Elastogran is Polyurethanes

Better protection for coasts from erosion

Elastomeric revetments with Elastocoast®

Elastogran
Stand-fast with ...

The German Bight and North-Frisian islands. Sylt with its so-called "Elbow" (Ellenbogen) and the Hamburg Holm (Hamburger Hallig) have been identified in red. The test fields for elastomeric revetment with Elastocoast are located here.

Sylt, the "Elbow" near List. A coastline threatened by erosion. Open pore revetment with Elastocoast.

Hamburger Hallig, north of Husum, overflow dyke. Open pore revetment with Elastocoast.

Elbgroyne Wittenbergen near Hamburg. Open pore revetment with Elastocoast.

The structure of an open pore revetment with Elastocoast.
A new dimension is added to the protection of coasts and embankments: Elastocoast

Since 2003 North Sea storms have been faced with a brand new force. Its name: Elastocoast. Its special feature: it binds broken rocks together to form a stable reinforcement which is both solid and elastic at the same time. This ensures that the forces of nature do not take their toll on the Elastocoast revetment.

Various threatened constructions both on the North Sea coast and on the river Elbe have already held fast with revetments made with Elastocoast.

Elastocoast: A noble heritage

Elastocoast is a special elastomeric polyurethane system, made by Elastogran; one of the world’s leading companies in the field of development, production and sales of both market-driven and customer-tailored polyurethanes.

Elastogran’s partner in the development of Elastocoast is Prof. Dr.-Ing. Erik Pasche, Head of the Institute of Hydraulic Engineering at the TUHH (Technische Universität Hamburg-Harburg).

Advantages of the reinforcement
+ Open pore structure
+ Elasticity
+ Heat and frost resistant
+ Hydrophobic, water-repellent
+ Economic
+ Easy to process
+ Environmentally neutral*

= revetments with Elastocoast

Prof. Dr.-Ing. Erik Pasche
TUHH, Hamburg, Head of the Institute of Hydraulic Engineering.

More and more flood disasters create more and more catastrophies all over the world: just remember the devastation caused by hurricanes Katrina, Rita and Wilma in the Gulf of Mexico in 2005. Both the frequency and intensity of storm surges will increase further. Coastlines will be put under ever greater strain by the force of high waves. Exposed coastlines, like those on the island of Sylt, will be eroded dramatically, thus threatening the future of our islands.

This major challenge can only be met with innovative concepts and solutions. Elastomeric revetments with Elastocoast provide just such an innovative solution. Elastomeric revetments utilise the properties of polyurethane (PU) to form a lasting and elastic reinforcement. This creates extremely stable, open pore and resistant revetments. Apart from their excellent structural stability, elastomeric revetments also excel due to their more ecologically neutral properties and lower costs compared to conventional revetments.*

*tested at BASF in accordance with the DIBt Data Sheet – Analysis of Effects of Construction Products on Soil and Groundwater.
Revetments with Elastocoast:

The components of revetments made with Elastocoast: Broken rock and the two-component polyurethane system Elastocoast.
Elastocoast: all tests passed with flying colours

The PU elastomer Elastocoast is:
- heat and frost resistant
- elastic
- abrasion-proof
- hydrophobic, water-repellent
- easy to process
- environmentally neutral

PU Elastomers by BASF used in track construction for more than 20 years

With targets of increasing speeds, greater hub loads, improved safety awareness and rising costs, railway operators are very keen to avoid both displacement and propulsion of rocks: elastomers by BASF are an ideal solution.

What makes Elastocoast so ideal for revetments?

Polyurethane or PU is an extremely versatile specialist plastic material. For decades PU applications have rendered our lives safer, more pleasant and comfortable: in sports and leisure, in and around cars and living accommodation. But PU materials by Elastogran are already established in other fields such as mechanical engineering, medical technology, and maritime applications such as buoys and oil pipelines.

Research and development teams at Elastogran and BASF utilise the innovative potential of the multi-talented PU for ever new economic and environmentally-neutral applications. We are deeply committed to coastal and flood protection. Our contribution towards the fight against the elements: Elastocoast, a specially developed PU system for open pore revetments. Elastocoast has tailor-made properties for maritime, ecological, economic, and civil engineering requirements. – With our expertise as a developer of innovative materials, we regard ourselves as partner and reliable mentor for public authorities, engineering and construction companies and universities in the field of hydraulic engineering and coastal protection.

