ACE Geosynthetics

CASE STUDY COLLECTION

Sustainable and Reliable Solutions

ACE Geosynthetics, founded in 1996, is the leading geosynthetic solution provider in Taiwan with worldwide reputation. Upholding the ethos of **A**ccuracy, **C**ollaboration, and **E**fficiency, we offer a comprehensive range of services that covers from the initial stage to the completion of work: site evaluation, design recommendation, material supply, and installation guidance. Safety, economic, and environment are our main consideration while delivering innovative and integrated solutions for engineering needs. ACE Geosynthetics not only stands for reliable solution provider, but also a trustworthy business partner in the geosynthetic society.

Our Vision

To be a Reliable Geosynthetic Solutions Provider for Sustainable Environment.

Our Mission

We strive to develop, manufacture, and promote quality geosynthetics and services to solve engineering problems with considerations of safety, economy, and environment.

Solving engineering problems with sustainability through the advantageous geosynthetic solutions of ACE.

Earthwork Construction

Roadway and Railway Construction

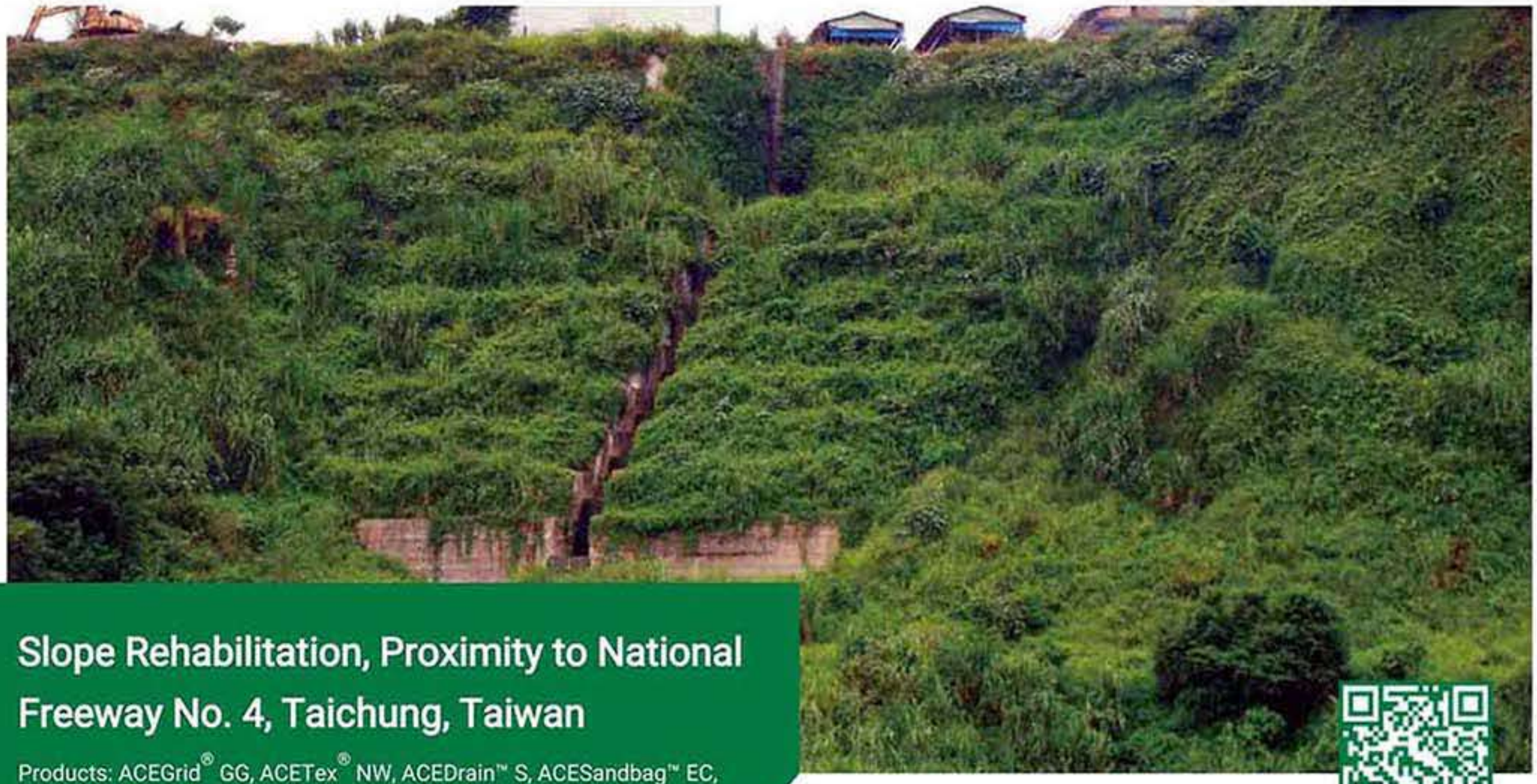
Marine and Coastal Structures Construction

Riverbank and Channel Protection

Environmental Protection

Erosion Control

Flood Control

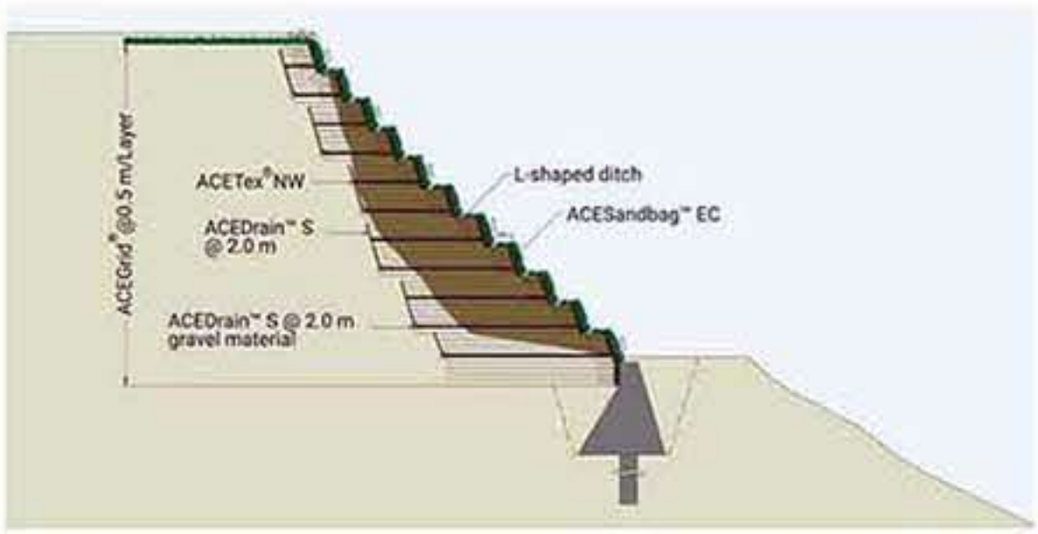


Slope Rehabilitation, Proximity to National Freeway No. 4, Taichung, Taiwan

Products: ACEGrid® GG, ACETex® NW, ACEDrain™ S, ACESandbag™ EC, ACEPin™ T

A devastating earthquake struck the site and caused severe damage to the slope and its drainage system. Large amounts of gushing water coming from heavy rainfall led to surface erosion and slope failure. The slope was 30 m high with an average gradient of 70°, consisting of red clayey silt intermixed with gravel, sensitive to water content variation. Rehabilitation aims to stabilize the slope, prevent future seismic damage, surface runoff, and groundwater seepage.

To ensure safety, durability, and sustainability, a reinforced earth slope (RES) composite system was used to rehabilitate the slope damaged by a devastating earthquake. Secant piles and toe berms were installed at the toe to provide sufficient base support, and 11 tiers of RES made of ACEGrid® geogrids and in-situ soil were placed in sequence up to the crest. Each tier was 3 m high with an inclined ratio of 1:2 (H:V) and wrapped with geogrid facing. ACEDrain™ S drainage board, pipes, and nonwoven geotextiles (ACETex® NW) were used as the intercept system to dissipate seepage. Longitudinal and horizontal trench systems were installed to facilitate surface runoff drainage. Slope face protection was achieved using soil-filled and hydro-seeded sandbags.

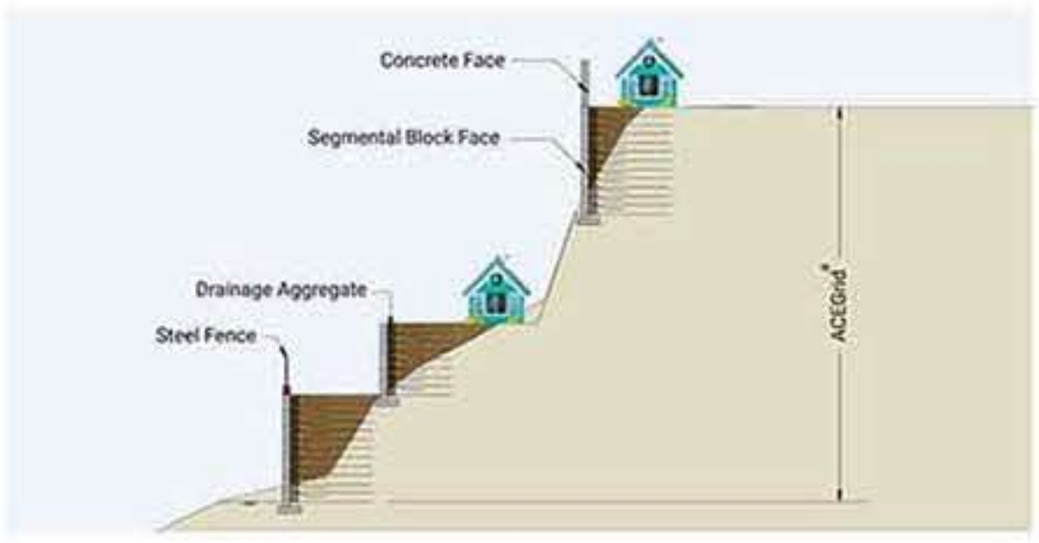


The project has visually integrated into the environment through the vegetation growth. The aesthetic appearance, togethering with a variety of local species observed on site, has demonstrated an eco-friendly capability of the system. In addition, the completed reinforced earth slope has remained in good condition through many extreme weather conditions since its completion. The result shows that it is a safe, durable, aesthetic, and sustainable solution for slope stabilization.

