ACE Geosynthetics

ACE Solutions in Hydraulic Engineering

2020

www.geoace.com

Founded in March 1996, ACE Geosynthetics is now a leader in Taiwan's geosynthetics industry and offers professional and innovative solutions for the global engineering market, including collapse site remediation, slope and retaining wall engineering, weak foundation improvements, slope erosion control, road engineering, environmental protection, maritime engineering, riverbank protection, etc. In the past ten years, our outstanding design and application performance of geosynthetic materials have been repeatedly recognized by International Achievement Awards from Industrial Fabrics Association International, and the number of obtained awards is among the best among global competitors. Currently, the countries to which the Company exports its products and services span more than 70 countries across five continents. Thus, ACE Geosynthetics has taken a place in the international geosynthetics industry stably.

Based on independent research and development capabilities and rich manufacturing experiences, we offer a wide range of high-performance products, including geogrids, geotextiles, geotextile tubes, vegetative nets, drainage materials, and landscaping and hydraulic materials. In addition to the ISO9001 quality management system certification, the TAF (Taiwan Accreditation Foundation) certified laboratory has been further established to strictly control product quality. At the same time, it has actively obtained product certification from various countries and is currently one of the manufacturers with the most complete set of global product certification systems. Meanwhile, in 2003, a professional engineering design team has been established to provide engineering planning and design integration and application services. We continue to strengthen our vertical integration capabilities from product development, manufacturing, and processing to engineering planning and design, and provide geosynthetic materials and services that meet the requirements of the environment and engineering to create the largest overall benefits for customers. At the same time, we hope to deepen customer relationships, and create a team of professionals to provide the best solutions in the global market.

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Engineering Planning and Design

We assist on-site surveys, provide systematic engineering planning, feasibility proposals and plan proposals according to customer needs. We can provide basic design, detailed design, materials and construction specifications, safety analysis in line with international design specifications, unit price analysis and data such as calculation of carbon emissions in the design stage of the case.

Construction Guidance and Support

We provide suggestions on specifications and quantity of construction equipment according to customer requirements, and we provide the construction plans or construction drawings, construction supervision focuses and other information as well. Or, we send experienced engineers to the job sites to guide the construction methods and techniques of using relevant products and systems.

Professional Technical Consultation

For product specifications, applications, design, durability, construction operations and subsequent maintenance, we provide economical and safe solutions for customers, and work with customers to develop new application systems that manage to solve difficult engineering problems.

Geosynthetic Product Testing

Our own TAF certified laboratory provides professional testing services for geosynthetic products. Various long-term tests can also be carried out to evaluate the long-term physical property changes of products in various environments as a reference for design consulting services.

Professional Services Provided by the Professional Technical Team

Civil Engineering | Geotechnical Engineering | Hydraulic Engineering | Marine Engineering | Environmental Engineering | Landscape Engineering

Technical service team composed of more than
40 engineering professionals in different fields

ACE Solutions

Landslide Remediation and Slope Construction

- Landslide Remediation and Road Rehabilitation
- Reinforced Slope and Retaining Wall
- Slope Erosion Control
- Debris Flow Control Embankment

Coastline Protection

- Seawall and Bulkhead
- Groyne and Jetty
- Beach Nourishment
- Sediment Dredging

Riverbank and Channel Protection

- Revetment
- Pier Scour Protection
- Channel
- Flood Detention

Roadway Construction and Base Reinforcement

- Subgrade Stabilization
- Base Reinforcement
- Pavement Improvement
- Road Embankment and Bridge Pier

ACE Solutions in Hydraulic Engineering

The Hydraulic engineering field mainly concerns various hydraulic structures, including dams, river and sea dikes, groynes, breakwaters, revetments, land reclamation, port construction, estuary improvement, dredging and coastal protection. For construction purposes, diversified oceanic and coastal structures such as seawalls, revetments and breakwaters can reduce the effects of waves, tides or storm surges. Areas that are subject to long-term effects of waves need improvements to prevent erosion. In areas with shore drifting sand, shore flow and waves, it is necessary to carry out silt balance treatment.

After the construction of hydraulic and maritime structures, the direction of drifting sand will be affected. If the structure is too long, the downstream will not be able to obtain the sand source, which will cause the downstream to be eroded and the upstream to accumulate sands. If the structure is too short, the shore current will flow through the structure to the downstream, which will bring the drifting sand downwards. So, the size of the hydraulic structure requires an appropriate design. As the public's awareness of environmental protection increases, the requirements of Hydraulic engineering projects not only end with the construction of structures, but also involve the management of the oceanic and coastal environment.

ACE Geosynthetics offers a range of solutions that are generally easier, more durable, more economical and more resilient than traditional reinforced concrete structures. For example, a geotextile tube is used as a temporary or permanent structure, on which local sand can be laid to form artificial sand dunes, or stones and concrete blocks can be laid to form the jetty, offshore dyke and other protective structures.

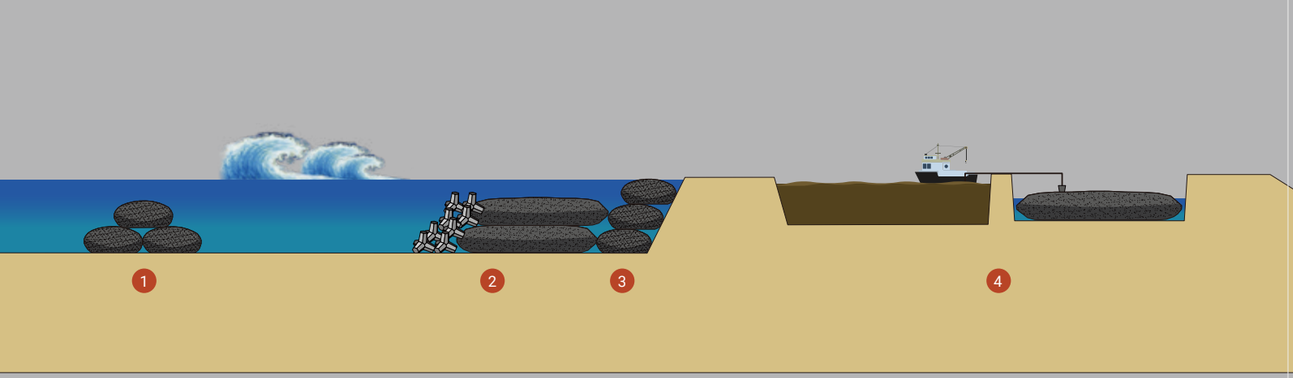
When using the geotextile tube to construct the hydraulic structure, no matter the rigid to flexible construction method is applied, there are advantages such as simplified simple construction, shortened short construction period, low construction cost, suitability for different local terrain conditions, and the structure is usually formed by filling the existing soil sand in the bag tubular body, which can greatly save material and handling costs, and the carbon emissions generated during the construction process are much smaller than those generated by the traditional method. Therefore, it speaks for itself that ACE provides an excellent solution that can meet the needs of engineering and environment in the field of water conservancy engineering.

1. Beach Nourishment

3. Seawalls and Bulkheads

5. Levees and Dikes

7. Revetments



2. Groynes and Jetties

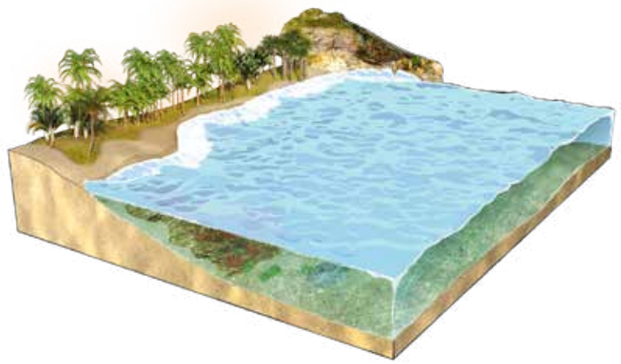
4. Sediment Dredging

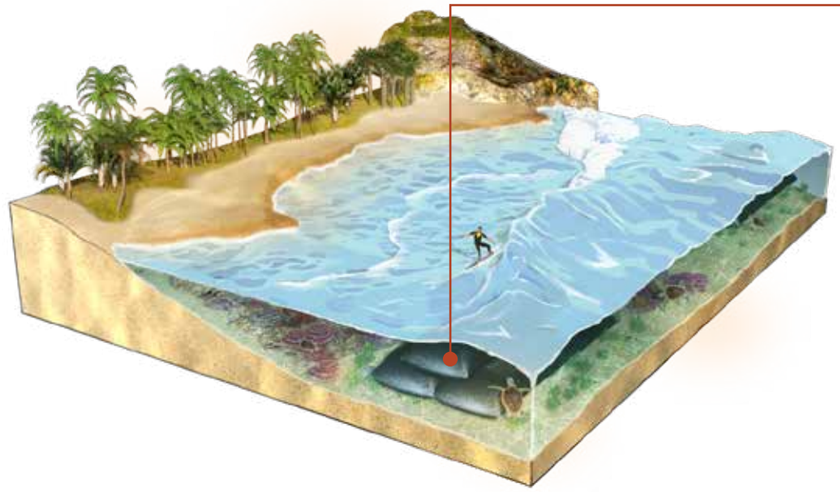
6. Pier Scour Protection

8. Flood Detention

1. Beach Nourishment

Due to the currents, the coastline can be eroded, causing the shoreline to recede and the original beach area to disappear. Relying on the natural drifting sand to restore the original beach landscape takes a long time, and if there are major climate events such as a typhoon strike, it will aggravate the shore erosion and make the beach shoreline retreat again; therefore, an appropriate beach nourishment project is needed to restore the beach.



