

## Nourishment efficiency along the Belgian coast

Bart Roest and Pieter Rauwoens

Hydraulics and Geotechnics, Department of Civil Engineering, KU Leuven, Spoorwegstraat 12, 8200 Bruges, Belgium

E-mail: [bart.roest@kuleuven.be](mailto:bart.roest@kuleuven.be)

### 1. INTRODUCTION

The Belgian sandy coast is a complex and dynamic environment. Several locations suffer from structural or storm-induced erosion, while other locations structurally gain sediment. Coastal management policies are in place to maintain the coastline and keep floodrisk at acceptable levels. Currently the coastline is maintained by sand nourishments, adopting the “soft where possible, hard where needed” philosophy from the Masterplan Coastal Safety (MDK, 2011). Nourishments are mostly applied on the beach and dune foot. Only a few shoreface nourishments were installed along the Belgian coast. Noteworthy is the ‘profile’ nourishment between Bredene and De Haan, where the whole coastal profile was extended seaward.

As sand nourishments form the core of coastal maintenance in Belgium, their performance or efficiency should be taken into consideration. Verhagen (1996) concluded that independent of nourishment schemes, an increased erosion rate is observed in the first 1-2 years after construction. The decay could be calculated with a combined exponential and linear function. The question is whether it also holds for the Belgian macro-tidal environment.

### 2. METHODS

Timeseries of coastal volume changes are available for the Belgian coast since the 1980’s. Volumes are reported per coastal section and per ‘layer’ with fixed boundaries (Figure 1). Thus the volumetric development of the dunefoot, beach, shoreface and sea bed can be tracked independently. Furthermore, nourishment and dredging volumes are reported per coastal stretch, administrative units of coast approximately 1.2 km alongshore. These volumes are assumed to be uniformly distributed. Depending on the project type these numbers are assigned to a layer. E.g. shoreface nourishment to the shoreface layer.

The lifetime of a nourishment project is defined as the (extrapolated) time taken to return to the pre-nourishment volume. Coastal safety may however require renourishment before depletion. Given the (bi-)annual monitoring frequency, only larger nourishments (>100 m<sup>3</sup>/m) are taken into consideration.

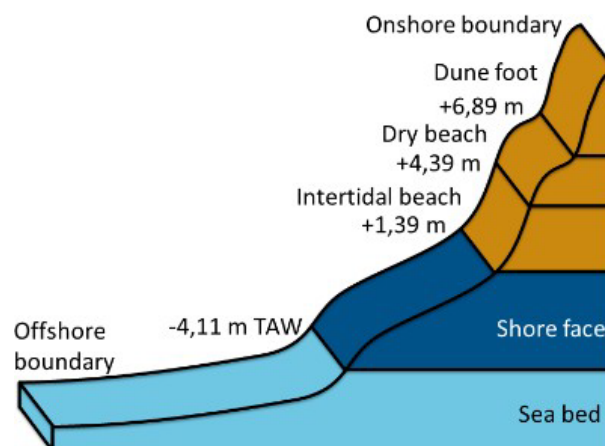


Figure 1: Layers defined for coastal volumes, separated at fixed height. Levels with respect to TAW (Belgian ordnance level), roughly Lowest Astronomical Tide (LAT).

### 3. RESULTS

Middelkerke's recreational beach was replenished by a large-scale beach nourishment (about 300 m<sup>3</sup>/m) in 2015 for coastal safety purposes. This nourishment shows the classical behaviour of intensified initial erosion in the first two years after construction as described by Verhagen (1996). The background erosion rate from the beach is 15 m<sup>3</sup>/m/year, similar as before (Figure 2, left). Previously small-scale recreation oriented nourishments were performed annually. As the beach is backed by a sea dike, there is hardly any accommodation space for wind-blown sediments and only a limited storm buffer can be created.