Construction of MSE Retaining Wall for Residential Safety, Mexico

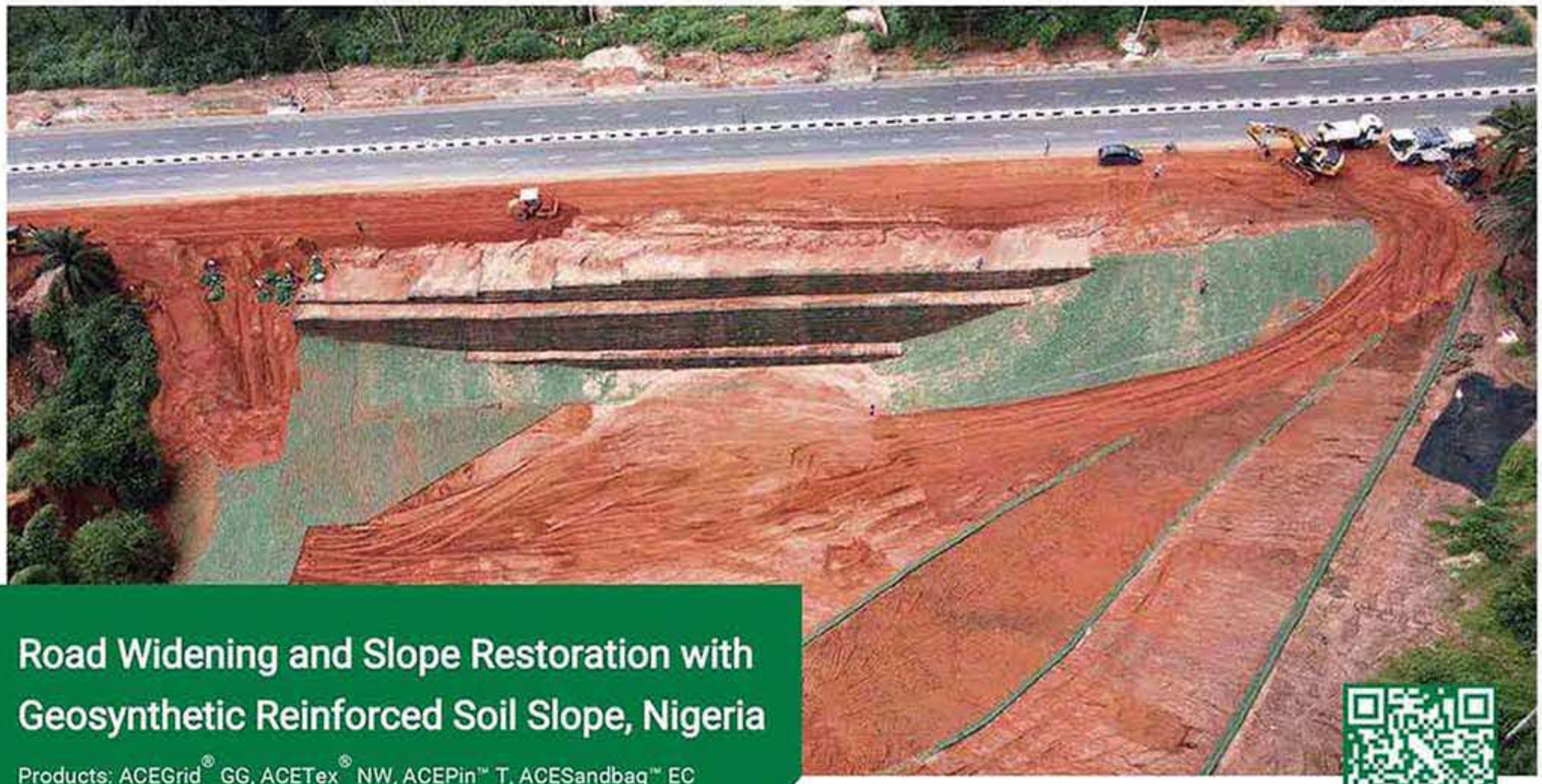
Products: ACEGrid® GG

The project planned to develop a residential housing complex in a mountainous area where rugged terrain was typical. Substantial leveling of the site was required for engineering safety. Multi-level and cantilever retaining walls were conventional solutions but had drawbacks such as vulnerability to differential settlement, seismic damage, and cost. Reinforced concrete structures were also time-consuming to construct.



The ACEGrid® mechanically stabilized earth (MSE) wall proved to be a cost-effective and efficient solution for the residential housing complex project. It integrated cut, fill, and retaining phases into one step, allowing for precise site preparation. The compacted fill reinforced with ACEGrid® geogrids provided a seismic-stable structure, while multi-level reinforcement mitigated differential settlement. The more than 300-meter-long MSE walls varied in height from 7 to 12 meters according to the site's terrain. To ensure an aesthetically pleasing result, modular concrete blocks were chosen as the facing system, adding to the project's overall visual appeal.

The ACEGrid® MSE wall successfully performed its function, overcoming the terrain constraints on the site. The system not only leveled the foundation but also constructed a retaining structure in a single step. Constructing a residential housing complex in a mountainous area with rugged terrain presents challenges. However, with the aid of ACEGrid® geogrids, the compacted soil offers a robust solution resistant to seismic disturbances. The success of this mechanically stabilized earth system highlights its potential as a model for future development projects.

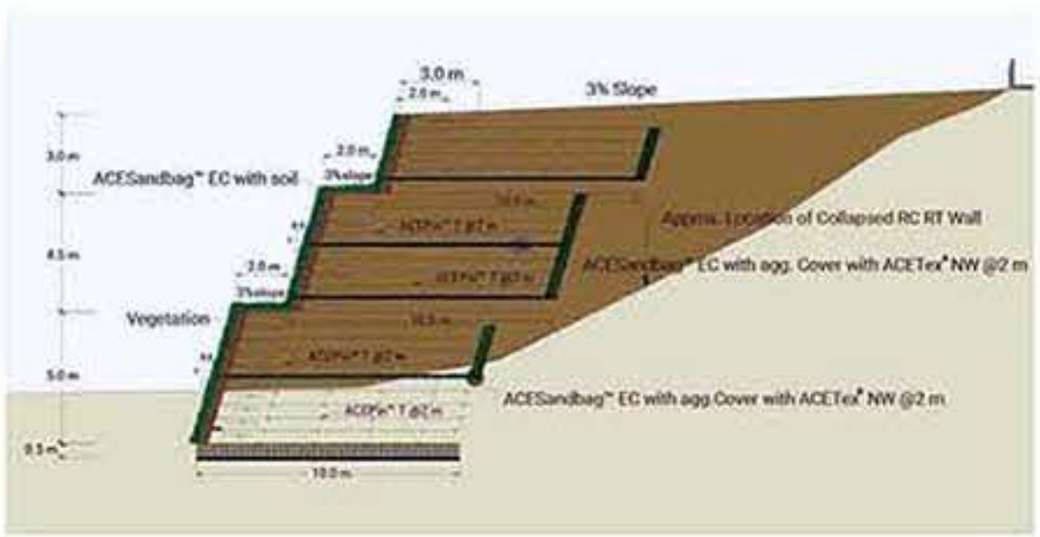


Road Widening and Slope Restoration with Geosynthetic Reinforced Soil Slope, Nigeria

Products: ACEGrid® GG, ACETex® NW, ACEPin™ T, ACESandbag™ EC

Reconstructing a key roadway in Nigeria is crucial for linking major communities and economic activities. This necessitates a technically sound and cost-effective solution with minimal to no maintenance demands. The area's primarily homogeneous, poorly consolidated soil is prone to uncontrolled surface runoff and erosion due to native vegetation exposing scoured by devastatingly high intensity rains. The solution must restore full access to the road and the economic value of the land.

To resolve the problems, steep slopes can be stabilized with planar polymeric reinforcing elements such as geogrids and woven geotextiles for the fortification of new and existing embankments. After thorough assessment of the ground conditions and utilizing the iterative trial and error process of the Bishop's Slip Circle Method, the proposed design of three tiers at a height of 5 m each with 1V: 0.2H slope was selected as it met the minimum performance criteria for the ACEGrid® GG150-I reinforced soil mass. An ACEGrid® reinforced soil slope about 80 m long, 10 m wide and the highest section at 15 m, was constructed to reclaim the slope and provide stable usable land for the pavement and drainage rehabilitation works. This type of retaining wall system required a much shorter construction time with the use of the in-situ fills.

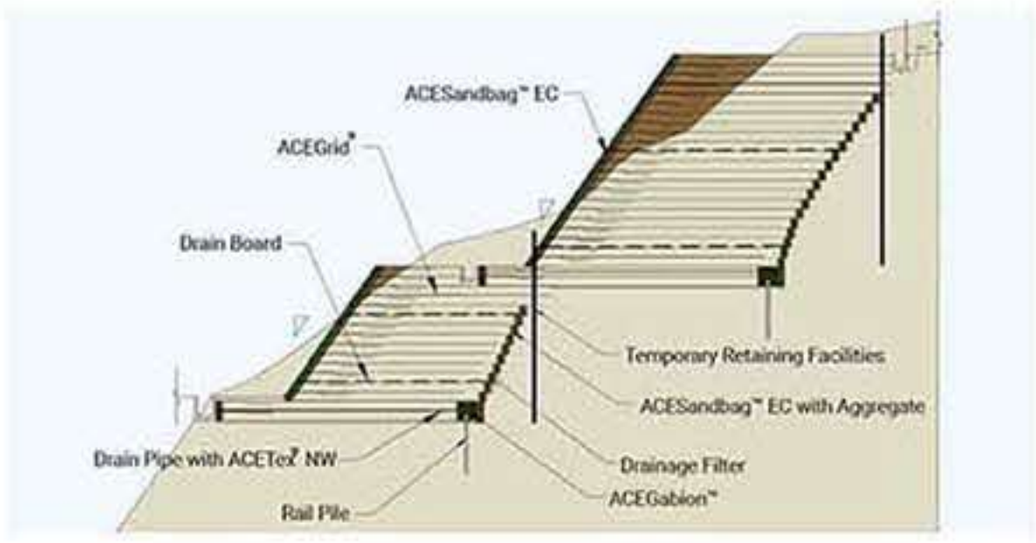


Polyester and polypropylene geogrids and geotextiles resist soil conditions and degradation are ideal for stabilizing slopes. Facing elements should prevent erosion and allow for vegetation. ACEGrid® is cost-effective due to reduced construction time and transportation. The project was also recognized in the top ten photo contest by the IGS Young Members Committee for its integration of engineering and aesthetics.

Reinforced Earth Slope, Tianliao Interchange, Freeway No. 3, Taiwan

Products: ACEGrid® GG, ACETex® NW, ACEPin™ T, ACESandbag™ EC ACEDrain™ S

Rehabilitation is urgently needed at the southbound exit of Tianliao Interchange, National Freeway No. 3 due to slope instability caused by frequent, heavy rainfall in the hilly terrain of Nan'an and Xide villages. Soft mudstone and poor vegetation exacerbate the issue and retaining secant piles have proven insufficient. Weathering has further weakened the mudstone, leading to a slide that endangers traffic safety. Thus, immediate rehabilitation must be conducted.



