



For more than 40 years, we have Protected Shorelines, Rebuilt Beaches and Reclaimed Land from the sea

Fighting and controlling the power of water is a daunting task. But more than 40 years ago, we developed a technology that could be used to stop storm damage, protect the environment, build custom structures, and even build islands where they didn't exist before. Geosystem technology is a proven, cost-effective method for a variety of shoreline protection and marine construction projects. Geosystems have been used to produce sand dune cores; wetlands and other habitats; jetties, dikes, and groynes; underwater structures—and to even raise brand new islands from under water.

Developed using input from the U.S. Army Corps of Engineers, Geosystems are cost-effective, durable, easy to install and highly flexible. It has been proven in applications around the world and is installed in more than 50 countries. Better yet, Geosystems have literally saved millions of euro's for companies and individuals.

In the Geosystem technology we have two products:

- TenCate Geotube® systems;
- TenCate Geocontainer® systems.

The TenCate Geotube® system can be applied in shallow water depths or on shore. The TenCate Geocontainer® system is for application in deeper water, water depth between 3 and 15 meters.





A Unique High Strength Fabric

Geosystems, TenCate Geotube[®] and TenCate Geocontainer[®], withstand the test of time—and water—with a unique fabric structure that is tough but flexible.





Case Study

application	Shoreline Protection, Beach Restoration
location	Atlantic City, NJ
product	TenCate Geotube® system

When erosion threatened Atlantic City's famous Boardwalk, millions of dollars of property were at stake. Hurricanes cut away so much of the sand that waves were literally washing over the Boardwalk itself. But with TenCate Geotube® systems installed to stop erosion and allow the sand to build upon itself, there is now more than 45 meter of beach (complete with oat-covered dunes) between the Boardwalk and the water. This project has been in place for over 10 years and is still doing its job.

Sand Dune Cores

Stopping Beach Erosion and Property Damage

TenCate Geotube® systems have proven to be exceptionally valuable for protecting shorelines from erosion, particularly during hurricanes and tropical storms. The process is simple: a large tube made of a specially engineered textile is filled with sand and buried under the beach. When rough weather threatens, the tube holds the sand and soil in place, preventing erosion and property damage.

TenCate Geotube® systems are high strength fabric containers up to hundred meter in length. In most cases, installation is permanent—and invisible. However, when necessary, units can easily be removed.

In fact, one of the advantages of TenCate Geotube® systems is that the gentle original slope of the beach can be recreated. This improves the aesthetics of the shoreline and also aids wildlife by providing a natural-seeming habitat—and blocking lights from shore that can confuse sea turtles and other creatures.



TenCate Geotube® system being filled with sand using a hopper.



Ideal for Individual Homeowners

The simplicity of the process lends itself well to commercial properties and homeowner associations whose members are looking for solutions to erosion problems. In fact, TenCate Geotube® system has been purchased and installed by many homeowners to protect their property and build up shorelines.

A TenCate Geotube® Shoreline Protection system can be installed in a short period of time. It has qualified for installation under emergency permitting allowed for repairing storm damage. Once installed, the TenCate Geotube® system is completely buried and helps contribute to a gently sloping shoreline.

A single TenCate Geotube® system can actually protect several homes. In many cases, homeowners have worked with each other to get the protection they need and reduce their costs. Homeowner associations can help coordinate efforts between members for proper shoreline protection using containment technology.

In many coastal areas, temporary permits are now in place that allow immediate installation of TenCate Geotube® systems to protect homes that are in danger.



TenCate Geotube® system sand dune cross section.



Case Study

application
location
product

Shoreline Protection
Bolivar Peninsula, TX
TenCate Geotube® system

Along the Bolivar Peninsula in Texas, a TenCate Geotube® system project used 5,000 linear meter of TenCate Geotube® systems to protect homes from damage from a series of tropical storms. After tropical storm Allison in 2001, residents reported that not a single dollar of property damage occurred behind the line of defense created by the TenCate Geotube® systems installed along the beach.

The project was so successful that another 4,500 linear meter were installed. Today, more than 30 kilometers of Texas shoreline are protected with TenCate Geotube® systems.





