Interreg
North Sea Region
FAIR
European Regional Development Fund

EUROPEAN UNION

Pilot renewing sea dike Middelkerke

A Practice Brief from the Interreg North Sea Region FAIR project

June 2020

Preface

The FAIR project

FAIR brings together flood protection asset owners, operating authorities and researchers from across the North Sea Region (NSR) to share the policy, practice and emerging science of asset management. Despite the diverse character of the NSR, asset managers face common challenges across the region.

The FAIR project aims to develop and implement improved approaches for asset management of flood protection infrastructure. It will optimise investment planning by exploring mainstreaming of these investments with other policy domains, and by mapping planned investments across a wide portfolio of flood protection assets. FAIR will also identify cost-optimal adaptive infrastructure upgrades by exploring a variety of technical designs, with adaptability and life cycle costing for various performance levels.

This Practice Brief

FAIR supports the delivery of local upgrade or maintenance projects and schemes for flood protection assets or systems. This Practice Brief presents **why** the project or scheme has been proposed. It provides an overview of the key challenges and intended outcomes. It elaborates on **how** these challenges have been addressed, and presents **what** has been the outcome from implementing this approach. Finally, the Practice Brief reflects on the innovation of the pilot with respect to the best practices in the FAIR end report and the FAIR recommendations.

The FAIR results

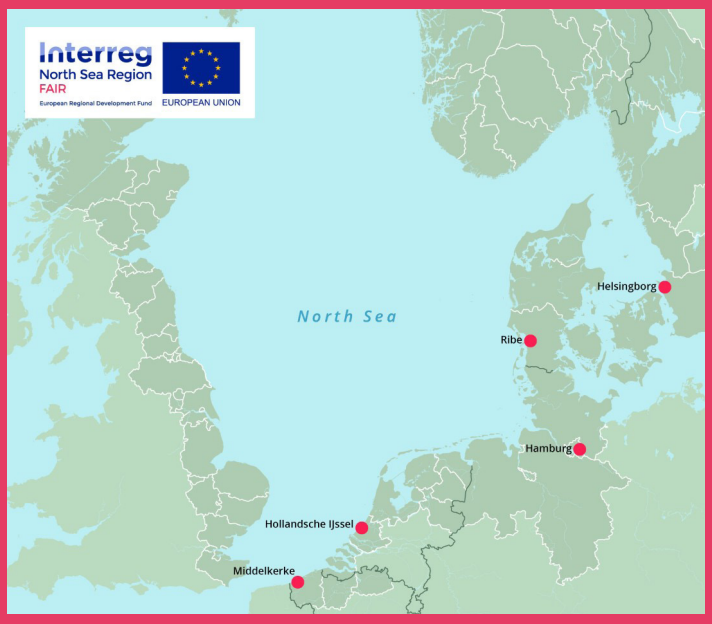
The demonstration and subsequent widespread implementation of the improved approaches and techniques will reduce the probability of flooding and minimise the impact of floods across the North Sea Region. This will improve the climate resilience at target sites covering most of the NSR. 'Target sites' are those areas being protected by entire flood protection systems (e.g. Danish coast, Swedish Coast, Flemish Coast, Dutch Delta) and individual assets (e.g. Hollandse IJssel storm barrier, Hamburg flood gates, etc).

The result indicators for the FAIR project are:

1. Reduce the life cycle costs of flood protection infrastructure through better targeting of investment;

2. Encourage the multi functionality of flood protection infrastructure through mainstreaming (that is, connecting) investments with other policy objectives;

3. Increase the life span of flood protection infrastructure through smarter maintenance and renovation.



Summary

Flood risk calculations of the Coastal Safety Master Plan show that there are major risks for victims and damage caused by flooding from the sea in Middelkerke. Tackling these risks is therefore a priority. This weak zone extends from Westende, part of Middelkerke, to Middelkerke.