The owner and designer chose reinforced earth technology for slope restoration, using ACEGrid® and ACESandbag™ EC for unsuitable on-site soils as the slope fill. The 2-tier terrace slope with heights of 7 m and 11m had an embedded length of 12.5m and a design strength of 200 kN/m. ACESandbag™ EC was selected as the wrap-around facing to prevent surface erosion and facilitate vegetation. The drainage system was carefully designed to account for heavy rainfall and abundant groundwater, including gabions and sandbags with drainage boards to intercept seepage. All drainage elements were covered with geotextile filters to prevent settlement. The excavation for the second tier was cautiously conducted in limited volumes due to the site constraint and the soft geological formation.

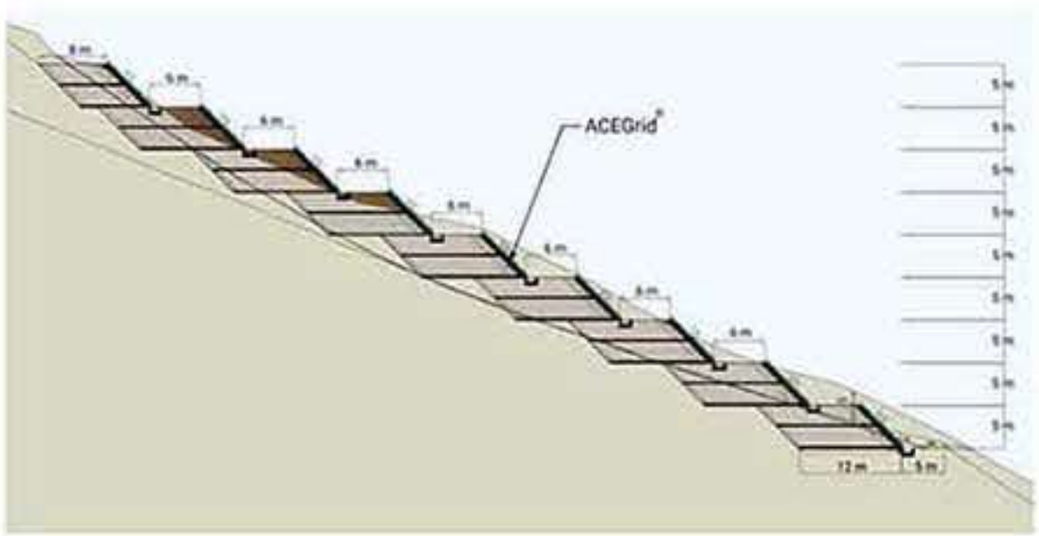
Rigorous soil compaction ensured sound quality and reduced disposal costs. This approach expedited construction, solved space limitations, and integrated the slope with the environment via vegetation growth. The slope's aesthetic design accommodates driving convenience and visual appeal. This eco-friendly project combines safety, a nature-like landscape, and ecological protection, showcasing reinforced earth technology's perfect combination. It was completed in under five months and shows no damage after several heavy rainfalls, ensuring excellent safety.

Landslide Repair of Ha Long - Van Don Expressway, Quang Ninh Province, Vietnam

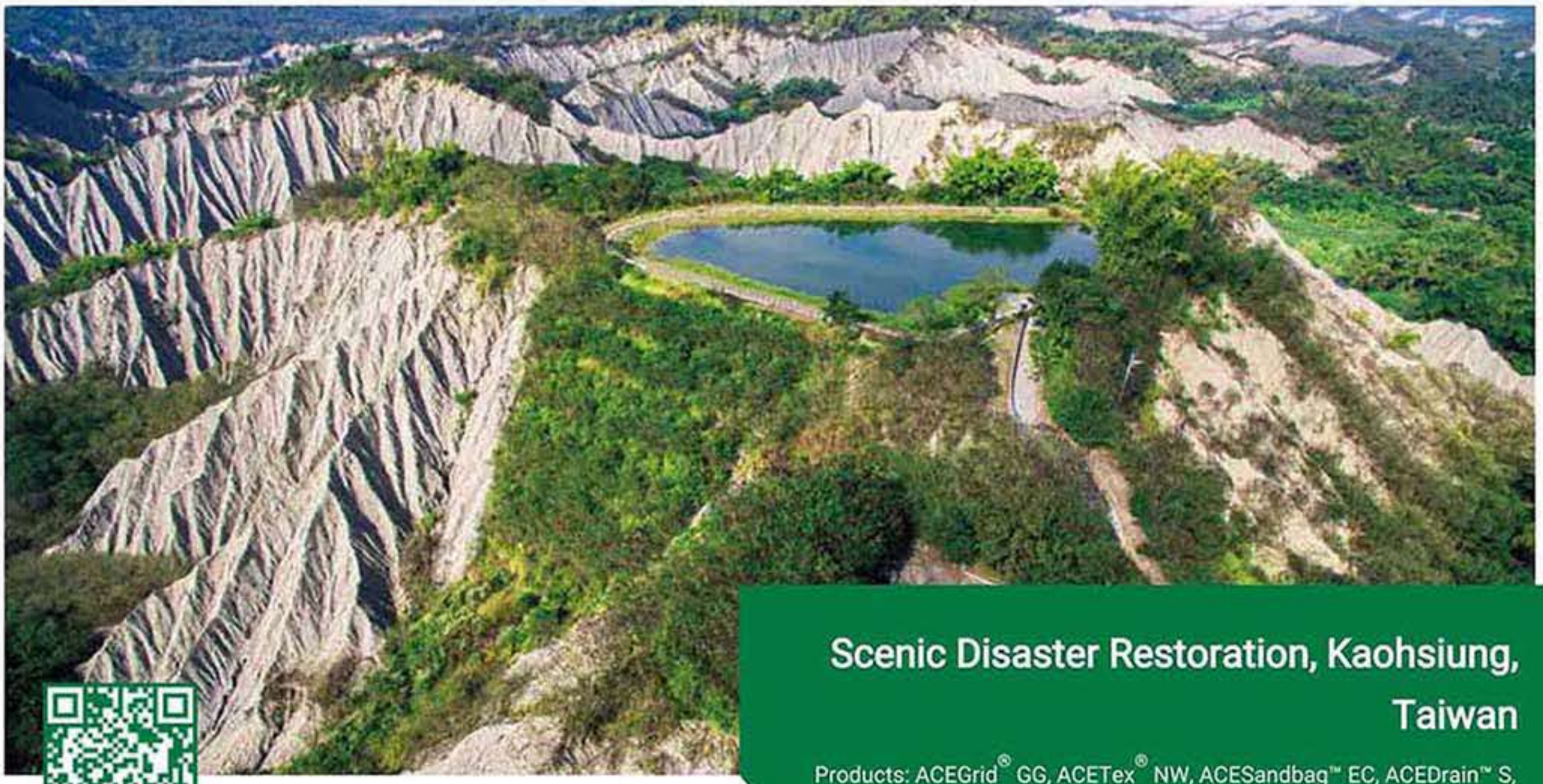
Products: ACEGrid® GG, ACETex® NW, ACESandBag™ EC, ACEPin™ T, ACEDrain™ S

The Ha Long - Van Don Expressway faced a major landslide due to bad geological conditions and prolonged rain. The landslide caused erosion and barrier lakes, with runoff and seepage as the primary factors, as the catch drain system was incomplete. As this expressway is vital to link Hanoi and Van Don Airport, a safe, sustainable, and eco-friendly repair method is necessary. Numerous slope surface protections were utilized due to the mountainous terrain and the importance of the project.

A Geogrid-reinforced structure (GRS) wrap-around with ACEGrid® was chosen to repair and strengthen the stability of this sliding slope and placed above the base of the slope that had with existing surface protection (covered with concrete brick/slab). This GRS was constructed in 4 to 9 sequential tiers and up to a final height of 45m with the embedded ACEGrid® length 8 to 12 m. The sequential tiers and embedded length of ACEGrid® ensured the height and stability of the structure. A drainage system was also installed at the top and inside the structure to effectively collect and drain the surface water and groundwater into horizontal and vertical ditches.



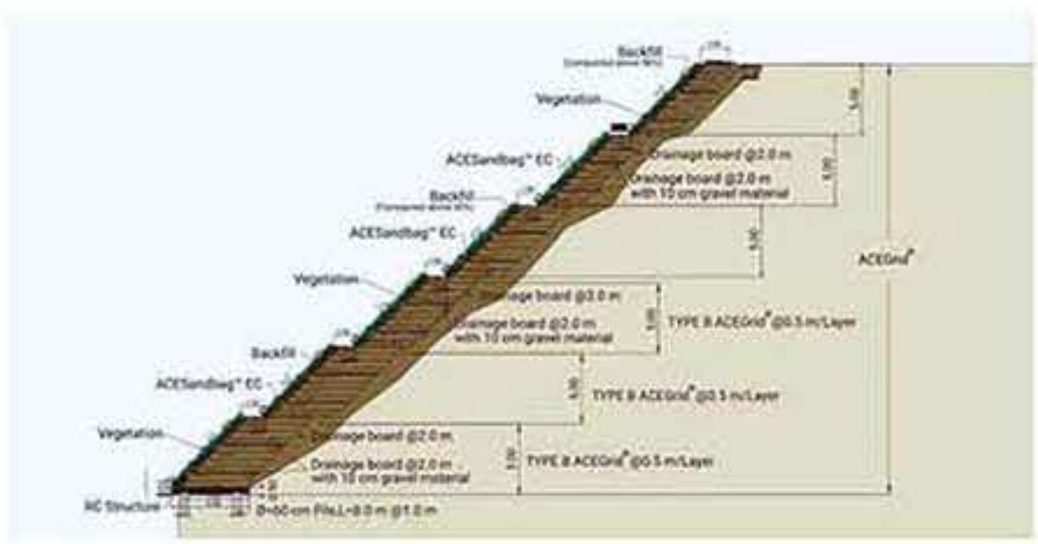
Simple construction machines and equipment, short construction time, low construction cost, the reuse of eroded soil in place, which could help cut costs for the purchase and transportation of soil from other places, green slope surface with natural vegetation, extremely low carbon emission, etc. These are the benefits of adopting GRS (by applying ACEGrid®) to a landslide repair. As a relatively new solution in Vietnam, the GRS for landslide repair has proven to be remarkably efficient compared to traditional methods.