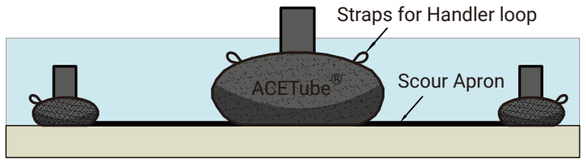


Before

After

ACETube®
Geotextile Tubes
for Coastal Protection

In beach nourishment projects, the wave dissipating concrete block/ concrete wave block is often used, but it can be lost easily due to sea current erosion. It will generate a large amount of carbon emissions during production and transportation, and it can seriously hinder the natural landscape. For coastal protection and reclamation, it is better to use coastal facilities such as offshore dykes, submerged levees hidden under water, or long levees in artificial bays to make sand accumulate along the coast.



Using the geotextile tube to construct the offshore embankments, submerged dikes, long banks and other hydraulic structures parallel to the coastline play the role of deflecting the drifting sand and preventing the scouring, so that the drifting sand can be accumulated to achieve the effect of beach nourishment.

As the geotextile tube is a flexible method, the special structure can be designed according to the project requirements, so that the impact of the broken wave on beach erosion can be reduced. It lowers the amount of drifting sand and maintains the static and stable effect of beach nourishment. Meanwhile, the artificial sand pumping for backfilling can also be used to speed up beach nourishment.

The geotextile tube is usually filled with the existing materials at the installation location to form the structure, and its underwater installation is easy. Therefore, compared with the concrete blocks or stones used in traditional construction methods, a large amount of expensive materials, transportation and construction costs can be saved as it is more environmentally friendly. In addition, the structure constructed using the geotextile tube can be well coordinated with the local terrain, so it can provide very good resistance to water flow scouring.

ADVANTAGES :

- The construction method of the geotextile tube is easier than that of other materials used in general marine engineering.
- The RC structure is highly costly, and the use of the geotextile tube method is fairly economical.
- The geotextile tube has a very good fit to the natural ecological environment, and the algae can adhere to its surface and grow at a fast rate, thus effectively reaching the target of ecological recreation.

REFERENCE 1

Hotel Beach Nourishment

Fujarah, UAE

2009

ACETube®

In 2007, a strong tropical cyclone Gonuhit the Fujarah coast, making a great havoc on the Emirates and causing serious erosion for several kilometers. Le Meridien Hotel urgently needed an effective solution to restore the beach.

An ACETube® geotextile tube structure in a U-shape, forming a seaward breakwater stretching out for 200 meters long on the southern and the northern side. This structure create a 228 m x 225 m safe zone to reduce the wave energy and nourish the beach.

After the project construction was completed, ACETube® geotextile tubes effectively controlled erosion and prevented Fujarah coast from further attack by cyclones. ACETube® represents the best way to reduce impact and reach sustainable development for our environment.

REFERENCE 2

Dredging of Port Channel and Land Reclamation

Kaohsiung, Taiwan

2018

ACETube®

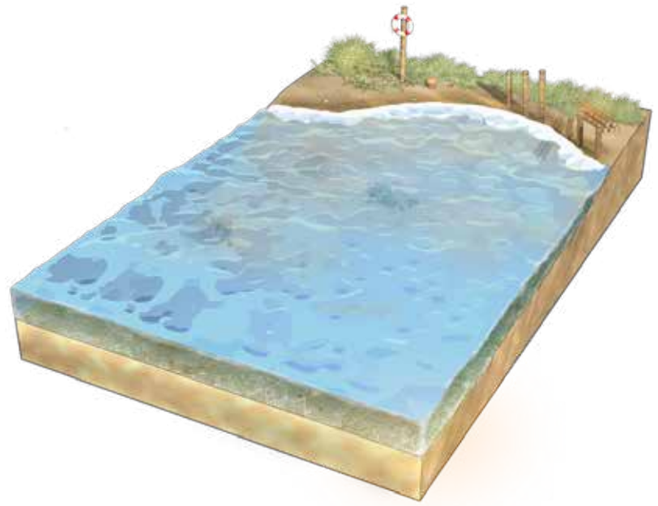
In order to expand the Kaohsiung Port terminal, it is necessary to clear and transport the channel silt to the planned filling area.

For embankment filling, the ACETube® geotextile tube forms the core structure of the embankment to increase the dredging capacity. Stones laid outside of the embankment protect and improve the service life of the structure. The height of a single geotextile tube can be up to 4.0 m or more. After double stacking the ACETube®, and adding the riprap cover, the levee height reached almost 9.0 m.

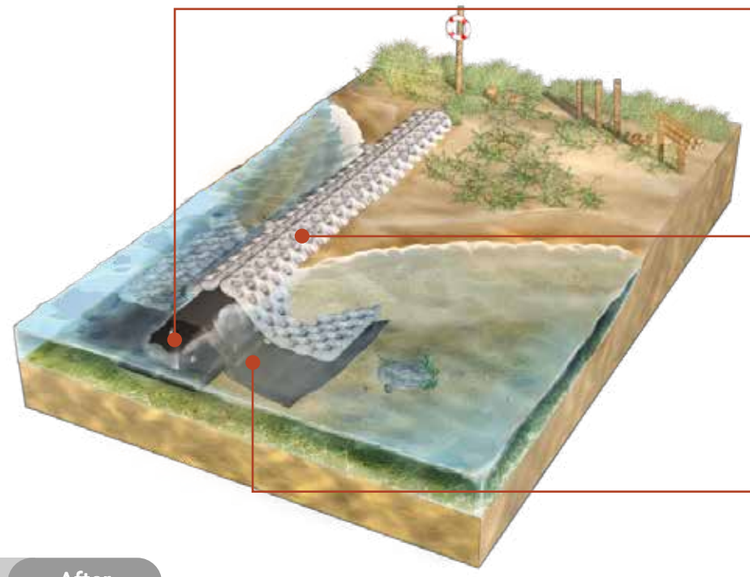
The ACETube® geotextile tube skillfully uses the dredged sand source as the sand embankment material to simultaneously reduce the cost of dredging and construction materials and lower the carbon emissions of the total project to achieve effects of safety, environmental friendliness and cost-effectiveness. The giant sand containment system manufactured with high-strength geotextiles can significantly increase the allowable fill volume in a single session, which greatly reduces the material and construction cost.

2. Groynes and Jetties

Factors such as coastal erosion, reduced sand transport in the river, and tidal changes caused by global climate variations will change the coastal line. As far as rivers and streams are concerned, if certain climate factors exist , the flow rates or flow differences can be larger. Especially during the rainy season or typhoon transits, the flow will increase rapidly, and cause damage to the riverbank and flooding outside the dyke, causing damage to crops or people's livelihood.

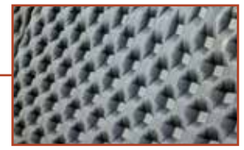


Before



After

ACETube®
Geotextile Tubes
for Coastal Protection



ACEFormer™
Geotextile Mattresses
Grouted with Cement Mortar
for Surface Protection

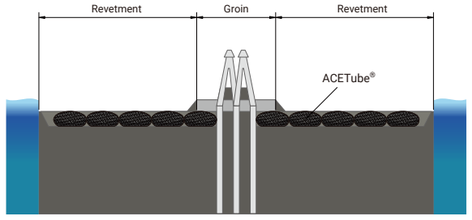
ACETex®
Geotextile for Separation
and Erosion Control

The use of the groyne can interrupt the wave or water flow energy to restore and protect the shoreline This interruption reduces the internal wave energy and flow rate so the suspended sediment is precipitated. Large wave energy increases the kinetic energy of drifting sand. The groyne often uses concrete or stone armor which is difficult to construct and costly. Because of the long-term erosion of the bed by ocean currents, it is easy to cause the rigid structure to be damaged due to differential subsidence, or the loss of rockfill, which may even cause damage to the overall structure of the groyne.

Maintaining or nourishing depleted beach levels is efficiently achieved by installing ACETube® perpendicular to shorelines to create beach remediating groynes or jetties. The ACETube® structures disrupt longshore currents and accumulate sediment, that sustains the existing coastline.