The option that was chosen to reinforce this weak zone consists of widening the current sea dike with a stilling wave basin (SWB) and providing dunes and beach nourishments in front of the existing sea dike. It concerns two sub-zones of Middelkerke: Westende-Bad and Middelkerke-Bad. The project area is approximately 4 km long. At the Middelkerke-Bad casino, the necessary safety is obtained by providing a water barrier seaward from the casino. This must connect to the development of the sea wall on both sides of the casino. The usage of dunes and beach nourishments is very adaptive (the beach or the dunes can be heightened) to accommodate the expected sea level rise and the resulting uncertainties. The project is innovative; a stilling wave basin is very efficient in reducing the wave energy and this project will act as the first use of it on a large scale. The dune before dike principle hasn't been tested before and will be a pilot project. The chosen measures are adaptive. In case of a sea level rise, the beach in front of the new sea dike can be strengthened or the dune itself can be heightened. The new dike and dune can facilitate different functions: recreation, nature, economic and so forth.

Figure 1: new sea dike Middelkerke, courtesy: Afdeling Kust

The Context

The renewal of the sea dike is a unique opportunity for the municipality of Middelkerke to put Westende back on the map as a tourist resort. The attraction of the two areas is closely related to the way the forces of nature, wind, sun and sea have, over time, dramatically evolved the landscape, especially the dunes..

The experience of these forces of nature has changed dramatically over time. Every new phase in the development of the coastal towns brought new elements into the coastal landscape. This project offers the opportunity to recreate the individuality of the coast with a structured design for the sea dike.

The original design of the first sea dike from the Interbellum was built on top of the existing dunes and focused strongly on the effects of seawater on the landscape. The adjacent buildings were only three to four storeys high so that the promenade on the sea front was not overshadowed by the buildings. Because the dike was much higher than the beach, a panoramic view on the horizon was created. During storm tides, the sea crashed against the sea dike, an attraction in itself. Sporadic dune formation for the sea dike was left undisturbed. The benches were placed parallel to the sea dike and there were no railings present.

From the 1970s, the sea dike was renewed and the unit gradually disappeared in materialisation and detailing, through the addition of windshields, covered terrace extensions and railings. At the same time, the adjacent buildings were raised to 9 storeys and became sand replenishments for coastal safety reasons; as a result of this the tide line was further away from the sea dike. Because of these changes, the attractiveness of the natural features of the landscape has declined. The current sea dike is outdated and the local government are strongly in favour of a new, more attractive sea dike.

This project is part of the Coastal Safety Master Plan to protect the Flemish coast against flood from the sea (return period of 1000 years). The project aims to incorporate as much varied residential, economic, tourism and recreational benefits as possible. The Flemish government also provides funding for the project, but only the basic solution, the extra costs for the architectural upgrade have to be funded by the local government whom, along with key stakeholders, have been involved from the beginning.

Why: The purpose

The key challenges

The Flemish government only finances basic flood protection but realises that a mono functional design will not meet the wishes of the stakeholders. The challenge is how to make stakeholders (local governments) into shareholders. Stakeholders are not the problem, but part of the solution. The design of the project together with the financing was and remains a big challenge. Each party has different views and interests and they do not necessarily align, also much of the design was also unprecedented due the usage of dunes and stilling wave basins.

The original assignment was to develop a wave-damping extension on the sea front at Middelkerke and Westende to fulfill the need for a new protection against flood from the sea, due to predicted climate change until 2050. The challenge was to turn this important investment into an opportunity and to give both Middelkerke and Westende a unique meaning.

Also the natural environment was important to attract tourism and all groups including residents who use the area to meet and relax on a daily basis.

The biggest challenge was to offer a solution which was deliverable within the available budget. A hard structure installation was too expensive and therefore the innovative and more cost effective dune solution was proposed.

A second challenge was how this investment can look beyond 2050, taking into account future trends and changes, where climate change will certainly require additional measures. Both the dune and the stilling wave basin are very efficient and adaptable towards a future sea level rise.