Scenic Disaster Restoration, Kaohsiung, Taiwan

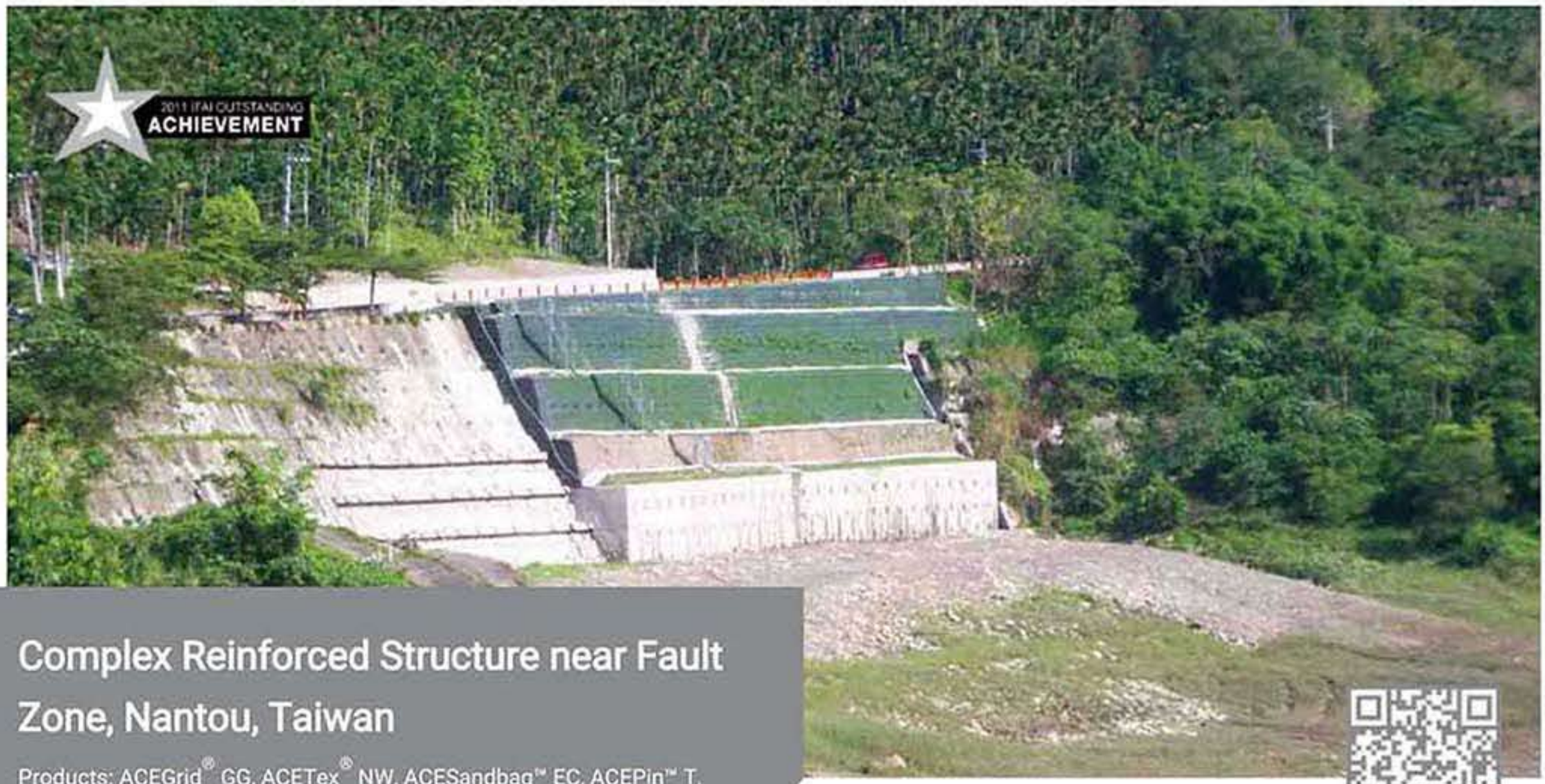
Products: ACEGrid® GG, ACETex® NW, ACESandbag™ EC, ACEDrain™ S, ACEPin™ T

The Moon World Landscape Park in southern Taiwan is a restoration project following typhoon Meranti in 2016. It features an observation platform with a wooden access staircase and an ecological lake pavilion. The typhoon's intense rainfall caused ground saturation and porewater pressure buildup, leading to slope failure by sliding. Surface erosion along the failed area further magnified the damage, resulting in the formation of deep gullies in several areas.



Reinforced concrete slab supported by 6m pile at 1m centers provided the stable base at the lower part of the slope. The rest of the slope was restored by constructing reinforced earth structure (RES) with ACEGrid® geogrids to reinforce the soil and increase its shear strength, ACESandbag™ EC for wrapped around facing and vegetation propagation, ACETex® geotextile and ACEDrain™ drainage geocomposite for subsurface drainage to reduce porewater pressure. Other used materials include ACE Gabions™, ACEPin™ T anchors. The overall construction reused the salvage soil from the failed slope to expedite the construction process.

The restoration of Moon World Landscape Park after Typhoon Meranti in southern Taiwan involved the addition of an observation platform and an ecological lake pavilion. To minimize the environmental impact of the restoration, a green engineering and green index approach was taken. The restoration was designed to restore the area to its original state of lush vegetation, resulting in a more natural and visually appealing landscape. With these methods, the project was completed with minimal disruption to the local environment.

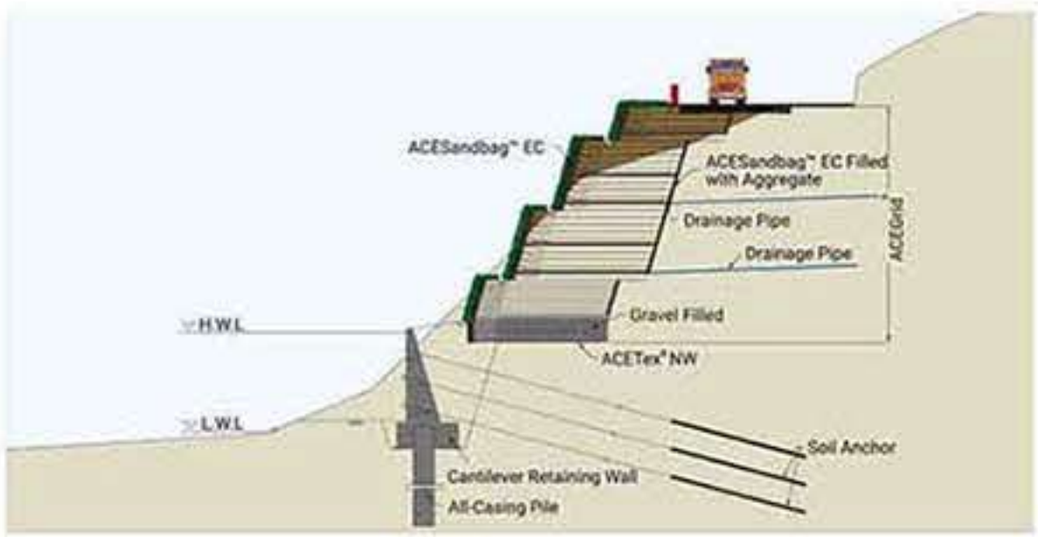


Complex Reinforced Structure near Fault Zone, Nantou, Taiwan

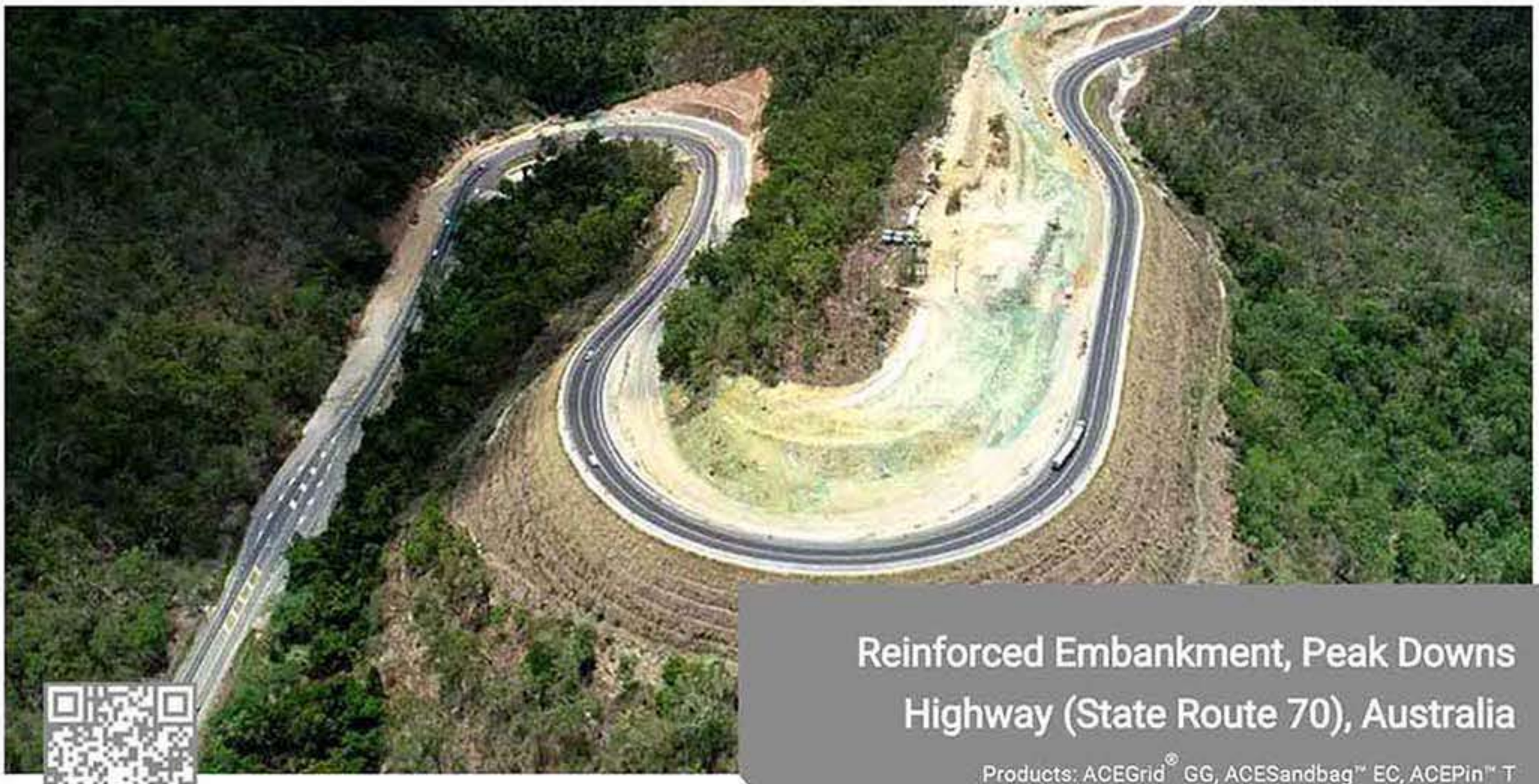
Products: ACEGrid® GG, ACETex® NW, ACESandbag™ EC, ACEPin™ T, ACEDrain™ S

This project in Route 131 in Nantou has poor geological conditions due to its location near several fault zones. In 2007, a significant landslide up to 80 m wide and 30 m deep occurred due to a torrential rainstorm, severely damaging the existing downslope structure being pulled out and exposed. The site's location in the water supply reserve area of Ming-Tan Reservoir also makes the toe of the slope vulnerable to scouring due to water level fluctuation.

