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Photography: Rijkswaterstaat (Leo Linnartz, Carrie de Wilde, Jurriaan Brobbel, Joop van Houdt), Deltares

For more information:

www.rws.nl/zandmotor
www.ecoshape.nl
www.dezandmotor.nl
www.naturecoast.nl
www.nemo.citg.tudelft.nl

The Sand Motor

Looking back at 2½ years of building with nature





In 2011, the coastline to the south of The Hague acquired a hook-shaped peninsula made of sand: the Sand Motor. Wind, waves and currents are spreading the sand from the Sand Motor gradually along the coast in both directions, preserving the coastline, and creating new nature and a dynamic recreational area. This is Building with Nature. Since the Sand Motor was established, there has been extensive research into how this innovation is working.

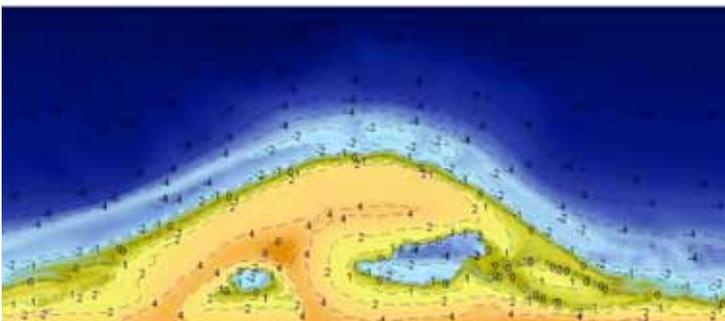
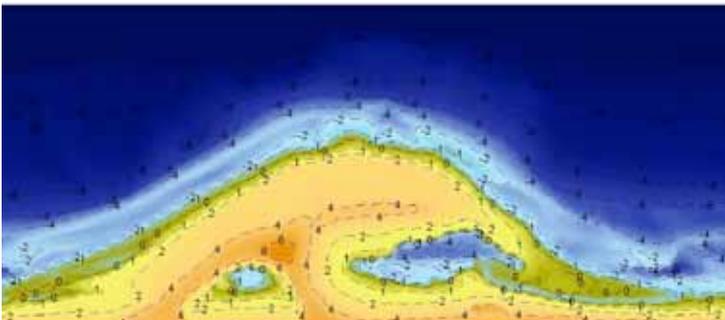
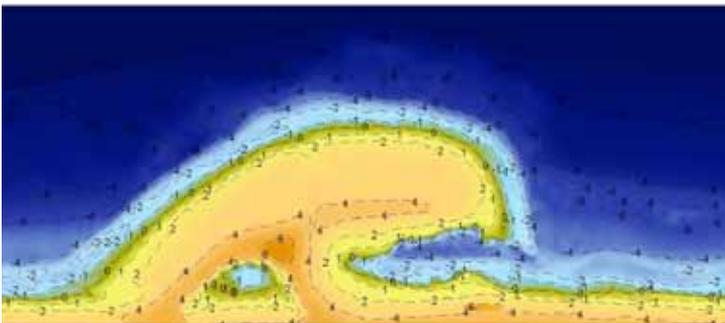
Dozens of researchers from a range of universities and research institutes have been monitoring every detail of the Sand Motor's Development. The first firm conclusions about progress will be possible in 2016 and 2021. Initial observations indicate that positive results are being

achieved in the areas of coastal defence, knowledge development, nature and recreation. This knowledge can be applied to new Sand Motors in The Netherlands and abroad. This brochure sets out the main conclusions from the interim policy evaluation for the Sand Motor Pilot Project.

Natural coastal maintenance

Wind and currents started to change the Sand Motor as soon as it was created. The alterations in its shape have largely matched expectations so far. The Sand Motor has been eroded on the western side, with the sand being deposited

to the north and south. As a whole, it has become narrower and longer. The northern side is most changeable: the shapes of the lagoon, channels and sandbanks are constantly altering.



Sand movement

Sand movement transformed the appearance of the Sand Motor between August 2011 and February 2014.