Case Study

application	Wetland Creation, Reclamation Bund For Silt Depot
location	Heeg, the Netherlands
product	TenCate Geotube® system

In Friesland, a province of the Netherlands, they have to dredge the canals very often; Friesland is in the Netherlands well known on its water recreation. To store a quantity of sludge material they had to create a large reclamation bund in the water. For constructing the bund they made use of the TenCate Geotube® system.

After that the TenCate Geotube® system was placed a local dredger could fill the area with local dredged materials. The TenCate Geotube® systems were placed in small curves to give the created land a more natural looking

Wetlands Creation

An Effective, Sound Way to Build Habitats

Because TenCate Geotube® systems are simple, cost-effective and environmentally friendly, they have been used in many areas for rebuilding wetlands habitats for birds and other species.

TenCate Geotube® systems can be installed quickly. They can be used to create kilometers of artificial shoreline if needed, while allowing sand to naturally collect behind them. Units can be covered or left exposed, with proper UV protection and provide erosion protection in all types of weather.

Better yet, birds and other wildlife find the exposed TenCate Geotube® systems ideal places to rest, sun and fish.



TenCate Geotube® system ready to be filled with sand.



Island Creation

Making Land Rise from The Sea

TenCate Geotube® systems have been used for many ambitious projects, but perhaps none as bold as creating entirely new land. TenCate Geotube® systems have been used for island creation because of its ease of installation, ruggedness and cost-effectiveness.

Kilometers of TenCate Geotube® systems can be used to produce durable shorelines that can be filled in behind the units to produce stable land for building. Skyscrapers have been constructed on property reclaimed from the sea by using TenCate Geotube® systems.

TenCate Geotube® systems can be stacked several high to produce the elevation necessary for back filling and land creation. The containers can then be covered with rip rap, sand or other soil to hide them and produce natural looking shorelines.



Case Study

application

**Creation of Island for
Upscale Community**

**location
product**

**Amwaj Island, Bahrain
TenCate Geotube® system**

As part of a \$1 billion project to reclaim land and build an exclusive community with upscale residences, luxury apartments and a marina, the developers of Amwaj Islands selected TenCate Geotube® systems as a way to literally build islands from the sea.

A total of 30 kilometer of 13.7m circumference TenCate Geotube® system were stacked two layers high to create containment dikes and sand was filled in behind them to a height of over three meters above sea level. Work could be completed so quickly that the shoreline for the island was created in five months' time.





Case Study

application
location
product

Core of a Reclamation Dike
Neuharlingersiel, Germany
TenCate Geotube® system

In the northern part of Germany there is the Wadden sea, which is well known of its typical environment. In the city, Neuharlingersiel, the small marina needed to be extended. Therefor the designer has planned a small harbour area in the sea, but it needs to be protected with a surrounding dike.

In the area there are hardly stones available for the construction of the dike, therefore they have chosen to save on the quantity of rock material by construction the core with a TenCate Geotube® system. The only rock that is needed for protection of the TenCate Geotube® system against UV and mechanical damages is approximately 1/3 of the quantity that normally would have been needed. For filling the TenCate Geotube® system local available sand was applied.

Breakwaters

Changing Water's Force from Bad to Good

Wave action has long been a problem for many beach communities, as it can erode beaches or place sand where it is not needed. To address this, TenCate Geotube® systems have been used at locations around the world.

TenCate Geotube® systems can be placed offshore in areas where wave action is causing damage. The units disrupt the water flow and waves, and the size and location of the structures can be engineered so as to encourage beach replenishment by the altered waves now reaching the beach. Many communities have added yards of shoreline with the simple, inexpensive installation of TenCate Geotube® system installed offshore.



TenCate Geotube® system placed offshore for use as a breakwater.

By using TenCate Geotube® systems to change wave patterns, millions of dollars have been saved in reduced property damage or expense for renourishing beaches.



Groynes

Simple and Effective

Groynes are a quick and economical method of shoreline protection that is ideal for TenCate Geotube® systems. These short, perpendicular extensions from the shoreline stop lateral drift of sand and allow beaches to renourish with little or no maintenance.