A composite protection system was adopted for the rehabilitation of the slope after stability analysis. The project involved two stages. In the first stage, a pile-supported RC waterfront protection wall was built for the lower slope below the highest water level. Drilled concrete piles were used to support the 8.5 m-high wall, and ground anchors were installed for additional tie-back resistance. In the second stage, a wrap-around reinforced earth structure (RES), utilizing ACEGrid® geogrids, soil bags, and ACEDrain™ drainage materials were constructed in four tiers up to 17 m high. Stacked soil-filled bags were used for slope face protection and planting vegetation. Drainage systems were installed to effectively manage seepage and runoff.



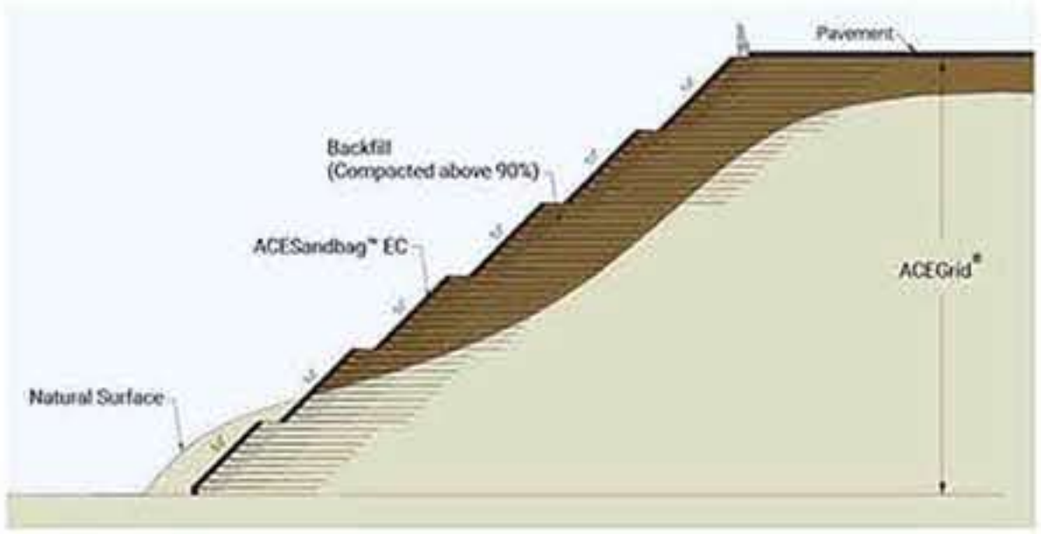
The reinforced earth structure with our products offers a straightforward, cost-effective solution. It can be built without the constraints of topography, utilizing common equipment and less specialized labor. The use of local collapsed rubble greatly reduced waste dumps. The structure's deformation rate declined from 0.03 mm/month to 0.007 mm/month within 6 months, demonstrating the effective control of sliding. This solution is a tailored solution for this project and proves advantageous for slope rehabilitation in similar circumstances.



Reinforced Embankment, Peak Downs Highway (State Route 70), Australia

Products: ACEGrid® GG, ACESandbag™ EC, ACEPin™ T

Queensland's Peak Downs Highway (State Route 70) was set to be widened to four lanes to accommodate heavy traffic. The Queensland Department of Transport and Main Roads (TMR) planned to expand the 780-meter uphill section near Mackay, including a large S-shaped bend. To meet the requirements, a 45-meter-high earthen embankment would be constructed to enhance safety and improve the turning radius.



To overcome the challenges of constructing a high embankment with steep slopes and an extended curved section, various options were evaluated, followed by a full-scale construction trial. The ACEGrid® geogrid reinforced embankment with steel mesh panel facing was chosen as the optimal solution. The flexible and adaptable nature of the ACEGrid® system allows for easy shaping and promotes vegetation growth. Its outstanding short and long-term performance characteristics further supported its selection. To meet the requirements of the high embankment, high-strength ACEGrid® GG150-1 and GG200-I were used as reinforcement materials. The embankment was constructed in multiple stages, layer by layer, with a slope gradient of 1:1. Non-woven fabric was placed on the inner side of the steel mesh panel to prevent backfill material leakage.

This road traverses a forested area, and after project completion, the afforestation status remains in good condition. By utilizing ACEGrid® reinforced embankments, the project strives to achieve multiple goals outlined in the United Nations Sustainable Development Goals (SDGs), including the conservation of terrestrial ecosystems and climate action. This case has been awarded the Environmental Excellence Award by IECA (International Erosion Control Association).

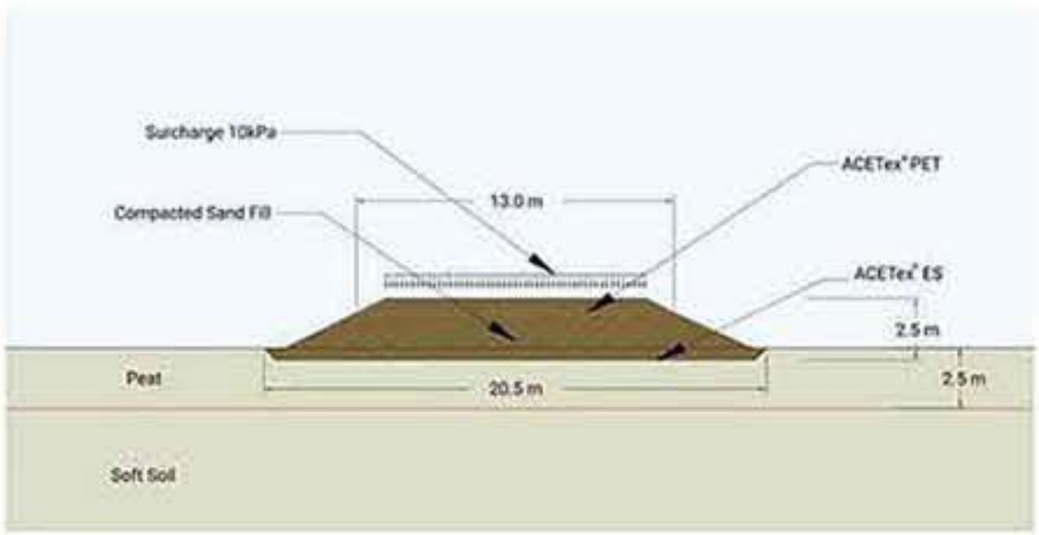
Subgrade Stabilization, Pan Borneo Highway, Sarawak, Malaysia

Products: ACETex® PET, ACETex® ES

The Pan Borneo Highway project aims to boost socioeconomic development in East Malaysia. The Sarawak segment, spanning 1,060 km, faces challenges like swampy areas and heavy rainfall. The current roads are unable to handle high traffic and heavy vehicles, causing pavement damage and potholes. Thus, improving the road's condition and widening it to accommodate heavy traffic became crucial.

The pavement design introduces a new method of incorporating geosynthetic materials to improve road performance. This eliminates the need for large-scale soil replacement or treatment, significantly reducing material and transportation costs. The construction process begins with subgrade preparation, followed by the installation of ACETex® ES geotextiles and prefabricated vertical drains (PVD). ACETex® PET geotextiles are then used for separation, filtration, drainage, and reinforcement. Once backfilled to the required altitude, the pavement structure is completed.

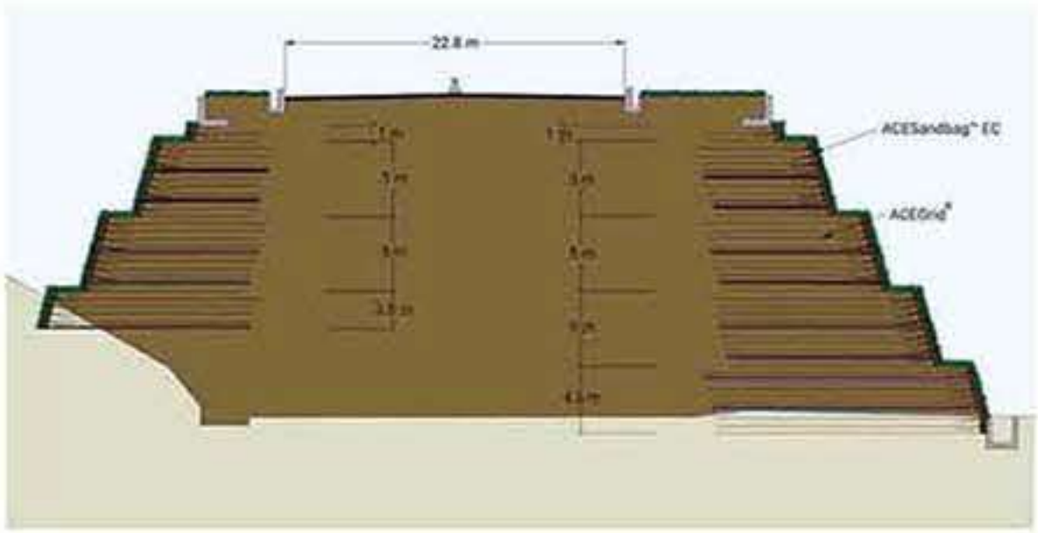
The geosynthetic materials supplied by Alpha Pinnacle Sdn Bhd play a pivotal role in enhancing the project. These materials not only accelerate subgrade consolidation but also augment the road's bearing capacity, facilitating the safe transit of heavy vehicles. The extensive application of millions of square meters of ACETex® ES geotextiles transform previously challenging terrains into robust and stable high-traffic routes. As a result, this forward-thinking approach is set to significantly reduce transit hours and bolster productivity in East Malaysia in the coming years.



Geogrid Reinforced Structure for Abutment Construction, Taichung, Taiwan

Products: ACEGrid® GG, ACETex® NW, ACESandbag™ EC, ACEPin™ T, ACEDrain™ S

Given the construction site close to a fault zone, one of the bridge abutments demands increased seismic resilience. Additionally, the river presents threats of soil, rock, and driftwood erosion against the abutment foundation, especially during rainy and typhoon periods. Soil excavation activities for the abutment further heighten risks of slope instability, underscoring the need for stabilization measures.