- The Sand Motor consists of 21,5 million m³ of sand.
- Relative to the situation immediately after construction, a total of 2.5 million m³ of sand has been moved.
- Most of that sand, 1.14 million m³, was transported northward.
- A smaller proportion, approximately 680,000 m³, has been deposited to the south of the original peninsula.
- 740,000 m³ of sand was moved outside the monitoring area: into deeper water, to places further along the coast, and to the dunes.
- Relatively large amounts of sand were moved in the early days of the Sand Motor. The Sand Motor still had its artificial shape at that time. This artificial shape resulted in faster sand movement.
- Storms accelerate sand movement. In the first winter of the Sand Motor's existence (2011-2012), there were several storms, and large amounts of sand were also moved during the storm in early December of 2013.

(Data from Shore Monitoring)

From top to bottom: Sand Motor depth sounding in August 2011, February 2012, February 2013 and December 2013

Flood protection

The first analyses of coastal defence (flood protection) will be completed in 2016. The researchers involved are already concluding that coastal defences have improved near the Sand Motor in the short and medium terms. The Sand Motor is developing in accordance with preliminary model results. Changes in shape and sand movements are being measured with equipment that includes the 40-meter-high Argus Mast on the Sand Motor, a radar station (for currents), jet-skis (for bed surveys) and a plane (for altitude).



The Argus Mast



The radar station in Kijkduin

Knowledge development and innovation

The Sand Motor is a pilot project that involves knowledge development. The question is whether the Sand Motor is an effective natural way of preserving the coast and whether it generates added value for recreation and nature. Knowledge development in these areas is proceeding apace.

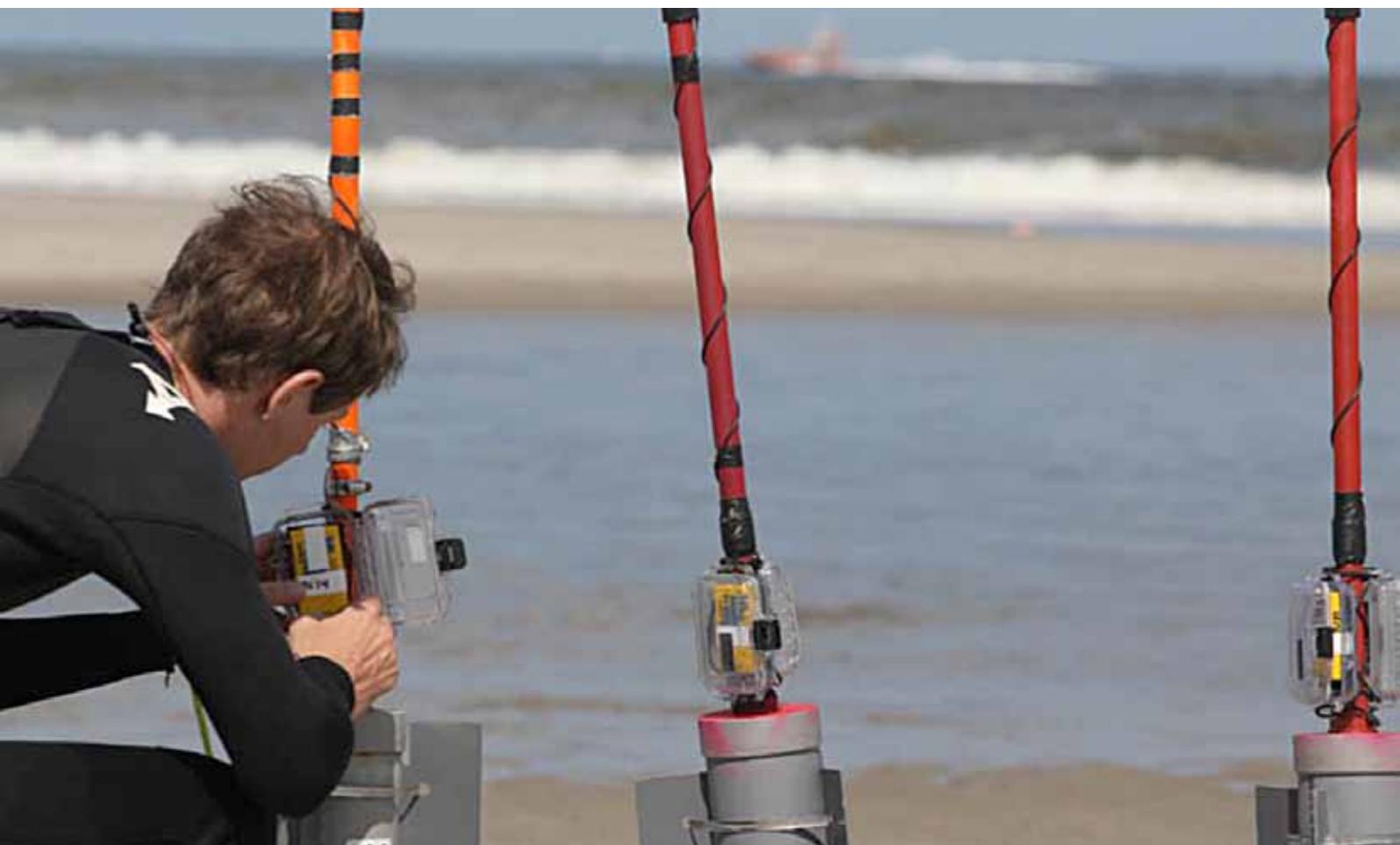
Rijkswaterstaat, Ecoshape and a range of universities and research institutes are hard at work collecting and analysing data. This research is crucial for the development of other Sand Motors around the world.