The large nourishment scheme between Bredene and De Haan in the 1990's has effectively extended the coastal profile seaward. After the nourishment and placement of sand fences in the dunes the beach volume has remained stable. This renders a life time of several decades, making it an enduring project with losses less than 5 m<sup>3</sup>/m/year. Most likely due to accommodation space in the dunes. Two additional 50 m<sup>3</sup>/m maintenance nourishments in 2014 and 2017 do however show more rapid decay (Figure 2, right). Both the nourished beach profile and sufficient accommodation space for wind-blown sediments appear to influence the life-time of nourishment at the Belgian coast.

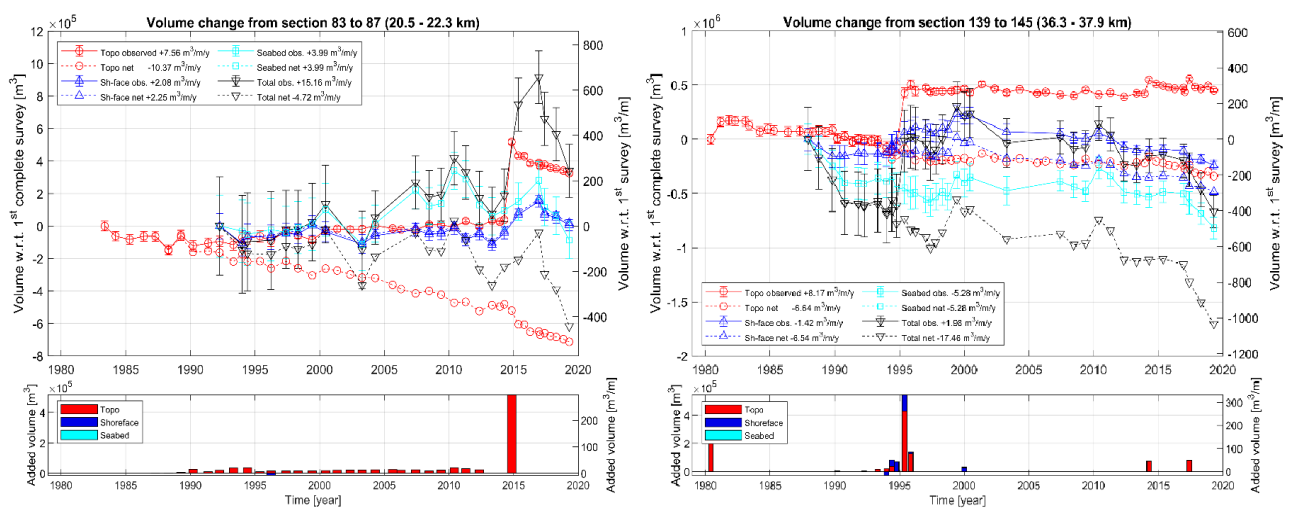


Figure 2: Left: effect of beach nourishment in Middelkerke. The large replenishment in 2015 has increased the beach volume >300 m<sup>3</sup>/m, while background erosion had remained similar (red lines).

Right: effect of beach nourishment near De Haan. The profile nourishment of 1994-1996 has increased the beach volume >400 m<sup>3</sup>/m, after which the beach remained stable (red lines).

### 4. ACKNOWLEDGEMENTS

Flanders Coastal Division is greatly acknowledged for providing coastal volume and nourishment data. Thanks to Rik Houthuys, nourishment and dredging data of the coastal zone are now attributed to coastal stretches.

### 5. REFERENCES

- Houthuys, R. and Roest, B. 2019. (2019). Belgian coastal volumes per coastal stretch (1979-2019). Dataset. VLIZ Marine Data Archive.
- Maritieme Dienstverlening en Kust (MDK). 2011. Masterplan Kustveiligheid.
- Verhagen, H.J. 1996. Analysis of beach nourishment schemes. Journal of Coastal Research, 12(1), 179-185. Fort Lauderdale (Florida).