1. Endurance test: heavy-duty vehicle on a sample of Elastocoast rock reinforcement.
2. Nearly 200 Elastogran staff work in the Technology Centre Lemförde in research, development and applications technology.
3. Approximately 60% of Elastocoast is made from modified fatty vegetable acids.
4. Trials with zebra fish, water fleas, algae, luminescent bacteria paramecium and other microorganisms prove the compatibility of Elastocoast with the environment.
5. Crude oil exploration: polyurethane as pipeline coating in contact with sea water.
6. Medical technology: polyurethane application for dialysis filters.
Searching analysis:

Impact on concrete revetments results in reflections with a potentially explosive effect.

Impact on revetment reinforced with Elastocoast is dissipated by the open pore structure.

High-tech measuring instruments for an in-depth analysis; lasers scan the revetment in three dimensions to produce extremely precise information about all structural changes in the groyne.

Elastomeric revetment (Sylt, Ellenbogen)

Groyne with elastomeric revetment
Elastocoast for every eventuality

Elastocoast creates value added revetments

Elastocoast secures the structural stability of heavily pounded revetment structures through reinforcing rocks at their points of contact. This stabilizes the open pore structure while at the same time enabling it to dissipate traction forces. This is what distinguishes elastomeric from conventional revetments.

Further reasons for choosing elastomeric revetments:

- considerably less bulky than conventional revetments
- utilises smaller, and thus cheaper, broken rocks
- relatively simple construction process
- open pore structure between the stones. Absorbs the energy of waves and converts it into thermal energy (instead of impacting the structure)
- the open pore construction retains the natural structure and allows it to continue as a habitat for animals
- plants can be planted for nature conservation and/or aesthetic purposes

Monitoring of revetments made of Elastocoast

Since the construction of the first groyne on the banks of the river Elbe near Hamburg in September 2003, Elastocoast projects have been undergoing a comprehensive monitoring programme.

The strain on the construction through the destructive action of high water, strong waves and the current are recorded and changes to the revetment surface are documented meticulously. The following process is employed to obtain these results:

- Load cells record the impact force of the waves.
- ADV sensors measure the current
- A 3D laser scanner scans the surface of the revetment. In combination with height differentiation models it is possible to obtain complex information about changes to the surface.

Scientific findings:

Elastocoast possesses visibly better properties to secure revetments than conventional methods. Both in the navigable channel of the river Elbe and the coastal shores of the Hamburg Holm, Elastocoast has proved to be a reliable method of stabilizing groynes, shores and riverbanks. Even in the surf along the shore off Sylt the revetment has withstood the strain of the power of the waves, corrosive seawater and the effects of frost and ice throughout the winter of 2005/2006.
The construction of elastomeric revetments:

Pilot project for elastomeric revetments at the Elbow on the North Sea island of Sylt

"The implementation of the pilot project at the Elbow on Sylt with elastomeric revetment has provided a new and promising process which meets the needs of both coastal protection and civil engineering.

From a construction point of view the Elasto-coast revetment stands out due to its simple and easy-to-use technology. A further advantage compared to conventional methods is that less construction material is required as the elastomeric revetment is not as bulky as conventional ones. This saves approximately 30% in broken rocks. In addition, the stone used is usually of a smaller grain size. This is cheaper, easier to handle and increases the load-bearing capacity of the revetments compared to coarser rock."

Dipl.-Ing. Martin Limbrecht, construction company Martin Limbrecht GmbH & Co, Niebüll.

The two components of the Elastocoast system are blended.

2. The tumbler coats the broken rocks with Elastocoast.
Simply better with Elastocoast

Sylt: protected from danger

Time and again, particularly after the autumn and winter storm surges the island of Sylt laments the loss of land. In 2005 alone expenditure for coastal protection amounted to Euros 3.5 million. The Elbow on the North Sea island of Sylt regularly suffers under the onslaught of the North Sea. For decades both the tides and the storms which, 90% of the time, blow from the west have been posing a major threat to the coastal area. So far all coastal protection measures in the most exposed areas have failed.

Elastocoast: for the protection of the Elbow

The fight goes on. On 17 June 2005 the ALR (Amt für Ländliche Räume = Authority for coastal protection) approved a pilot field on Sylt for the construction of an elastomeric revetment with Elastocoast.