Because TenCate Geotube® systems can be custom sized, groyne applications can be designed for optimum performance. TenCate Geotube® systems can be filled with sand from the area when allowed, simplifying the construction process. If regulations require fill material to come from another location, the units can still be filled less expensively than other construction methods.



TenCate Geotube® systems being positioned to create groyne for shrimp farm inlet.



Case Study

application	Island Construction, Reclamation Bund for Constructing Work Island
location	Incheon, Korea
product	TenCate Geotube® system

For the construction of the new bridge between Seoul and Incheon island in Korea, the contractor has to cross the sea. Total length of the new bridge will be around 13 km and a lot of piles will be constructed directly in the sea. On the landsite, near Seoul, the contractor has chosen for constructing a bund with TenCate Geotube® systems, instead of using steel sheet piles. The bund will be constructed out of 3 rows stacked TenCate Geotube® systems, 1st on the bottom two 4 meter diameters TenCate Geotube® systems are installed next to each other. On top of these bottom systems another TenCate Geotube® system is placed with a diameter of 5 meter. Back fill of sand will be placed and the 3rd layer of TenCate Geotube® systems will be installed. This is all forming the bund of the work island.





Case Study

application	Marina Construction
location	Stella Maris, Ecuador
product	TenCate Geotube® system

Stella Maris, a luxury resort on the Pacific Coast of Ecuador, used TenCate Geotube® systems to construct the cores of two jetties because there was not a nearby source for rock. TenCate Geotube® systems were filled with sand dredged from the ocean at the site. The units were stacked in a “pyramid” method to build up the jetty core. To keep the individual 20 meter long TenCate Geotube® systems straight during filling (while being pounded by waves), a steel position frame was used. A total of 2.000 lin/m of 13,7 m circumference TenCate Geotube® systems form the core of the jetties which were then covered with rock to provide permanent protection. The TenCate Geotube® systems were strong enough so that heavy construction machinery could drive on top as the structures were being built.

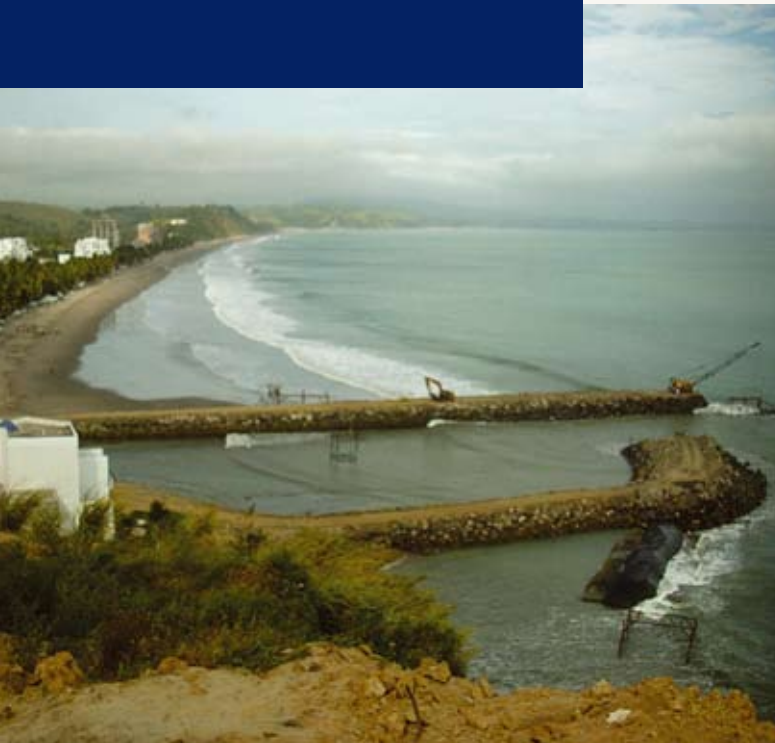
Jetties Versatility in Construction

TenCate Geotube® systems are often used for jetty construction, because of its flexibility in design, cost effectiveness and speed of installation. In many areas, there is not enough rock nearby to allow jetties to be built from stone, and TenCate Geotube® systems can be used so that sand and soil from the immediate area produce a stable structure. This can save significant amounts of money over trucking in materials.