Also, the ACEFormer™ geotextile mattress can be added for surface protection or stabilization. Compared with the rockfill, the ACETube® geotextile tube can be filled with local sea sand, which can cut down costs by reducing the need for purchased materials and transportation. And the underwater installation of the ACETube® geotextile tube is simple, cost-effective and with little impact on the environment. Furthermore, the ecofriendly geotextile materials adapt to the marine environment, attracting fresh aquatic plant and animal life.

In addition to the construction of the groyne, the geotextile tube can also be used for the protection of the jetty structure. The geotextile tube is placed on the riverbed around the jetty to stabilize the jetty foundation and increase its resistance , thus improving the overall stability and water flow control capability.



ADVANTAGES :

- The ACETube® groyne system can resist river scouring to avoid structural subsidence, reduce the flow rate and increase the deposition rate to stabilize the river channel.
- Cost advantages over traditional methods.
- The geotextile tube can be used in green projects to effectively reduce carbon emissions and achieve energy-saving and carbon-saving effects.

REFERENCE 1

Riverbank Erosion Control, Zhuoshui River

Changhua, Taiwan

2017

ACETube® ACEFormer™

2017 IFAI International Achievement Award (IAA) Best in Category & Award of Excellence

Zhuoshui River often encounters the problems of flood plain shrinkage. A spur dam was installed to serve as the river bank protection; however, due to long-term erosion along the foundation at the spur head, soil loss and local settlement of the structure occurred resulting in the destruction of the gabion shield and exposure of the pier head.

The ACETube® geotextile tubes were used to shelter the foundation of the PC spur dam. First, a layer of polypropylene ACETube® paved both sides of the dam's foundation to retard base subsidence. The ACETube® were then filled to different heights or stacked together to stabilize the foundation, and to reduce the effects of scour and improve the effectiveness of siltation at the pier heads. Also, at the most severe erosion sites, gabions overspread the ACETube® and gaps were filled with local sand to amplify the overall erosion resistance of the structure.

This project has canvassed more than 1,100 m of the Zhuoshui River bank for the protection of flood plain slopes and several spur dams along the river. Instead of solely using gabions, the combination of gabions with ACETube® geotextile tubes can save around 30-40% of the overall costs, and furthermore reduce approximately 88% of carbon emissions. The shoreline has extended and direct erosion of the flood plain has reduced, successfully improving the safety of the embankment and well exerting its functions.

REFERENCE 2

The Project of an L-Shaped, Sand-Containing Breakwater

UAE

2013

ACETube®

2013 IFAI International Achievement Award (IAA) Award of Excellence

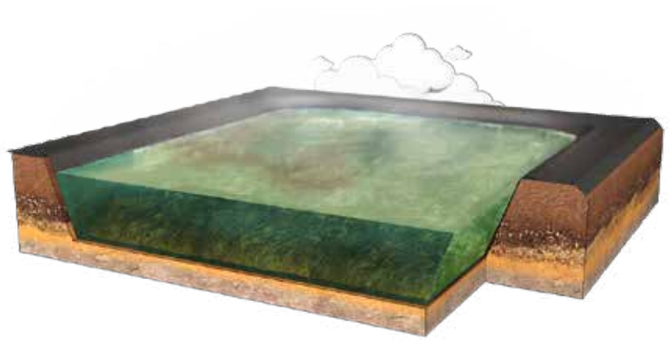
This project was at a coast in Ras Al Khaimah, where there was a groyne for the protection of the navigation channel. The local authority planned to build a fishing port right there where the groin was and decided to make use of it as a part of the port.

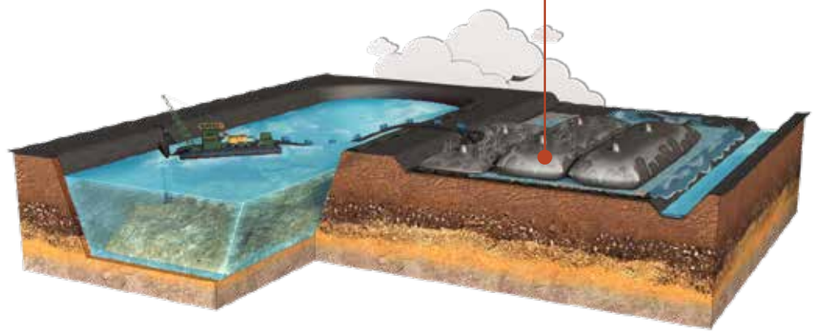
This project design applied various types of ACETube® as the perimeter barrier structure which contained and trapped in-situ sand to forming the core of the breakwater. The construction was carried out from bottom to top with the usage of 286 ACETube® geotextile tubes. Externally, ACETube® was covered with an under-layer of aggregates and further protected by a layer of armor rocks. The final look was similar to a rubble-mound type breakwater.

The innovative application of ACETube® for breakwater construction significantly reduced the cost and minimized environmental disturbance. The project even won 2013 International Achievement Award from IFAI for its outstanding performance.

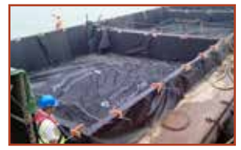
3. Sediment Dredging

Freshwater and seawater currents carry sediments into harbors and other naval passageways constricting navigation and the flow of water. Dredging the sediment accumulated along the beds of watercourses clears and deepens paths for ships. The dredged material is effortlessly stored in ACETube® or ACEContainer™ then transported to various sites for disposal or more beneficially utilzed to form hydraulic structures.





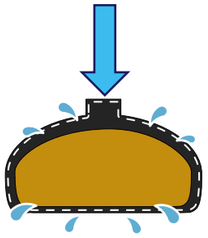
ACETube®
Geotextile Tubes
for Dewatering



ACEContainer™
Geotextile Containers Fitting in Split Barge for Marine Structure Construction, Land Reclamation, and Dredging

Before | After

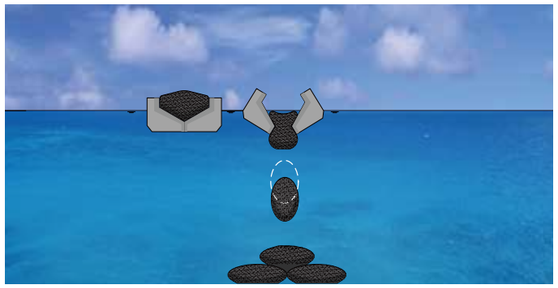
ACETube® dewatering tubes are tubular-shaped containers fabricated by multiple pieces of engineered woven fabrics with excellent filtration characteristics. In general, sludge is pumped into ACETube® dewatering tubes with or without flocculants depending on the sludge particle sizes. During and after the filling process, the water dissipates through the fabric while the solid particles are retained within the geotextile tubes with low moisture contents. Afterwards, the volume of sludge reduces significantly, and a great deal of removal and disposal works are saved. Moreover, the installation and usage of ACETube® are very cost and time effective.



Water drained out

In most traditional dredging practices where tools are used for excavation and sludge is placed in the treatment tank for natural drying subject to land restrictions, it can lead to a lengthy processing time and a limited processing amount, thus affecting the efficiency of dredging operations. By comparison, the geotextile tube can be quickly dehydrated in the early stage and is not subject to land restrictions, which effectively solves the shortcomings of its traditional methods and improves the effectiveness of dredging.

ACEContainer™ are monolithic geotextile containers designed to fit in split barge and pour in sediment sand or other ground materials to dredging. When the geotextile containers are filled to a desired depth of the split barge hopper, and then they are sealed and ready to be dumped to the targeted position through the barge tugging.



The volume of ACEContainer™ matches up to the hopper of barge which can exceed 200 m³. With the use of ACEContainer™, a great amount of loosely or lightly cohesive materials can be effectively and efficiently contained, moved, and dumped into (deep) water area without polluting the surrounding water body (ocean or river) at the dumping location. In some cases, ACEContainer™ geotextile containers are filled with dredged materials and deposited to build coastal protection facilities; two jobs are accomplished by one thing without considerable costly materials, transportation and installation works.

ADVANTAGES :

ACETube® Dewatering System

- Highly time and cost effective.
- High sludge treatment capacity.
- There are fewer site restrictions and stacking can increase throughput.

ACEContainer™

- The bag body can be customized to match the changes to the tank of the open-bottom vessel (hopper barge), so it can effectively deal with a large amount of silt.
- Based on the mathematical calculation and hydraulic simulation testing results, it is possible to design a geotechnical sand container that meets the requirements of throwing operations at sea under different conditions.
- It can facilitate rapid dredging, maintain the depth of the channel without affecting shipping and prevent marine pollutions.

REFERENCE 1

The Sand Drift Treatment and Land Reclamation Project, Taichung Port

Taichung, Taiwan

2009

ACETube®

In order to alleviate the silt problem in the navigation channel and restore the sediment storage capacity in the northern silt area, the Taichung Harbor North Silt Area needs to construct a cofferdam in the shoal location of the existing silt area with geotextile tubes that can be quickly constructed with lower environmental impact.

In this case, the existing sea sand is filled into the giant ACETube® geotextile tube. The geotextile tube forms a gravity structure to meet the needs for stability of the cofferdam, and has the functions of energy dissipation and wave breaking, and thus it can dredge the silt and fill the land.