To increase stability and anti-scour ability of the bridge abutment, a reinforced concrete structure with wrapped-around reinforced earth structure is proposed. ACEGrid® geogrids and in-situ excavated soils and rocks are used for the reinforced earth structure, which is 20 meters high, with 4 stages of 5 meters each and includes drainage layers. The U-shaped structure covers the rigid abutment and protects the peripheral slopes from scouring. Additionally, the design, optimized to enhance seismic resistance, is suitable for the project, which is located in the area adjacent to two fault zones and avoids stress concentration problems.

The reinforced earth structure significantly enhances the bridge's safety, stability, and serviceability. Using excavation soils for backfill reduces construction costs while the integration of green vegetation harmonizes the bridge with its natural surroundings. The wrap-around structure fortifies the abutment's foundation and slope, withstanding scouring and supporting vehicle loads. Moreover, the use of in-situ soil and rocks in the reinforced structure lowers carbon emissions by 65%, reducing about 967 t-CO2e, and the project cost by 2.06 million NT dollars. The city government is pleased with the results, citing safety, cost-effectiveness, pleasant landscaping, and eco-friendliness as key factors.

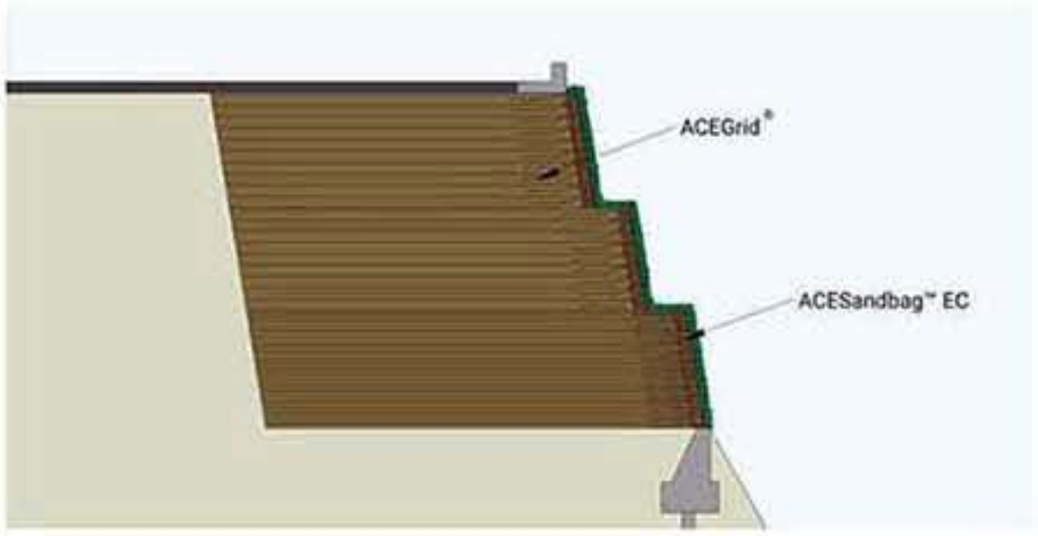
GRS Embankment for Earthquake Recovery on National Freeway No. 4, Taiwan

Products: ACEGrid® GG, ACETex® NW, ACESandbag™ EC, ACEPin™ T, ACEDrain™ S

The National Freeway No. 4 extension intersects the Chelungpu fault, notably affected by the Chi-chi earthquake's 85-kilometer rupture, causing substantial terrain changes. This site, with elevations between 300-450 meters, is bound by Wuniulan Creek on the west and a debris-laden steep slope to the east. The design elevation of the embankment varies by 20 meters due to alignment. Crucial retaining structures ensure safety against the unstable ground of colluvium, gravel, and fault-associated shale layers.

A 168-meter-long geosynthetic reinforced soil structure (GRS) embankment was built for stability and earthquake damage control. ACEGrid® geogrids and excavated material from the nearby tunnel were utilized. The GRS foundation replaced weak colluvium using crisscrossed ACEGrid® geogrids and compacted backfill. The embankment had a 1:0.2 slope aspect ratio, three stages with step-back platforms, and incorporated permeable material, HDPE drainage pipes, and ACESandbag™ geobags for drainage and vegetation. Pile-supported retaining structures and reinforced concrete lattice girders protected adjacent slopes and riverbanks. Preloaded anchors ensured stability, meeting safety requirements in various conditions.

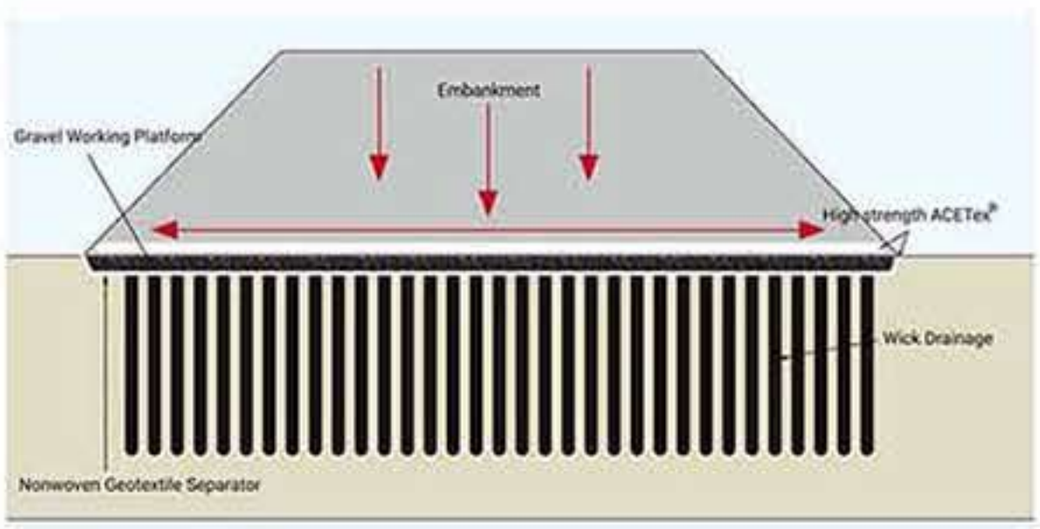
Given the challenges posed by the active Chelungpu fault for structural safety, a GRS embankment was deemed the most suitable solution. Safety considerations include replacing weak subsoils with a GRS foundation to enhance stability and restrain fault zone displacement. Static and dynamic analyses confirm the embankment's stability, meeting safety requirements. Adjacent slope stabilization methods ensure comprehensive protection. The design allows for the reuse of excavated materials from a nearby tunnel, promoting sustainability and cost effectiveness.



Queensland Motorways Gateway Upgrade Project, Queensland, Australia

Products: ACETex® PET

The Queensland Motorways authority planned to enhance the Gateway Bridge River Crossing with three key projects: doubling the bridge, upgrading 16 km of the southern motorway, and devising a new 7 km northern motorway route. Spanning a flood-prone area with soft riverbed deposits, the upgrades addressed potential low bearing capacity and settlement risks, ensuring stability and safety for the infrastructure.



To minimize the risks caused by the soft soils, ground improvement was crucial. The designer adopted prefabricated vertical drains (PVD) to accelerate the dissipation of excess pore water in the soft deposit and therefore to cause an increase in shear strength and a decrease in compressibility. The contractor first placed a layer of ACETex® PET woven geotextile, which was supplied by our Australian distributor Global Synthetics Pty Ltd, and then placed a layer of the gravelly platform on the surface of the ground. ACETex® provided functions of reinforcement, separation, and filtration so that the induced pore water could be easily dissipated without loss of fine particles. Then, PVDs were installed in square patterns (spaced 1.5 m center to center) to cover all the treatment areas.

ACETex® PET boasts exceptional permeability and soil particle filtration, allowing fine silts to pass while securing larger particles. When paired with PVDs, this fabric expedites the consolidation process, prevents bearing failures, and minimizes settlement. This combination drastically reduces the duration of settlement, significantly bolstering soil stability and load-bearing capabilities.

Airport Apron and Runway Rehabilitation, Asia

Products: ACETex® NW DPF

Due to a surge in air travel demand and efforts to reduce strain on the nation's busiest civilian airport, plans are in motion to construct four airport runways, catering to up to 100 million passengers annually. The airport is set to become a pivotal international aviation hub.

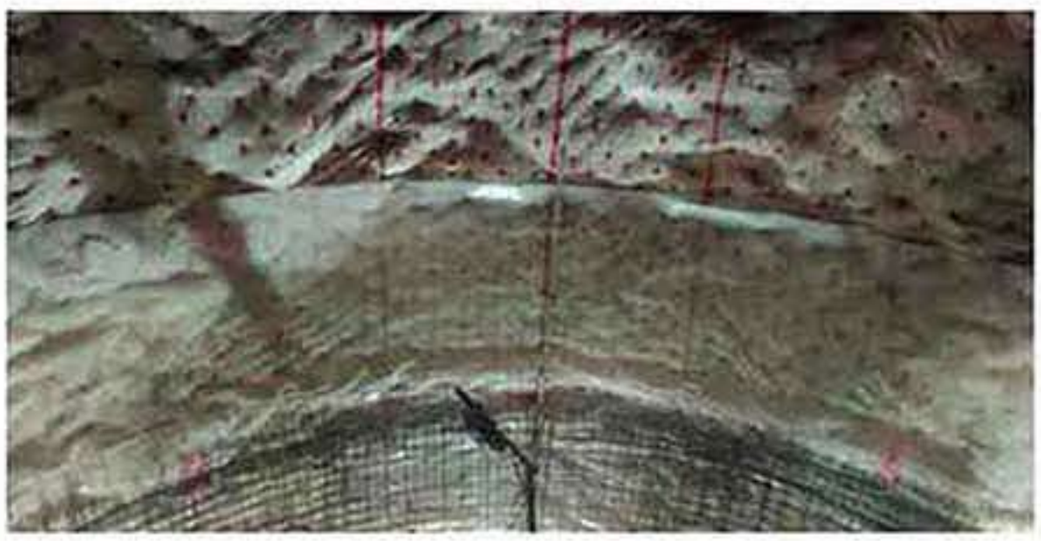
Challenges present in airport aprons and runways include the potential for reflective cracking and damage between the base and surface layers. Additionally, load distribution issues are also a concern. ACETex® NW DPF nonwoven geotextile, made from PP continuous filament yarn, addresses these challenges. When laid between the base and surface layers, it disperses loading evenly, prevents reflective cracking, and maintains structural integrity. The application not only decreases the risk of malfunction but also ensures that aprons and runways can withstand stresses from airplanes and vehicles. Furthermore, the permeability of ACETex® NW DPF aids water flow while holding back soil particles, effectively preventing soil erosion and movement.