TenCate Geotube® systems also allows great versatility in construction. Because units can be custom sized to various lengths and circumferences, less material may be needed. Also, because TenCate Geotube® systems can be filled quickly in place, construction time can be reduced dramatically.



TenCate Geotube® system being held in place by steel frame as it is filled.



Underwater Structures

Containment Systems that can be Dropped In Place

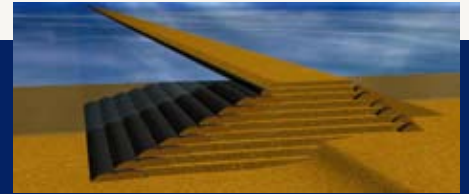
Another product of Geosystem technology is the TenCate Geocontainer[®] system, which is specially designed to be filled before being placed in the water. Split hopper barges are used to fill the TenCate Geocontainer[®] systems, which are sewn shut once filled, then reinforced with rope ties.

When the barge moves to the proper position, the bottom opens and the container slides through and settles to the bottom. TenCate Geocontainer[®] systems can be placed in position with a high degree of accuracy.

TenCate Geocontainer[®] systems are used for underwater structures, can create dikes, closures, contain dredge spoils or other materials, or change water and wave action.



TenCate Geocontainer[®] system being dropped from split bottomed barge.



Case Study

application
location

Dam Construction
Cornelis Douwe Channel,
Amsterdam

product

TenCate Geocontainer[®] and
TenCate Geotube[®] system

To create a new industrial area from a lake, a large dam had to be constructed in a channel that was the former access route to the shipyard ADM. The dam is constructed using TenCate Geocontainer[®] and TenCate Geotube[®] systems. On the outside of the dam 2 TenCate Geocontainer[®] systems were dropped next to each other and one on the inside. The outside slope was 1:3 and inside 1:1. Totally 73 TenCate Geocontainer[®] systems are used. In the top of the dam TenCate Geotube[®] systems are applied. This construction method saved approximately 100.000 m³ of sand.



To the best in our knowledge the information contained in this brochure is true and correct. However, new research results and practical experience can necessitate alterations. No liability is accepted for the information provided.

Unless otherwise stated, all technical values are means from standard tests and are subject to normal production variations. Minimum values are based on a 95% confidence range. The right to make changes without prior notice is retained.

Current data sheets are available on the internet under www.tencategeosynthetics.com

Austria	Tel. +43 (0)732 6983 0	service.at@tencate.com
Central Eastern Europe	Tel. +43 732 6983 0	service.at@tencate.com
Czech Republic	Tel. +420 2 2425 1843	service.cz@tencate.com
France / Africa	Tel. +33 1 34 23 53 63	service.fr@tencate.com
Germany	Tel. +49 6074 3751 50	service.de@tencate.com
Italy	Tel. +39 0362 34 58 11	service.it@tencate.com
Near Middle East	Tel. +971 5048 10557	service.nme@tencate.com
Poland	Tel. +48 12 268 8375	service.pl@tencate.com
Romania	Tel. +40 21 322 06 08	service.ro@tencate.com
Russia / CIS	Tel. +7 495 739 12 60	service.ru@tencate.com
Scandinavia / Baltics	Tel. +45 4485 7474	service.dk@tencate.com
Spain / Portugal	Tel. +34 91 650 6461	service.es@tencate.com
Switzerland	Tel. +41 44 318 6590	service.ch@tencate.com
UK / Ireland	Tel. +44 1952 588 066	service.uk@tencate.com

502630 UK | 09.2009 | Blömer Vormgeving

TENCATE GEOSYNTHETICS NETHERLANDS B.V.
Sluiskade N.Z. 14
7602 HR Almelo
The Netherlands

Tel. +31 546 544 811
Fax +31 546 544 490
www.tencategeosynthetics.com
geotube@tencate.com

 **TENCATE**
materials that make a difference