Using the existing sea sand to backfill the giant ACETube® geotextile tube can reduce the amount of concrete and reduce the damage of the project to the coastal ecological environment. Compared with the wave block of equal weight, it can reduce at least 2500T-CO^2 emissions. Compared with riprap of equal weight, it can reduce engineering costs by 50% and truly achieve the green goals of safety, economy, ecological protection and carbon reduction.

REFERENCE 2

Dredged Materials Disposal, Wan Chai Development Phase II Project, Victoria Harbor

Hong Kong

2011

ACEContainer™

On average, Hong Kong's Victoria Harbor has about 220,000 ships to visit the port each year. In order to ensure the normal operation of the shipping, the competent authority has attached great importance to the siltation problem of the port.

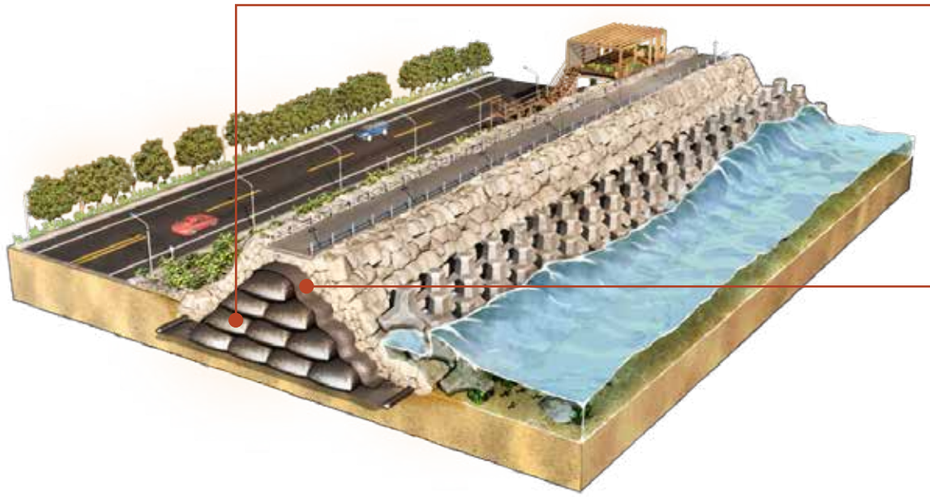
For sludge dredging and treatment, the designer manages to deploy the ACEContainer™ sandbags in the second phase of the Victoria Harbor Development Project. The ACEContainer™ is sized and installed according to the opening space of the open-bottom vessel (hopper barge). After being filled with silt and sealed, it can be directly transported to the intended location by the open-bottom vessel (hopper barge) for throwing operations.

The use of ACEContainer™ is a faster and more effective solution than conventional dredging techniques. As ACEContainer™ has excellent tensile and stitching strength, water permeability and filtration properties, it can properly encapsulate sludge during the casting process to avoid environmental pollution.

4. Seawalls and Bulkheads

Due to the tidal current difference between the port and the coast, the foundation of the dike is gradually lost. The dike will be damaged over a long time, and the original wave-eliminating block will disappear, which will affect the safety and stability of the embankment foundation structure.

Seawalls, as wave-proof structures built along the shoreline, are important hydraulic structures to withstand waves, tides or surges for protection of inhabited land and people. Seawall structures incorporating with high-strength and flexible ACETube® geotextile tubes and ACETex® geotextiles as filtration and erosion control geosynthetic fabric adapt to almost any shoreline curve, dip and juncture.



ACETube®
Geotextile Tubes
for Coastal Protection

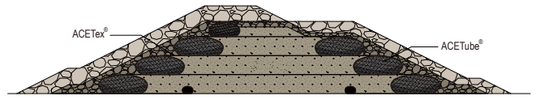
ACETex®
Geotextile for Separation
and Erosion Control

Before | After

Replacing the traditional RC structure with the geotextile tube not only can eliminate the wave impact energy more effectively, but also has the advantages of rapid deployment, cost-effectiveness and environmental protection. ACETube® geotextile tubes are monolithic-tubular containers fabricated by multiple pieces of highly engineered synthetic woven fabrics. In order to form flexible mass-gravity hydraulic structures for coastal protection, it can be filled with in-situ solids. In general, geotextile tubes are hydraulically filled with in-situ sand/water slurry by pump, dredger or funnel. During and after the filling process, the water dissipates through the fabric, while the sand can be retained within the geotextile tubes and become the main composition of the structures.

The construction method using the geotextile tube is simple, as only one sand pump or small sand pump dredger is required for construction, and the sand can be extracted from the local sand source to fill the bag. Compared with other construction methods, the purchase and transportation cost of the materials can be greatly reduced, and the impact on the environment ecology and landscape is smaller.

Using the geotextile tube as the embankment can strengthen the stability and safety of the overall structure of the seawall, and successfully block the wave attack to achieve the basic protection effect on the sea side. At the same time, it can avoid the damage of the embankment, thus eliminating flooding and disasters outside the embankment. The dike core can be completely composed of the geotextile tube, or the geotextile tube can form the outside of the embankment, as shown in the following figure.



The geotextile tube is a flexible method, which can be used to design a special structure type to break the waves according to the demand, effectively reduce the beach erosion, and stabilize balance of the drifting sand in the upstream and downstream. Overall, the advantages of using the geotextile tube to construct breakwaters are significant.

ADVANTAGES :

- The flexible structure has better resistance to water flow impact.
- Construction is simple and fast.
- The silt can be extracted and used as the material to fill the bag, which can reduce the cost of material purchase, handling, and silt removal.
- The traditional reinforced concrete is replaced with local materials and environmentally friendly bags to reduce environmental damage.
- The geotextile tube is used as the embankment material, and the structural stability is better.

REFERENCE 1

Dredge and Land Reclamation, Anping Harbor

Tainan, Taiwan

2015

ACETube®

Anping harbor has been used for 36 years; the original design became inadequate, so it was required to build new facilities. In addition, dredging the harbor was also an urgent issue.

The required dike for land reclamation was 168 m long and 10 m wide at the bottom and 2.5 m at the top. Considering in situ varying topographic contours, different sizes of ACETube® geotextile tubes were designed. The silt could fill the ACETube®, and backfilling the area behind ACETube® dike would provide the reclamation material.

The dike constructed by ACETube® geotextile tubes used more than 5,200 cubic meters of silt dredged from the deposit area of the Harbor, effectively reducing the cost of silt removal. Comparing ACETube® and caisson, the ACETube® solution provides a relatively easy and faster installation at a lower cost than using caissons.

REFERENCE 2

Reinforced Earth Quay Wall

UAE

2010

ACEGrid®

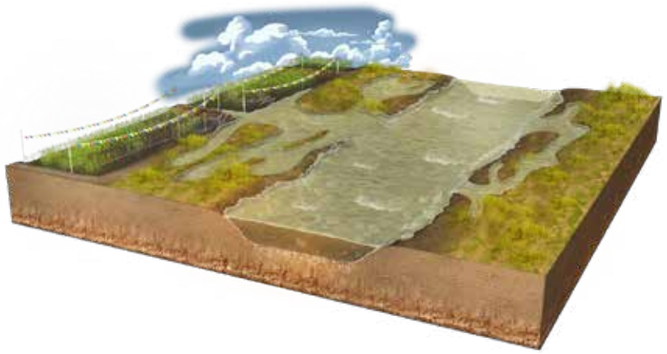
Excess shipping traffic caused access and management of the port in difficult. The port authority decided to build both a quay wall and a marina to expand the mooring area and facilitate the port activities.

The designer proposed building a 3 m high reinforced earth quay wall. The wall face was built with stacked precast concrete blocks, each 70 cm high. These blocks then were with ACEGrid® geogrid. To avoid the reduction of soil strength caused by the sea, as well as the possible structure settlement, the foundation of the retaining wall below water level was backfilled with graded aggregate. The upper part above water level was backfilled with sand.

The quay wall and marina have been attacked by tropical cyclones from the Gulf of Oman, these structures remain steady. The capacity and convenience of the fish port has been significantly enhanced by the construction of the quay wall.

5. Levees and Dikes

River bank erosion is a natural phenomenon, but it may be accelerated by human behavior. Water conservancy engineers need to master the river landscape to make the river function and maintain ecological balance. ACE Geosynthetics uses geosynthetics to provide cost-effective, highly efficient and environmentally friendly hydraulic engineering solutions, such as rugged river revetments or flow control structures that can reduce river bank scouring or promote sedimentation.



