectives within the boundaries of the natural dynamics of the coast.

**Solutions:**

In March 2007 the Coastal Division initiated an Integrated Master Plan for Coastal Safety (*Masterplan Kustveiligheid*) to protect Flanders against extreme flooding events in the present and in the future (2050). Extreme flooding events were defined as those associated with storms with a 1:1000 years return period. The Master Plan aims to ensure the same level of protection under current conditions and in the case of a +30 cm sea level rise by 2050.
Before the Master Plan was finalised, an emergency plan for the execution of most critical works was in place between 2004-2010. This made it possible to resolve most pressing problems and cover short-term risks that were mapped by a study that was part of the Master Plan elaboration. In particular, implemented emergency measures have provided protection against storms with 1:100 years return period as a minimum along the entire coastline.

The Flemish government approved the Master Plan for Coastal Safety on the 10th of June 2011, after it was approved by the ten Flemish coastal cities and coastal communities. The Master Plan includes both soft and hard measures. Soft measures consist of beach and dune nourishment. The permit granted by the Federal Government enables to extract about 20 million cubic meters of sand – taken from the Belgian part of the North Sea – over a period of 10 years, thus fully supporting beach and dune nourishment. Beaches and dunes are monitored every year to adapt their management accordingly. Beach nourishment is managed using a 5-year plan in order to respond to still occurring erosion and cope with future sea level rise; the volumes needed for maintenance are estimated around 500,000 cubic meters per year.

The Master Plan also foresees the construction of storm walls to protect coastal cities and harbours (hard measures). An optimal design of these hard protection measures has been designed to minimise their height and optimise their spatial integration. For the harbour of Nieuwpoort, the construction of a storm surge barrier at the harbour entrance was also considered.

www.kustveiligheid.be [2]) provides information on specific measures planned in each coastal community as well as the relative work progress. At end 2013, planned beach nourishments have been completed in the following focus areas: De Panne, Koksijde – St.Idesbald, De Haan - Wenduine, Ostend centre; emergency beach nourishments have been executed in Knokke-Heist. The beach nourishments between Ostend-centre and Ostend – Raversijde is in progress.

The city of Ostend represents one example of coastal city at risk. The city is protected by a sea wall that was built 140 years ago. Over the years, the sea wall accelerated the erosion of the beach in front of that same wall. In 2004, an emergency beach nourishment was undertaken, increasing the level of protection up to the level of a storm with a return period of 1:100 years. On-going and planned works will ensure Ostend protection to standards defined by the Master Plan. These measures include the creation of a larger beach. In the central area of the city this beach will be stabilised by a new harbour dam which was built perpendicular to the coastline at the north eastern side of the new beach. It is expected that the new harbour dam will reduce the requirement for maintenance of beach nourishment to once every five to ten years. Coastal protection of Ostend has been combined with the harbour improvement plan and additional projects, including renovation of the sea promenade and an underground parking.

**Importance and relevance of the adaptation:**
Case developed and implemented and partially funded as a CCA measure.

**Additional Details**

**Stakeholder engagement:**
www.kustveiligheid.be [2]), that provides information on specific measures planned in each coastal community as well as the relative work progress.

**Success and limiting factors:**
The Master Plan clearly identifies most critical areas of the coastal system, enabling optimisation of the use of resources and focusing on real priorities. Other success factors are:

- Adoption of an integrated approach, based on the integration between soft (beach and dune nourishment) and hard (storm return walls, broadening of seawalls with stilling wave basin, storm surge barrier) protection measures;
- As part of the integrated approach, a combination of protection measures with local requalification interventions, such as in the case of the city of Ostend, where coastal protection was integrated with the
harbour improvement, the renovation of the seaside promenade and the construction of underground parking;

- Adoption of a dual temporal vision, including both the short term view that aimed to improve the protection of currently critical areas and a long-term view (2050) aimed at providing the desired level of protection even in the future.
- Wide stakeholder participation, during both the design and implementation phases of the Master Plan.

The coastal protection Master Plan is rather ambitious and therefore requires continuous engagement and technical-financial support. This is required in the future so as not to limit the full implementation of identified measures. Particular attentions is also intended to be given to monitoring and assessment of potential ecological effects of planned interventions, including beach nourishment in particular.

**Budget, funding and additional benefits:**
The total investment cost by the Flemish Government of the Master Plan for Coastal Safety is about 300 million euros. This estimation does not include costs related to the architectural development of hard protection measures aiming to preserve or even improve the local architectural and recreational values. This costs are covered by coastal municipalities. Maintenance costs of the new beaches (i.e. conservation of safety conditions after beach and dune nourishment) is around 8 million euros per year.

Principal benefits are related to the main Master Plan goal, i.e. to protect coastal communities against storm events with a yearly probability of 0.1%, under current condition and the case of sea level rise (up to 30 cm by 2050). Coastal protection implies the maintenance of coastal human actives, including in particular: residential use of the coastal space, tourism, harbour and industrial activities. Wider beaches and the design of sea walls that optimises their integration in the existing coastal space will likely generate benefits in terms of tourism.

**Legal aspects:**

**Implementation time:**
Works implementation started in 2011 and should continue until 2015.

Reference Information
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**Websites:**

**Sources:**
Kustveiligheid (Coastal Safety) website and Masterplan Kustveiligheid (Master Plan for Coastal Safety).

**Source URL:** https://www.adaptecca.es/en/implementation-integrated-master-plan-coastal-safety-flanders

**Links**
[3] mailto:john.pauwels@mow.vlaanderen.be