Utilizing ACETex® NW DPF for separation and filtration markedly enhances the stability and integrity of apron and runway structures. It prolongs the durability of the pavement foundation and curtails maintenance needs. This method also streamlines the installation and hastens the construction timeline. Thus, ACETex® NW DPF embodies a holistic and efficient solution.

High-Speed Rail Tunnel Construction, Asia

Products: ACETex® NW DPF

The development of high-speed rail tunnels is pivotal for enhancing connectivity between cities, facilitating regional transportation, and boosting tourism. These tunnels alleviate road congestion by diverting traffic and promote inter-regional collaboration. Effective drainage in tunnel engineering is crucial for preserving structural integrity, preventing corrosion, avoiding hazards, and ensuring tunnel longevity.



Selecting the right materials is vital to minimize water-related damage, ensure efficient drainage, maintain the structural integrity of the tunnels, and guarantee safety within these passages. Nonwoven fabrics, specifically ACETex® NW DPF nonwoven geotextile made from PP continuous filament yarn, play a significant role. Positioned between the concrete and waterproofing layers, ACETex® NW DPF protects tunnel structural panels and filters impurities adeptly. Due to its high alkali resistance, this fabric retains consistent drainage capabilities, even with prolonged exposure to cement. ACETex® NW DPF also acts as an isolation barrier, effectively preventing soil particle infiltration from the tunnel's exterior, enhancing its stability. This design ensures the tunnel's ongoing usability and safety.

The successful results from the project indicate that ACETex® NW DPF delivers performance tailored to the needs of such projects. Utilizing these materials increases the tunnel's durability and safety while potentially decreasing maintenance costs, contributing to the project's reliability and economic efficiency.

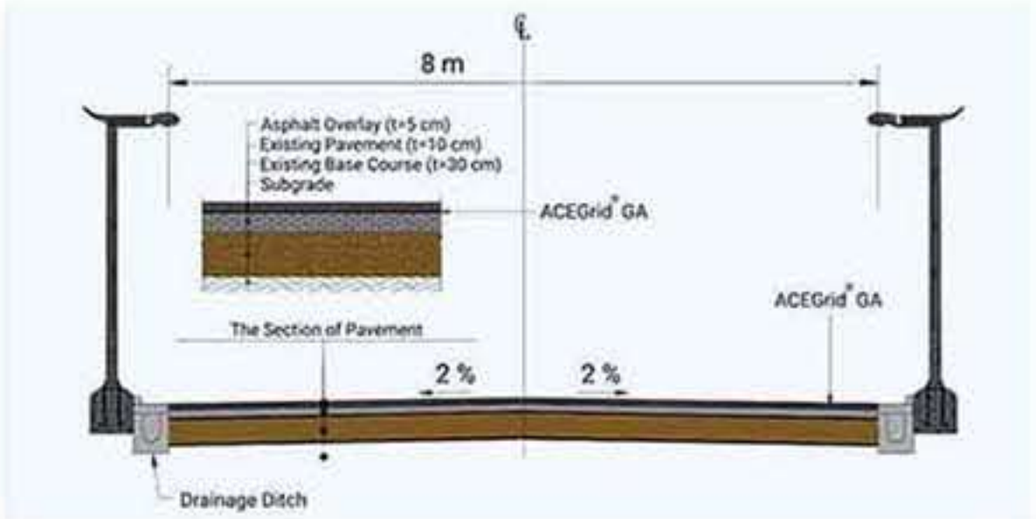
Pavement Rehabilitation to Increase Traffic, Colombia, South America

Products: ACEGrid® GA

The asphalt pavement on a highway in Colombia is experiencing extensive reflective cracking due to heavy axle loads and increased traffic. These cracks result in discomfort for users, water infiltration, potholes, reduced bearing capacity, and a shortened pavement lifespan. To address these issues, an economical and long-lasting solution is required to rehabilitate the pavement distress and ensure improved performance.

Reflective cracking in roads not only compromises safety but also leads to issues such as user discomfort, water infiltration, and reduced bearing capacity. As these problems emerge, roads necessitate maintenance. In response, the government is pursuing an economical and long-term solution to address these pavement cracks.

Increasingly, ACEGrid® GA glassfiber geogrid is being utilized at the base level of asphalt overlays to enhance overall performance. Its key advantage lies in its placement within the asphalt layer, effectively restricting reflective cracks and simplifying installation. For this project, ACEGrid® GA was installed directly after milling the original pavement and then overlaid with hot mix asphalt. Post-construction, the reinforced pavement remains in excellent condition, free from reflective cracking and potholes. Additionally, the depth of ruts has diminished, significantly improving the road's serviceability.



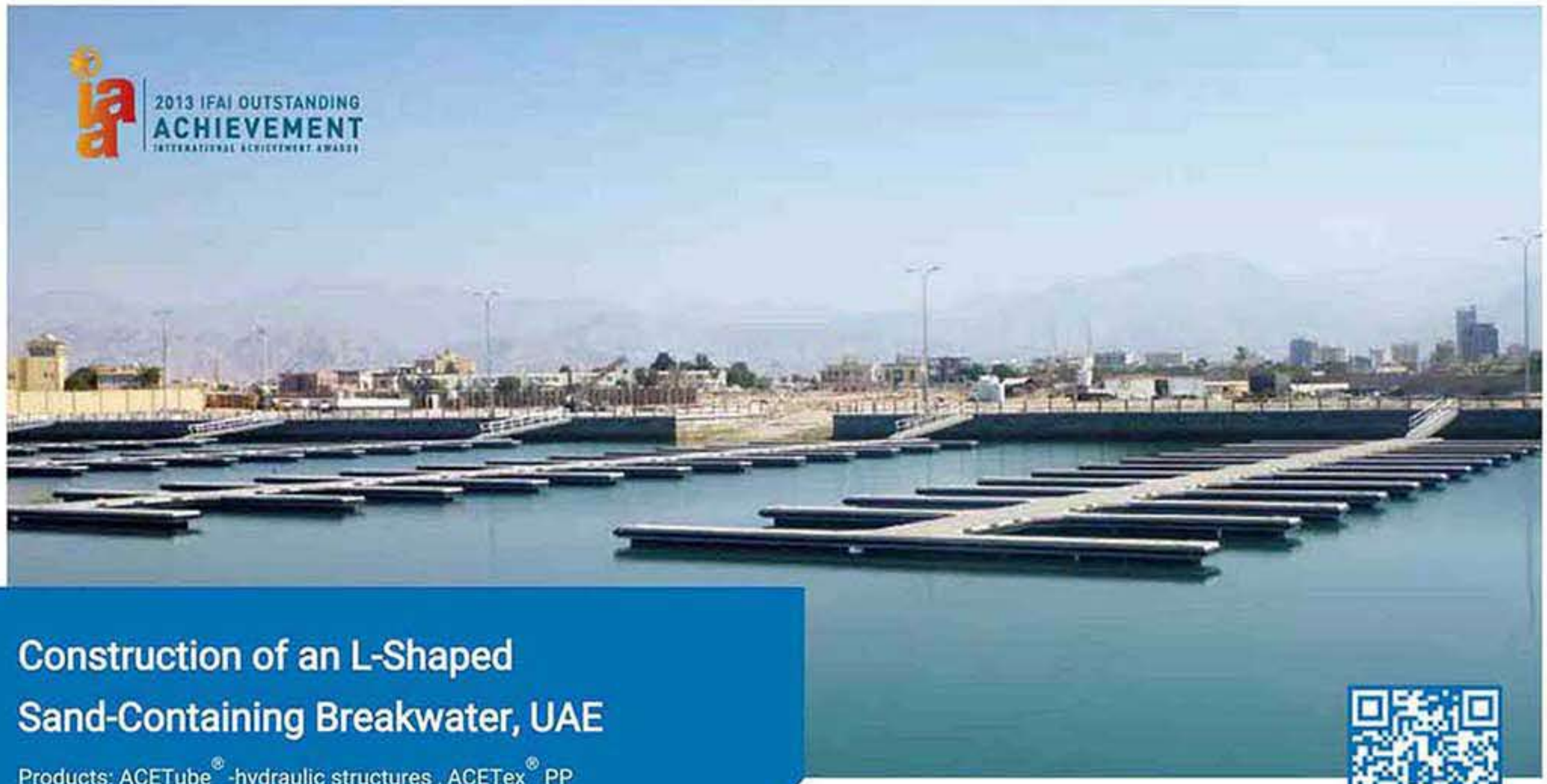
Asphalt Pavement Rehabilitation, Chile

Products: ACECompo™

This project was in Chile, South America. To provide safe and comfortable pavement for users, the managing authority renovated the pavement every five to ten years to ensure the pavement's quality and safety. The road problem was caused by the repeated loading, along with the vehicles coming back and forth, weather changes, ruts and potholes. Reflective cracking existed on the old roads, so it was necessary to modernize the roads.

ACECompo™, a geocomposite constructed by a high-tenacity fiberglass grid, a lightweight polyester nonwoven geotextile, and bitumen coating, was introduced to improve the damaged asphalt pavement. ACECompo™ offers high strength, high modulus, and high temperature resistance for performing high reinforcement ability and raises the resistance of ACECompo™ to the damages form installation. First, three to five centimeters of the surface were removed by milling machine. Then, after the rubble was transported by truck loader, tack coat was added on the road to increase the adhesion of the ACECompo™. The ACECompo™ helped to strengthen the effect of road reinforcement and reduce the transverse rifting behavior caused by temperature variation.

Due to the short construction period, vehicles could drive immediately on the road after completion. With the ACECompo™ geocomposites to reinforce asphalt layers, the pavements can extend their service life and reduce the occurrence rate of reflective cracking under cyclic traffic load. After several years, the road was plainly in good condition. No ruts, potholes and reflective cracking problems happened again. Therefore, ACECompo™ proved to be beneficial to prolong the service life of roads.