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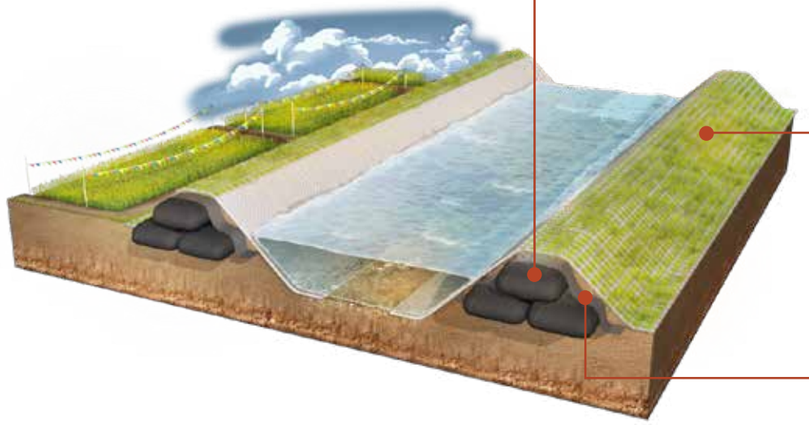
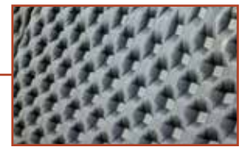


After

ACETube®
Geotextile Tubes for Coastal Protection

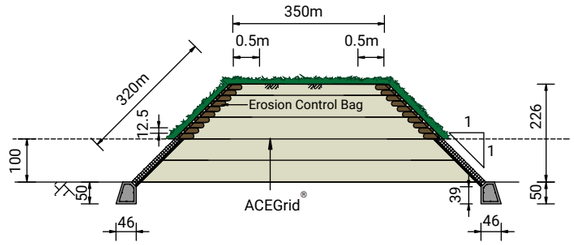


ACEFormer™
Geotextile Mattresses Grouted with Cement Mortar for Surface Protection

ACETex®
Geotextile Mattresses for Separation and Erosion Control

When the heavy rain strikes, if the flood passage section of the river is insufficient, overflowing or dike burst may occur to cause flooding. By constructing dikes or dams, it can be used to protect against floods and protect the safety of people around the river. In the meantime, during heavy rains and floods, in order to reduce the erosion of river banks by rivers with high flow rates and flow volumes, artificial revetments need to be built to protect river banks.

The reinforced soil structure constructed by the ACEGrid® geogrid can be used as a very economical and effective levee heightening system. It is generally built above the normal water level. Different panel systems can be chosen according to the local hydrology and geographical environment, and it can quickly strengthen the flood control and anti-scour ability of the new embankment.



In addition, ACE's revetment system can also be combined with ACETex® geotextile or the ACETube® geotextile tube to stabilize and strengthen the embankment, or the ACEFormer™ geotextile mattress can be used to further strengthen the surface.

The reinforced soil structure is a gravity retaining structure composed of a panel system, stiffening materials, and rammed backfill soil. The reinforcement material is buried between the soils, and the tensile strength and shear strength of the original soil are increased by the strength of the material. Its application not only can greatly reduce construction costs, shorten the construction period, achieve earthwork balance, and allow large deformation of structures caused by earthquakes or other external forces, but also increases its aesthetics upon completion.

When the reinforced soil structure is used as the embankment, the geogrid has good hydrolysis resistance and will not be damaged by the water soaking, and the soil sand surrounded by the stiffening grid will not be lost, so the overall stability can be maintained.

ADVANTAGES :

- It is faster and more cost-effective to design the Wrapped Around Reinforced Revetment with ACESandbag™ and ACEGrid® than the traditional reinforced concrete revetment.
- The ACESandbag™ uses the existing soil as the filling material for easy vegetation, which is conducive to the maintenance of the local ecological environment.

REFERENCE 1

Canal Improvement Project

Pingtung, Taiwan

2009

ACEGrid® ACESandbag™

According to the “flood control plan for flood-prone areas,” the Niaosong Canal should be rectified according to the principles of safety, economy, ecological protection and carbon reduction to expand its flood passage section.

The foundation of the project uses the pre-cast concrete blocks. The existing dredged soil is used to construct the ACEGrid® Reinforced Revetment above the flood level.

The flooding of upstream villages and farmland can be improved to reduce the flooded area by about 300 hectares. The reinforced wall surface can be planted and greened. Upon completion, the planting and greening effect is remarkable, and it has the advantages of porosity, rough surface and self-purification ability to restore water quality. In-situ backfilling with local dredged earth and stone can reduce transportation costs and carbon emissions.

REFERENCE 2

Zhuoshui River Revetment Improvement Project

Changhua, Taiwan

2015

ACETube® ACEFormer™

2017 IAA Award of Excellence

The river bank in this area has been scoured by water for a long time, resulting in the loss of earth and rock in the high riverbank. The bank line is continuously advancing to the dike to seriously jeopardize the stability of the dike structure and the safety of life and property of local residents.

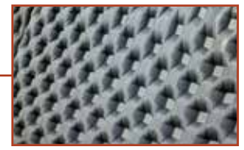
The ACETube® geotextile tube is filled with the existing river silt near the site, and the surface layer is laid with the ACEFormer™ geotextile mattress filled with cement mortar to strengthen the slope strength and protect the high riverbank from loss.

After the remediation, the bank line extends outward, prevents the river from directly scouring the high riverbank, and improves the safety of the riverbank and the dike. Compared with the gabion, it saves the cost by about 30%~40% and reduces the carbon dioxide emissions by 88%. And it is also conducive to the river environment due to in-situ backfilling with the use of existing silt.

6. Pier Scour Protection

As the pier is affected by the fluvial process, natural scouring and accumulation can occur. Especially when the bridge crosses the rushing river, and it often encounters floods, the riverbed of its pier, abutment or foundation can be subjected to intense erosion for a long time. This results in continuous loss of the soil coverage and the exposure of the bridge foundation, which can affect the stability of the bridge as a whole and even cause the bridge to fall. In recent years, under the influence of climate change, heavy rainfall and flood events are more frequent, and bridge erosion protection requires more effective solutions.

ACETube®
Geotextile Tubes for Coastal Protection

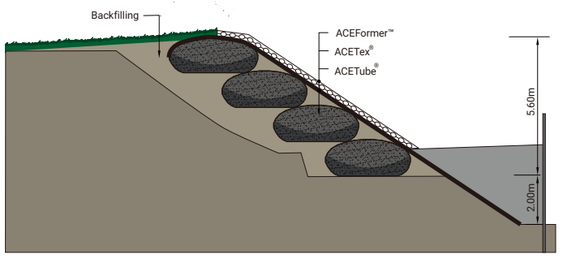


ACEFormer™
Geotextile Mattresses Grouted with Cement Mortar for Surface Protection

Before | After

Flexible ACETube® geotextile tubes or ACESandbag™ geotextile bags hug bridge piers and other monopile or gravity foundations, barring the underwater shearing of soil around the piers. The protection methods employed are further fortified with protective ACEFormer™ geotextile mattresses cover.

After the geotextile tube is filled with the riverbed soil and stones, it can be stacked around the foundation of the pier, which can form a flexible structure that is resistant to water flow scouring and can stabilize the foundation of the pier.



The geotextile tube can be constructed in a curved section according to local conditions, and the construction is easy and fast. Meanwhile, the fabric form can be laid on the outer layer of the stacked geotextile tube.

The fabric form is filled with cement mortar to enhance the impact resistance and avoid damage by foreign objects, and it can slow down the coastal water flow due to its large surface roughness, so as to increase the rate of river bed siltation, and indirectly achieve the effect of river rectification. Overall, the effect of bridge foundation protection can be brought into full play.

ADVANTAGES :

- The flexible bag structure can be flexibly applied to different terrains according to the local conditions, thus helping create a sustainable green environment for energy saving and carbon reduction.
- The materials can be used directly at the time of construction, and there is no need to purchase additional sand and gravel, or excessive equipment and manpower, which can save costs.

REFERENCE 1

Protection of Pier Foundation of Zhongsha Bridge at Zhuoshui River

Changhua, Taiwan

2015

ACETube® ACEFormer™

2015 IFAI Award of Excellence

After decades of use, due to continuous and severe erosion over a long term, some pier foundations and surrounding areas of Zhongsha Bridge have been extremely unstable and need to be dealt with immediately.

Adopt the scouring protection system composed of the ACETube® geotextile tube and ACEFormer™ geotextile mattress.

A significant amount of cost of using expensive concrete materials can be saved. The flexible nature of the material allows it to adapt to different topography and local conditions, which not only makes engineering easier, but also helps the structure to adapt to the environment.

REFERENCE 2

River Bank and Pier Protection Project

Peru

2013

ACETube®

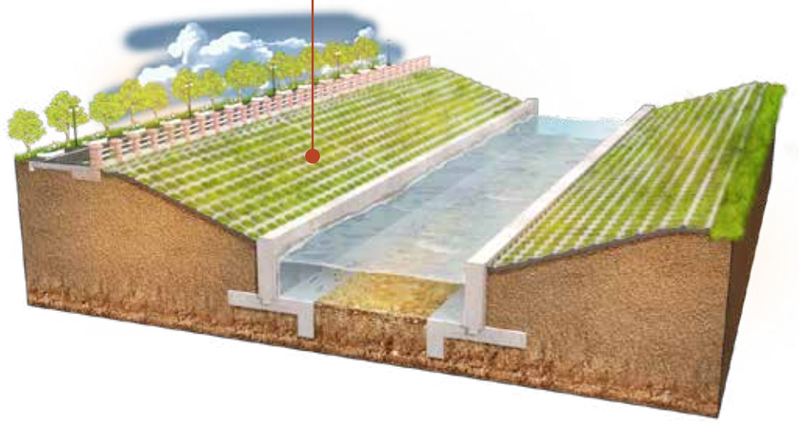
The long-term lateral erosion of the riverbank causes the slope to collapse continuously and the side slope on the bank to be nearly vertical, and as the vegetation cannot grow, it poses a threat to the stability of the riverside roads and the bridge along the river bank.