The intended effects

The main ambition behind this project is to re-introduce nature as a dynamic coastal defence system and to bring back the contact between nature and the sea. Hard structures require large investments and seem, because of unpredictable climate change and sea level rise, to have an expiration date. Creating more environmentaly friendly, instead of hard, infrastructure is an innovative way to develop new coastal defences. With this project we demonstrate that natural structures, which are cheaper and easier to construct, are a more sustainable solution and moreover have a greater experience value than hard infrastructures. A more flexible and cheaper structure requires more management, however, this management provides some employment. The further follow-up of the project through regular monitoring and data collection/analysis can also be the perfect opportunity for scientific learning. So this represents an opportunity to develop an innovative and a cross-border model that supports the belief in the concept of a green sea dike.

How: The approach

The Coastal Safety Master Plan includes various innovative and adaptable solutions to protect Middelkerke and Westende against flooding from the sea.

The Flemish government tries to include local cities and communities as much as possible but can only offer a basic solution. Local governments can participate in the different projects with extra funding to include architectural upgrades or even different solutions, which can be beneficial for their specific locations but have to finance these extra costs.

This incorporates certain risks. The local government does not always have the necessary funding and due to a change in the management of the cities and communities, visions and decisions can change. By including them they will become a shareholder and can actively try to build support for the project. During the design phase there is intensive cooperation and consultation with local inhabitants and local businesses as well as relevant governments agencies, through meetings and the sharing of information and opinions.

Figure 2: new dune in front of the sea dike, courtesy: Afdeling Kust

What: The outcomes

The standard solution was to secure the municipality of Middelkerke by means of a large beach nourishment which would be financed entirely by the Flemish government. Another possibility was to expand the existing sea dike and to provide a larger beach in front of this sea dike. This (much more expensive) solution was preferred by the municipality who were also willing to co-finance the project. As a result, the municipality was immediately involved and there was sufficient support for this project.

The result is an innovative and adaptive design that lends its own character to both Middelkerke and Westende, is very flexible and can easily be adapted to cope with the sea level rise. The design also takes into account the different environmental, economic, tourism and recreational needs of the locations. Due to the use of the dune-for-dike principle, whereby instead of a hard dike a natural solution is used, less investment is required, which increases maintenance costs but is more cost-efficient in the long term. The increase in maintenance costs is caused by the dunes tendency to grow requiring periodical maintenance to prevent build up which will obstruct the view from the sea dike towards the sea.

The implementation of the project was delayed due to a change in the management of the municipality and a shift in the proposed projects, a risk that was difficult to estimate in advance.

In the project great importance was attached to consultation with all relevant partners. The construction of the sea dike is an important investment from which all parties need to benefit. Focus interviews, workshops and information updates were used to understand what local communities, businesses and other interest groups saw as important factors in relation to the project. Clients and key stakeholders are involved in an umbrella working group that closely monitors the project. The steering committee records and evaluates interest group opinions before a thoughtful transition can be made through the various steps in the design process.

Reflection on innovation

The dune-for-dike principle is innovative. It is the first time that a hard structure will be replaced by a dune over such a large distance. This solution is not only cost effective, but also uses natural principles. This solution is adaptive, when the sea level rises, the dune and the beach in front can easily be raised to meet safety standards. The dune area itself can become a natural attraction and support tourism as well as the local environment.

The use of a stilling wave basin on such a scale is also innovative. This structure provides a very efficient damping of the attacking waves during a storm. Because of this, a less high beach needs to be installed for the sea dike.

Contact

Project leader

Remco Schrijver and Bart Vonk, Project Leader - **bart.vonk@rws.nl**

Pilot leads

Niels Vanmassenhove – **niels.vanmassenhove@mow.vlaanderen.be**

Further reading

The documents relating to the FAIR project can be found on the following websites:

http://www.fairproject.org/

https://northsearegion.eu/fair/

Partners

FAIR brings together Asset Owners (facing real problems and challenges) and leading scientists (with domain expertise) to share and develop innovative solutions to the management of flood protection assets. In doing so, FAIR is the first collaboration of its kind.