Construction work for the 10.5m by 26m strip of land started on 5th September 2005. Following intensive planning involving both the ALR and the TUHH, as well as experts from Elastogran and the company who carried out the work, Martin Limbrecht GmbH & Co. - low water and good weather conditions allowed the completion of the pilot project within a few days.

The high-pressure method

![The Elastocoast-rock mix is applied to the revetment.](image1.jpg)

In the High-Pressure method Elastocoast is sprayed onto the loose broken rock revetment.

![The high-pressure method](image2.jpg)
Elastogran is one of the world’s leading companies in the field of speciality plastics polyurethanes (PU). Elastogran, a company of the BASF Group can look back on over 40 years of PU know-how. Our headquarters in Lemförde, Lower Saxony, hosts the international technology centre of the BASF polyurethane world. Second to none: the range of the dynamic market and technology leader for speciality PU comprises nearly the entire polyurethane product portfolio.

Working hand in hand with our customers

The Elastogran Group has 11 sites in Europe. We distribute all BASF PU base products Europe-wide and develop, produce and distribute polyurethane systems as well as thermo-plastic and cellular speciality elastomers.

The entire BASF PU business in Europe, the Near East and Africa is concentrated at Elastogran. From here we have built a strong market position. Close customer contact is implemented world-wide through close co-operation: Elastogran representatives and BASF sales organizations work around the globe in close partnership with their customers.

Individual Innovations

No matter which PU application is involved – Elastogran turns the apparently impossible into an innovative reality. In close project-related co-operation with the customer our specialist teams of chemists, physicists, engineers and sales experts develop tailor-made, creative and economic solutions. We create a solid and reliable base with our customers through both active dialogue and combined experience. Our sectoral applications technology which stretches throughout Europe is strictly focused on value added benefit.

Integration

Our close links with BASF (BASF – The Chemical Company), one of the world’s leading enterprises in the chemicals business, enables us, as part of the trans-national BASF Verbund, to access resources world-wide: for research, raw materials supply, infrastructure, sales and finance.
Acting with Responsibility

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<tr>
<th>Responsible Care®</th>
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<td>Elastogran supports Responsible Care, the worldwide initiative of the chemical industry, and thus commits itself to continually safety, health and environmental protection.</td>
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<td>Within the Elastogran Group, Responsible Care for safety, health and environmental protection is an issue, which – for the sake of environmental sustainability – is considered as being a corporate value as important as economic criteria for boosting the company’s success.</td>
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<td>The whole process of development, production and storage of our products as well as their transport, application and finally also their disposal or recycling is evaluated and continually further developed with respect to the reduction of possible environmental impacts.</td>
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<td>This includes, in particular, the protection of resources as well as prevention of emissions and waste. Elastogran appropriately informs customers, partners and neighbours about environmental aspects of products and processes. Our environmental management system is geared to the guidelines of Responsible Care and meets the requirements of the international standard ISO 14001.</td>
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<td>Methods for recycling polyurethanes are as diverse as their use. In order to find the right method, it is necessary to clarify their specific origin and use.</td>
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<td>Alongside thermal re-utilisation of PU products, the recycling of production waste also plays an important role. The following processes are already being introduced on a practical scale:</td>
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<td>- Flock-bond</td>
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<td>- Particle-bond</td>
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<td>- Chemical recycling</td>
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<td>- Raw material processes</td>
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<td>It is generally not possible to state whether such processes are more ecologically beneficial than thermal re-utilisation.</td>
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<td>Customer satisfaction is the basis for sustained business success. Therefore, we want to meet the customers’ requirements on our products and services in the long run.</td>
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<td>To ensure success in a reliable way, Elastogran introduced a quality management system already several years ago including all divisions.</td>
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<td>Each business process is regularly assessed and further developed based on informative performance indicators. The target is to reach optimum efficiency and almost perfect coordination of all activities and operations. Each employee is asked to make a contribution to quality assurance and continuous improvement with its capabilities and ideas at its workplace.</td>
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<tr>
<td>The Elastogran quality management system is based on the international standard ISO 9001, supplemented by the additional requirements of the automotive industry ISO/TS 16949.</td>
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The data contained in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, this data does not relieve processors from carrying out their own investigations and tests; neither does this data imply any guarantee of certain properties, or the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior notice and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed. (04/06)