The ACETube® geotextile tubes in different sizes are stacked on the bank slope and around the pier to form a revetment, and the ACETube® geotextile tubes are stacked on the upper part of the river bank to form several layers that increase the revetment height. A total of 2,050 geotextile tubes in three sizes are mainly used.

In addition to adjusting the river environment, extensive use of existing silt to fill the ACETube® can also save a lot of cost and time for material purchase, transportation and installation. The ACETube® is a flexible material. It can be installed and adapt to different terrains and local conditions; the flexible structure formed after filling has good resistance to water flow scouring.

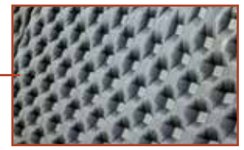
7. Revetment

Owing to the current action, the river banks are prone to erosion. Especially when the flood passage section of the river is insufficient, when it is raining, the floods can easily scour and destroy the river bank slope. Revetment structures are built to protect slopes, banks or cliffs against erosion.



Before

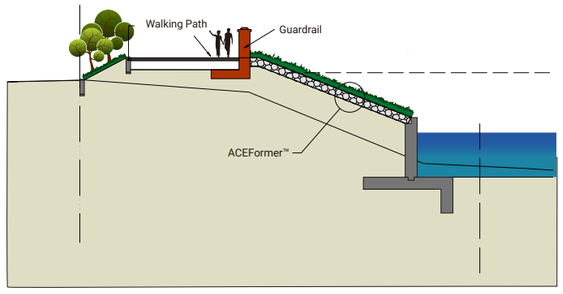
After



ACEFormer™
Geotextile Mattresses Grouted with Cement Mortar for Surface Protection

ACELiner™
Geosynthetic Clay Liners Consisting of Two or Three Layers of Geosynthetics Enclosing a Layer of Sodium Bentonite

Geosynthetics have multifunctional purposes in coastal revetment construction including toe scour protection, filtration, drainage, and separation. Several cost-effective ACE geosynthetic options exist that frame riverbanks, curtailing erosion and protecting riversides and adjacent structures from destructive flow velocities apparent in rivers during storms and floods. ACE revetment systems incorporate ACETex® geotextiles or ACETube® geotextile tube structures to stabilize and reinforce embankments and are further fortified with ACEFormer™ geotextile mattresses or ACEMat™ erosion control mats armor.



In order to prevent the erosion of the slope and the loss of soil, using the ACEFormer™ as the revetment is a very effective solution. ACEFormer™ are two-layer and high-strength geotextile mattresses grouted with cement mortar or concrete. The geotextiles are able to accommodate different landforms, and provide a formwork to construct a surface protection structure. With the filling material, the ACEFormer™ system provides an effective shield and medium against erosion, and to reduce the wave energy and flow velocity on the applied surface.

ACEFormer™ is very different from the traditional steel formwork. It contains the interconnected bag space for filling cement mortar. When the mortar is solidified, a rigid panel is formed for protection. As it is not like the general formwork that needs to be removed after grouting, it can save working hours.

The ACEFormer™ is available in a variety of thicknesses, permeable areas and surface finishes. If you want to enhance the anti-leakage ability of the lining building, you can use the ACELiner™ Geosynthetic Clay Liner. If it is combined with the vegetation, a vegetative fabric form can be used, which is equipped with openings to spray grass seeds and increase the surface area for plant growth.

ADVANTAGES :

- Strong, durable and resistant to water erosion.
- Simple and quick installation to reduce construction time and costs.
- Reduce the usage of costly materials to save money.
- Many types and filled thickness to suit diverse project needs.

REFERENCE 1

Riverbank Protection, Niaosong Canal

Kaohsiung, Taiwan

2010

ACEFormer™

The "Niaosong Canal Widening and Improvement Project" was set to:

- Resume the discharge capacity of flood control.
- Reduce the risk of flooding.
- Ensure the safety of local residents and their properties.
- Promote favorable land appreciation.

In addition, the construction also entitled the canal to become an eco-friendly environment and a water-accessible area.

Pursuing the objectives of the project, the designer came up with a good idea of using ACE Revetment Composite System to meet all the requirements in one solution. To overcome the scouring, reinforced concrete (RC) revetment was used for the area below the water level. The revetment was then backfilled with engineered fill, sloped upward and backward to the pavement grade. To prevent the erosion of surface run-off and to minimize the possible harsh destruction due to overflow or flooding, ACEFormer™ Vegetation Type (V Type) geotextile mattress was placed on the backfilled surface. Different from traditional concrete structure, ACEFormer™ not only provides a durable surface for scouring resistance, but also offers spaces for vegetation to grow.

The initial palish gray surface of the ACEFormer™ has been changing to rich fresh green and a variety of local species have been observed on site. Although the site has experienced several challenges of strong typhoons and torrential rainfalls, the canal stays stable and the flooding damages have ceased completely.

REFERENCE 2

Lakeside Revetment

Prahova District, Romania

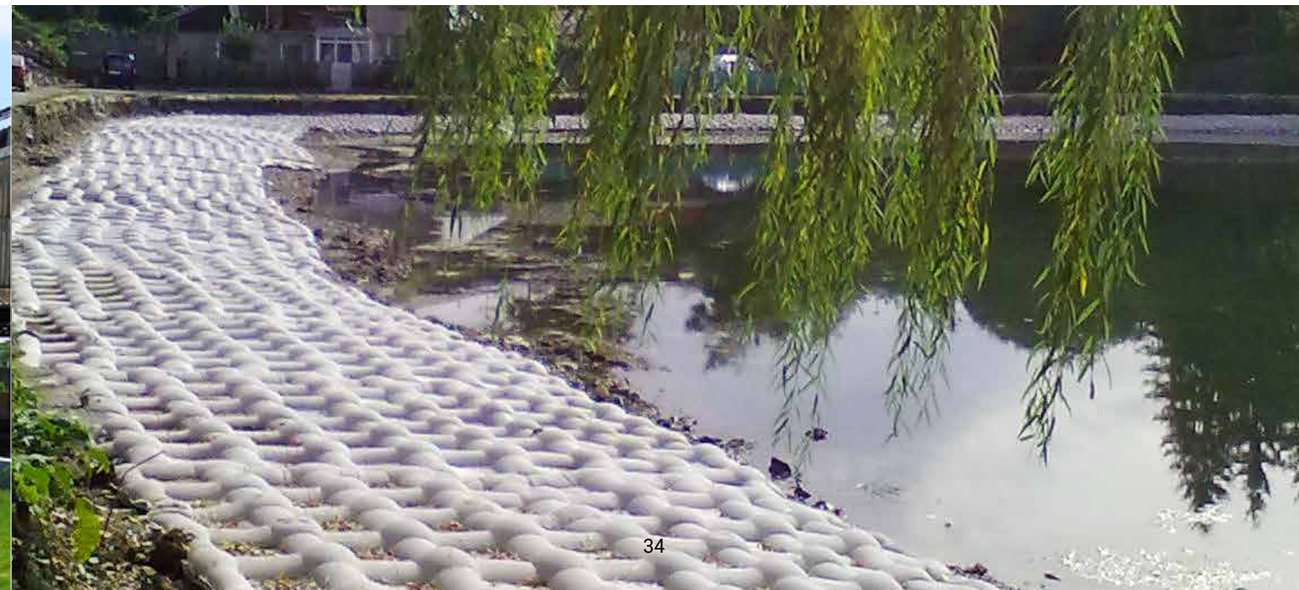
2011

ACEFormer™

In a leisure zone planning area located in Prahova District, Romania, there was a severe landslide caused by heavy erosion which imperiled the houses and buildings and building around the lake. On the other hand, disordered growing vegetation was another issue associated with the planning area. A solution which would protect the community and residents from further dangers of erosion as well as beautify the planning area was immediately required.

The best solution was to construct the revetment with ACEFormer™ Vegetation Type geotextile mattresses. This easy and quick method could shorten the construction time after the water in lake was drained out.