There are two scientific research programmes: NatureCoast is entirely devoted to the Sand Motor; NEMO includes activities that cover the Sand Motor. The research addresses several areas, including morphology, hydrology, ecology, administrative issues and recreational use. The monitoring activities cover the dunes, the Sand Motor itself, and the surrounding area. The STW research programme NatureCoast has already resulted in a range of

presentations and publications. A total of twelve doctorate students, three post-doctorate researchers and four graduates are involved. There will be more publications in the years to come.

Safe bathing app

One of the concrete results of the research activities has been the development of an application for emergency services, including the lifeguard service, that improves predictions of dangerous bathing situations caused by currents. The Safety Region was positive in its assessment of the initial trials with the application. Evaluation will continue over the course of 2014.



Preparations for monitoring currents using drifters

An attractive recreational and nature area

The Sand Motor results in a constantly changing coastline and it opens up new opportunities for recreation and nature. On the basis of the initial observations, the researchers involved notice that more habitats have been created for flora and fauna as a result of the arrival of the Sand Motor. The lagoon and the dune lake are home to more sediment-dwelling animals and the number of species has also risen. The same applies to the numbers and species of birds. Seals and a harbour porpoise have also been seen on occasion.

Plant growth and dune development

Immediately after construction, the Sand Motor was still bare. Two years later, visitors have seen pioneer vegetation such as sea rocket, prickly saltwort, and atriplex varieties. Young dunes have also emerged in various locations (Linnartz, 2013).

Recreation

The first study of recreation on the Sand Motor was conducted in 2012 (Provincial Authority of South Holland, 2012). It found that a wider variety of recreational visitors were frequenting the beach between Ter Heijde and Kijkduin. There are now more recreational options on this section of the coast as a result of the presence of the Sand Motor. The four main groups of recreational visitors are bathers, dog-owners, walkers and a new group: kite surfers. In addition, the Sand Motor has proven appealing for a range of outdoor activities such as horse-riding, fishing, running, fossil-hunting and even, in the winter of 2012-2013, snow kiting. In short, the Sand Motor has provided an accessible natural environment that can accommodate a wide range of recreational options.



Cormorants and seagulls rest on a sand bank



Marram and sand couch encourage the emergence of young dunes on the Sand Motor. January 2012.



The Sand Motor is a popular location for kite surfers

Safety on the beach

The Sand Motor is home to tidal flats that are submerged at high tide. Because they are not always familiar with the area and because of the changes in the shape of the Sand Motor, visitors have sometimes been cut off by the water at high tide. There are signs at the entrances to the beach that provide visitors with information about the tides around the Sand Motor and how they can navigate them by following marked trails.

High levels of interest

Since the launch of the project in March 2011, there has been considerable interest from both home and abroad. Both domestic and international media have turned the spotlight on the Sand Motor. Government delegations from abroad visiting the Netherlands to view our hydraulic engineering works regularly take a look at this innovative project. The experience and expertise generated by the project are actively shared.

More information?

The first official evaluation will be completed in 2016. Go to www.sandmotor.nl for a film about the first two and a half years of the Sand Motor's life, aerial photographs and the interim policy evaluation.



Sand Motor at low tide, March 2013



Sand Motor at high tide, March 2013