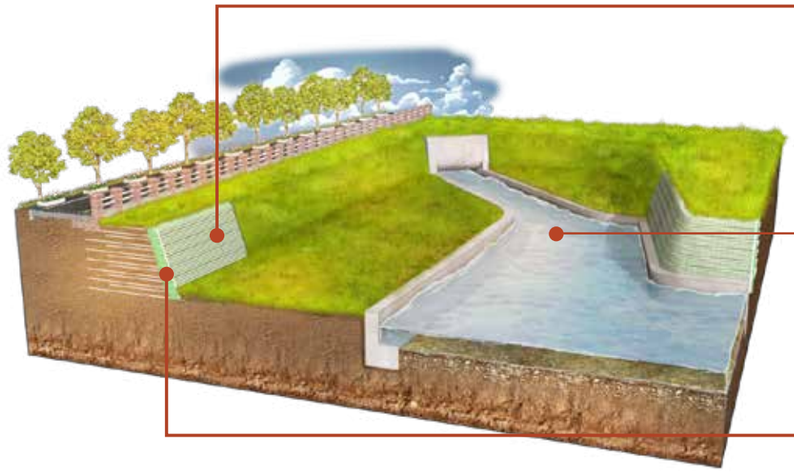
The ACEFormer™ act as a strong cover layer on the eroded area, and counteracts attacks from water to prevent landslides. The special design of ACEFormer™ Vegetation Type would also crop landscaping plants to avoid the wanton growth of weeds.



8. Flood Detention

The urbanization or the development of watersheds will result in the failure of existing drainage facilities or the reduction of protection standards. The extreme weather will not allow immediate venting of heavy rains, resulting in excessive surface runoff and flooding. The probability of flooding will become high and harm people's living space, thereby leaving people's livelihood in trouble. Therefore, various flood control measures should be properly planned to effectively control storm runoff, and setting up a flood detention pond is one of the important practices.

Before



After

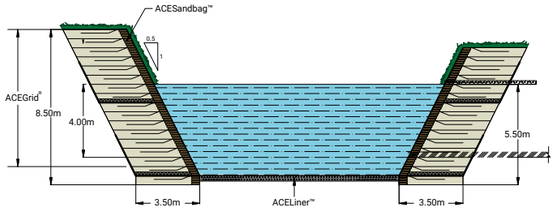
ACEGrid®
Flexible Woven PET Geogrids for Soil Reinforcement

ACELiner™
Geosynthetic Clay Liners

ACESandbag™
Durable Sandbags for Erosion Control

Flood detention pond often installed in the storm runoff area to temporarily store surface runoff, which has the effect of reducing and delaying flood peak flow, and can reduce the impact of flood on downstream low-lying areas. Today, there are extreme climate threats everywhere in the world, and the importance of the flood retention pond is increasing.

In addition to the general flood retention function, the flood detention pond can also be used as a recreation space. The construction of the flood detention pond with the Wrapped Around Reinforced Retaining Wall can directly use the excavated soil in the field, and the construction is convenient, so the construction cost can be reduced, the construction period can be shortened, and the earthwork balance can be achieved. As the surface can be planted, it is more beneficial to the creation of a recreational space. If we want to strengthen leakage resistance at the bottom of the pond, we can use the ACELiner™ Geosynthetic Clay Liners.



The mechanical effect provided by the geogrid is a stable "apparent cohesion," which is also the main stabilization mechanism of the soil reinforced structure. The geogrid will not be damaged by water soaking, and the soil that is surrounded by the geogrid will not be lost, so the reinforced structure can maintain stability.

The geogrid has the function of strengthening the soil, which can make up for the insufficient shear strength or tensile strength in the soil. The layered configuration can increase the friction between the material and the soil layer to strengthen the soil. Therefore, the reinforced retaining wall can have a larger slope degree than the natural slope, and increase the flooding capacity of the flood retention pond.

ADVANTAGES :

- It introduces the flood peak flow into the pond to delay the discharge time, effectively alleviating the burden on the overall drainage system in the original area.
- It can directly use the excavated soil in the field to save material purchase and handling costs.
- It is convenient for construction, which can greatly reduce construction costs and shorten the construction period.
- It helps create an ecologically green environment that allows the original flora and fauna to have a good habitat.

REFERENCE 1

Geosynthetic Detention Basin at Shalu Interchange

Taichung, Taiwan

2015

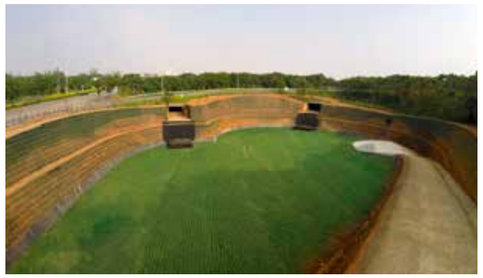
ACEGrid® ACESandbag™

2016 IAA Award of Excellence

In order to control the floods in the region for a long time, it is proposed to set up a disaster-proof flood detention pond that can accommodate and effectively delay stormwater runoff.

The green space in the northern upper circle of the National freeway's Shalu Interchange is used to dig and construct a detention pond in the stable gravel layer. The pond wall is reinforced with the ACEGrid® geogrid and the ACESandbag™ erosion control bag to hold the local earth and stones.

It is a wrapped-around reinforced structure constructed by using a large amount of excavated earth and stones. In addition to being equipped with the flood detention function, it can also effectively reduce the costs. We set up disaster prevention facilities in idle spaces to effectively address the threat of regional flooding. The stiffend slope has a good vegetative effect, so that the space can still retain the original green landscape.



REFERENCE 2

Detention Pond Under the Shalu Overpass of Freeway No. 3

Taichung, Taiwan

2014

ACEGrid® GG ACEDrain™ S

The flooding problem of Shalu District mainly resulted from the drainage construction was unable to catch up the speed of regional development and the construction projects on the area increase rapidly, making impervious areas and the surface runoff increased as well.

The treatment plan included using the spare space between bridge piers under the Shalu overpass of the Freeway No. 3 located to construct a detention pond with 1,026m³ volume.

The construction utilized local materials, natural granular backfill to form mechanically stabilized earth (MSE) wall as the wall structure around the detention pond. The bottom of detention pond uses RC raft foundation. Every 4 m vertical height of the MSE wall lays out light gravel drainage layer with horizontal and vertical ACEDrain™ geocomposite drainage panels of 2 m spacing, so that the seepage water in the soil layer behind the slope is diverted into the pond to release the water pressure and to maintain the long-term stability of the reinforced slope. Moreover, the reinforced slope uses durable erosion control bags which are filled with in-situ selected soils and staked on the slope with ACEGrid® GG geogrids wrapping around, allowing the slope to have stable foundation for vegetation and to reach the effects of greening and ecological friendliness.

The detention pond allows surface runoff to be stored temporarily within it and thus achieves the effect of flood storage; moreover, it is able to reduce flood peak flow produced by rainstorm or delay the arriving time of peak flow, and then decrease flooding condition of low-lying district downstream during rainy seasons. Using mechanically stabilized earth (MSE) on this construction not only fulfills the basic demand of security and economy in civil engineering but also conforms to the current trends of carbon reduction and ecological sustainability pursued by the engineering industry.

REFERENCE 3

Ecological Landscape Park with Function of Flood Detention, Pinglin Forest Park

Taichung, Taiwan

2015

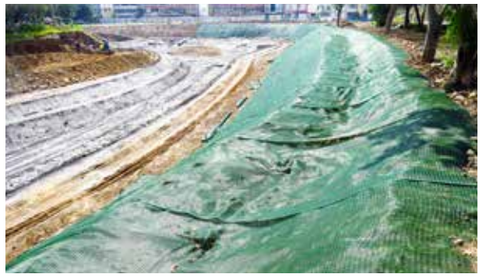
ACETex® ACEMat™ ACESandbag™

2016 FIABCI-Taiwan Real Estate Excellence Award

The old military camp site is revitalized and built into a multi-purpose ecological park with landscaping, rest and flood detention functions. It is planned to be a 3.7 hectare original forest park and a 32,000 m3 ecological flood detention pond.

ACETex® geotextiles and geosynthetic clay liners are laid under the flood detention pond, pile up pebbles at the bottom and the lower half of the slope, and stack the upper half of the slope with the ACESandbag™ Erosion Control Bags. Also, we use the ACEMat™ Turf Reinforcement Mats to carry out erosion protection and planting on the slope of the park.

The occurrence of flooding is greatly reduced, and the recreational and sightseeing space is created to enhance the quality of nearby living environment. The park can adjust the microclimate of the adjacent area, reduce the heat island effect, improve air pollution, and improve the overall quality of life of the local people.



REFERENCE 4

Maple Garden, a Recreational Park with Function of Flood Detention in the City Center

Taichung, Taiwan

2012

ACEGrid® ACETex® ACEMat™

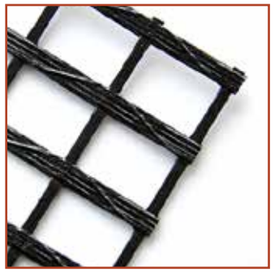
2014 FIABCI World Prix d'Excellence Award

2013 FIABCI Taiwan Real Estate Excellence Award

The base covers an area of about 30,000 square meters. Because the originally planned project was terminated in the early stage, a large depression was left in the base. It has been re-planned and transformed into a multi-functional ecological park that combines functions of landscaping, ecological protection, exhibitions, flood detention, drainage and air quality adjustment, and has become another well-known new attraction.

The slope around the park is a Wrapped Around Reinforced Soil Structure constructed with ACEGrid®. The pebbles are laid at the bottom of the flood detention pond and the overlying ACETex® Geotextile is used as a filter layer, and the upper part is protected by gabions and erosion control mats.

The park is designed to accommodate floods in the volume of 200,000 m³. Upon completion of the project, it has effectively exerted the function of flood detention and flood control when it was hit by strong typhoons several times. Nearly 400 arbor trees and shrubs that cover an area of 16,000 m² were planted in the park to add 28,000m² of green space to Taichung City, effectively reduce the heat island effect and make it the multi-functional urban lung. The park not only provides better protection for the safety and quality of life of the people, but also further enhances the tourism industry in Taichung and promotes regional economic prosperity.



ACEGrid® Geogrids

ACEGrid® is woven from high-strength polyester fiber bundles (PET) for soil reinforcement. The mesh size and structure are adjusted according to the product specifications. In addition to the anti-UV protective film, the outer layer may also be added with flame retardant components to improve fire resistance and durability.

ACETube® Geotextile Tubes

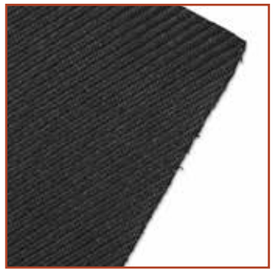
ACETube®, a large-sized tubular bag made of the polypropylene (PP) geotextiles, can be filled with sand and stones to form a gravity structure, which is usually used to construct various types of structures for shoreline protection. The bag material has good durability, good water permeability, sediment retention efficiency, and good workability, and as it can be filled with in-situ materials, it can also greatly reduce the construc-tion cost.

ACETex® PET Geotextiles

ACETex® PET is woven from high-strength polyester fiber bundles (PET) to exhibit high tensile strength at low strain. It has the functions of reinforcement and separation, and can be widely used for soft soil improvement, base stabilization, and weak foundation reinforcement, etc.

ACESandbag™ Geotextile Bags

ACESandbag™ is highly robust geotextile bag for forming temporary or permanent structures in hydraulic and geotechnical engineering, erosion control and facility protection. The sizes and shapes of ACESandbag™ can be customized to satisfy the desired purpose. The bag material is resistant to ultraviolet rays, water permeable, and easy for construction, and the filler can be taken locally.



ACETex® ES Geotextiles

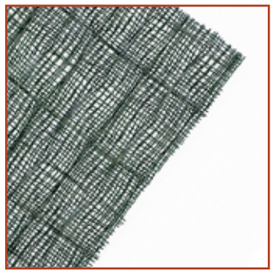
ACETex® ES is woven into a special structure with self-developed polypropylene (PP) yarns. It has high stiffness and high water permeability. It can also have excellent separation, filtration and reinforcement functions. It is especially suitable for road subgrade stabilization and base reinforcement. It can improve road safety and extend its service life.

ACEFormer™ Geotextile Mattresses

ACEFormer™ consists of two layers of high-strength geotextiles for slope, river bank and pipeline protection. It is filled with cement mortar, and a rigid protective layer can be formed after consolidation. Different types can be designed according to environmental requirements, and all will have the advantages of easy construction and good adhesion to the protected object.

ACETex® NW Geotextiles

ACETex® NW is nonwoven geotextile made from either polyester continuous filament yarns by needle-punched manufacturing process; or polypropylene staple fiber by needle-punched manufacturing process with thermally bonded surface.



ACEMat™ R High Performance Turf Reinforcement Mats

ACEMat™ R is a three-dimensional fabric woven from high-strength polypropylene (PP) yarn has a quadrangular pyramid structure that interlocks with the soil, protects the soil surface from erosion, and retains plant seeds and roots to promote planting. It provides an efficient solution for erosion control in exposed steep slopes and heavy rain areas.

How Quality is Achieved?

1.Expertise

ACE Geosynthetics has more than 40 engineering experts with different professional knowledge covering geotechnical engineering, hydraulic engineering, marine engineering, environmental engineering, landscape engineering, construction management, mechanical engineering, chemical engineering, material engineering, textile engineering, and so forth. These professionals are primary keepers of all production and operation at ACE, to ensure all in coming tasks are well interpreted, evaluated, processed, and produced.

2.Quality Management

The fundamental quality management system of ACE Geosynthetics is recognized and certified by ISO 9001 and 9002. With the basic guideline of ISO 9001, ACE Geosynthetics further obtained CE Marking, BBA Approvals, and NTPEP Qualification Report for its final product(s).

3.In-house Certified Laboratory

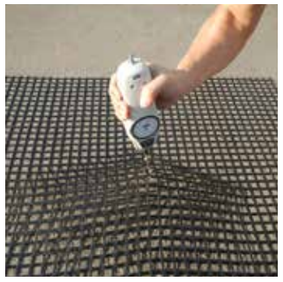
There is an in-house civil engineering laboratory to carry out a series of professional tests for research and development and product quality control purposes. The laboratory is certified by TAF (Taiwan Accreditation Foundation), and is further recognized with the ILAC Laboratory Combined MRA Mark as shown below:

ilac-MRA

TAF
Civil Engineering Laboratory
2285

FACTS

With premium grade yarns and cautious production process, the physical and mechanical properties of ACE products are as good as expected. Besides regular tests in the lab, various long-term and short-term experiments for the inherent physical property, mechanical property and long-term design property of product are also carried out. Tests like UV test, chemical resistance test, seawater immersion test, cement soil burial test, PVA geogrid anchoring test, adhesion test with asphalt pavement, oxidation test, filtration test, abrasion test, and many other tests have been done (or in the process of doing).



Adhesion Test

Filtration Test

Outdoor Exposure Test

Anchoring Test

Cement Soil Burial Test

Oxidation Test

Seawater Immersion Test

Chemical Resistance Test

Why Choose ACE Geosynthetics?

Since 2006

Since 2003

Participation in relevant associations

International awards

Countries where our products are sold

6 Continents

70 Countries

A diverse team with 20 years of experience

Patent Portfolio

Issued Patents 60+

Countries 25

Published Papers 56

Annual Participation 10+

Journal publications, exhibitions, seminars

From product development/ manufacturing to processing

Professional Ability

Integration Ability

Quality Assurance

From engineering planning and design analysis to construction

International Certification

BBA

GOSTR

TAF

ISO9001

CE

NTPEP

ISO14001

ISO50001

ISO14064

Geogrid Carbon Footprint Assessment

Geotextile Tube Carbon Footprint Assessment

Reinforced Embankment Carbon Footprint Assessment

Would Like to Know More about Geosynthetics?

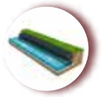
Come to Explore and Learn Geosynthetic Applications in ACE Geosynthetics Ecopark!

ACE Geosynthetics Ecopark is organized and constructed by ACE Geosynthetics with total area 10,000 m² to demonstrate various geosynthetic applications in civil engineering. The concept of considering the sustainability of both engineering and environment is influencing the contemporary engineering methods. As issues of traditional engineering methods and environmental impacts keep arising, geosynthetics is gradually becoming the preferred solution for the broad civil engineering application. It is proven that constructions can be easy and environmentally friendly with geosynthetics.
When visiting our educational Ecopark, you are capable to find out over 20 applications built in actual dimensions (1:1) with vivid demonstration. This Ecopark is not only to demonstrate the geosynthetic applications but also to achieve the educational purpose to make more people realize the benefits of applying geosynthetics to our environment.

Welcome to visit ACE Geosynthetics Ecopark to explore more about geosynthetics!
http://www.acegeosyntheticsecopark.com/

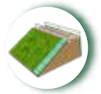
Reinforcement

1. Segmental Precast Concrete Panel Facing
2. Cast-in-place Concrete Facing
3. Modular Block Facing
4. Gabion Facing
5. Wrap-Around
6. Wire Mesh Facing



Shore Protection

16. Ecological Tank
17. Geotextile Tube
18. Geotextile Mattress
19. Sand Bag
20. Modular Block
21. Masonry Block
22. Riparian Tank
23. Gabion with Geotextile Bag
24. Reinforced Levee



Erosion Control

13. Geomat
14. Rectangular Pyramidal Geomat
15. High Strength Geomat

Landscape

25. Footpath Pavements
26. Landscape Facility

Other Applications

7. Basal Reinforcement of Railway
8. Monitoring System
9. Pavement Reinforcement
10. Waste Landfill
11. Rainwater Harvesting System
12. Ecological Pond

ACE Geosynthetics

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Note: The information provided herein is accurate to the best knowledge of the company and is given out in good faith. All the information contained is intended as a general guide only to use of such products and we do not accept liability for any loss or damage however arising, which results directly or indirectly from use of such information. ACE Geosynthetics has a policy of continuous development thus information and product specification may change without notice.

2020/06