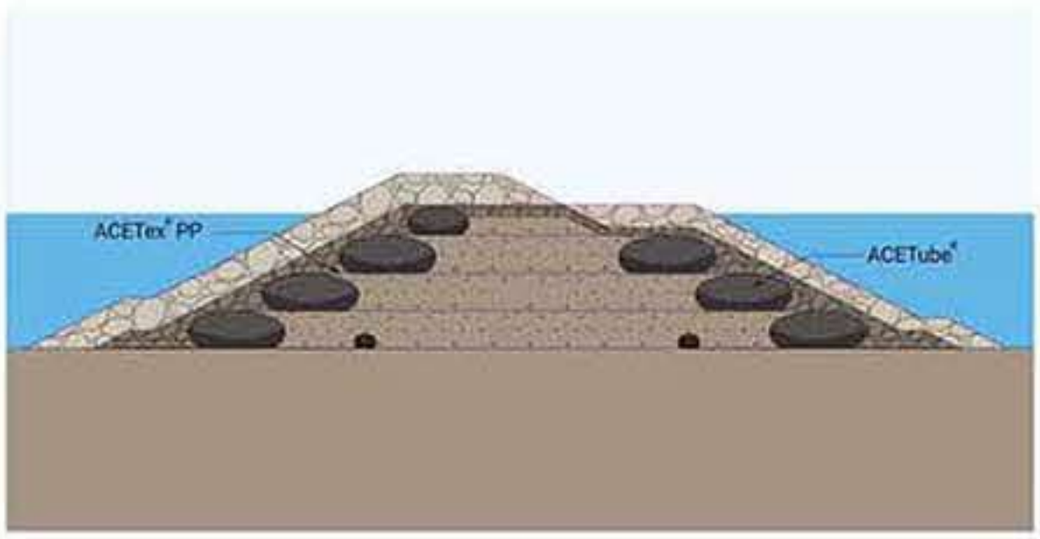
Construction of an L-Shaped Sand-Containing Breakwater, UAE

Products: ACETube® -hydraulic structures , ACETex® PP

A construction project was undertaken in UAE to build a fishing port where a groin was located. A 700 m L-shaped breakwater was designed to be attached to the groin to create the port. The newly built 147 m breakwater would run northeast from the coast and then connect with the groin, with the entire structure being 9 m high (2.5 m underwater and 6.5 m above sea level). Cost-effectiveness, fast construction, and optimal safety were important requirements for the project.

In the UAE, breakwaters are typically built with costly rubble. Other materials, such as concrete boxes (caisson), concrete blocks are also expensive. Therefore, the local authority sought a more economical solution for the project. After a thorough assessment, ACETube® geotextile tubes were chosen to construct the proposed breakwater. Generally, geotextile tubes are filled with sand and used as a core in breakwater structure; however, this project design applied various types of ACETube® as the perimeter barrier structure which contained and trapped in-situ sand to form 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.

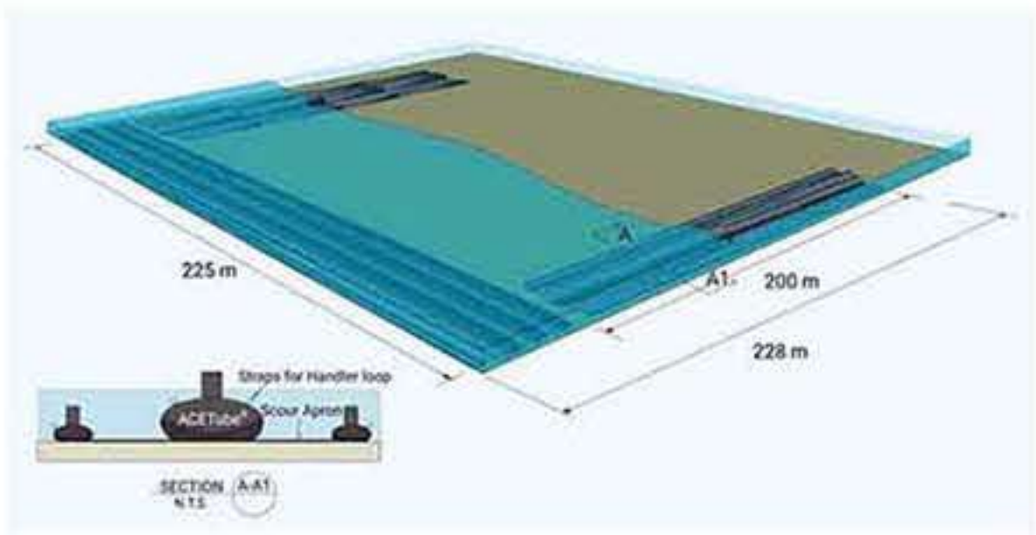
The innovative application of ACETube® for breakwater construction significantly reduced the cost and minimized environmental disturbance. The outcome exceeded expectations. The project even won 2013 International Achievement Award from IFAI for its outstanding performance.



Restoration of Eroded Coastline and Beach Nourishment, Fujarah, UAE

Products: ACETube® -hydraulic structures

In 2007, tropical cyclone Gonu caused havoc on the Fujarah coast, leading to serious erosion for several kilometers. Although sand movement could help beach nourishment, recovery was slow. Le Meridien Hotel initially used a traditional method, the riprap groin, to protect the northern and southern shore. However, without a solid foundation, it failed to function and sunk due to repeated wave actions and yearly cyclone attacks.



In order to make less impact on the tourist attractions and environmental aesthetics, the owner of the Le Meridien Hotel sought an innovative approach: reconstructing the groin and nourishing the beach. The ACE engineering team designed a structure using ACETube® geotextile tubes in an anti U shape, forming a seaward breakwater stretching out for 200 meters long on the southern and the northern side. This vertical submerged breakwater created a 228 m x 225 m safe zone to reduce the wave energy and nourish the beach. A variety of types of geotextile tubes were designed by the engineering team to conform to the undulating terrain ranging in circumference from 8.6 m to 17.2 m and in length from 52 m to 77 m; these geotextile tubes were pumped and filled up with the sand in situ to create a cofferdam.

After the project's completion, ACETube® geotextile tubes effectively controlled erosion and protected the Fujarah coast from further cyclone damage. ACETube® represents the best way to reduce impact and achieve sustainable environmental development.

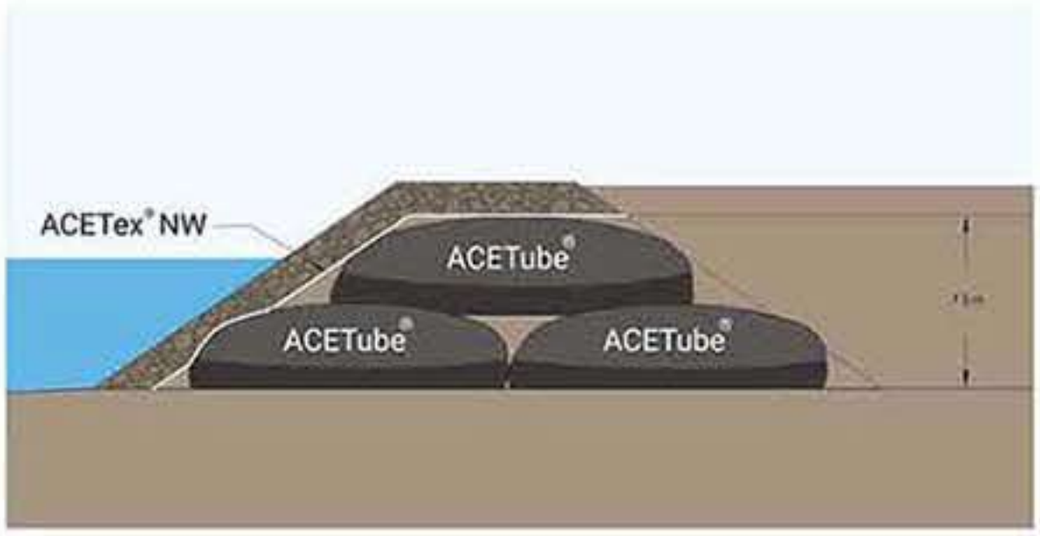
Giant Geotextile Tube for Harbor Temporary Cofferdam Reclamation, Kaohsiung, Taiwan

Products: ACETube® - hydraulic structures, ACETex® NW

Kaohsiung Harbor, the world's 15th largest container port, undertook a land reclamation project. This involved creating a north-south container terminal and an L-shaped temporary cofferdam using caissons and ACETube® geotextile tubes, considering the site's 4-meter underwater depth. The design should overcome underwater construction challenges, prevent erosion, cost-effectiveness, ecological considerations, and engineering feasibility.

The S4-S5 terminal at Kaohsiung Intercontinental Container Center required east-west and north-south temporary cofferdams to prevent erosion and backfilling of tidal land during rainy seasons and typhoons. The levee was 7.5 m high and 700 m long. ACETube® geotextile tubes were stacked pyramid-style based on oceanographic data: Type A (36 m circumference) on the bottom layer and Type B (32 m circumference) on top, covered with non-woven fabric and 300-500 kg riprap for surface protection.

ACETube® provides an innovative, ecological, and cost-effective engineering solution that reduces carbon emissions and prevents environmental harm. The high tensile strength, great permittivity, and light weight of geotextile tubes make them convenient, timely, and economically beneficial. Using in-situ sediments from the seabed, as opposed to sand filling, introduces a new function for the geotextile tubes. They act as a core of riprap-covered temporary cofferdams and prevent wave erosion from causing loss of backfill sand. The geotextile tubes were also filled with sediments from the seabed, providing more allowance for large ships. Taking into account the multifunctionality, construction costs, and ecological impact, geotextile tubes are the most suitable solution for this project.



Dredged Materials Disposal, Victoria Harbor, Hong Kong

Products: ACEContainer™

Victoria Harbor serves as a vital port with approximately 220,000 annual ship visits. Maintaining smooth shipping operations is crucial for the port authority's success. However, managing the cleanup and disposal of sediments, including oil mixed settlement, suspended solids, and fluvial sediments from upstream rivers, poses a significant challenge. Environmental concerns arise regarding the disposal of dredged sludge materials, as it affects water quality and natural habitat loss.

To execute the dredging and disposal of sludge materials, ACEContainer™ was utilized. With custom dimensions of 28 m in circumference and 12 m in length, ACEContainer™ had a filling capacity of up to 300 m^3. The technique involved using a split bottom hopper barge and a clamshell bucket to fill the container with sludge. Once filled, the ACEContainer™ was securely closed and reinforced. It was then transported to the designated location, where the bottom of the ACEContainer™ was opened, allowing it to settle on the seabed. Post-construction monitoring confirmed that there was no damage or leakage. ACEContainer™ effectively contained the dredged materials, preventing the spread of suspended solids in the water. It proved to be an advantageous solution for dredged material treatment in terms of environmental suitability and containment effectiveness.

ACEContainer™ offers a high-performance and efficient solution for dredging operations, surpassing traditional techniques. It aids in the improvement and maintenance of ports, harbors, and waterways while preventing environmental pollution during disposal. Furthermore, once laid on the seabed, the ACEContainer™ can be used as the core of marine structures, such as breakwaters or shoreline protection.

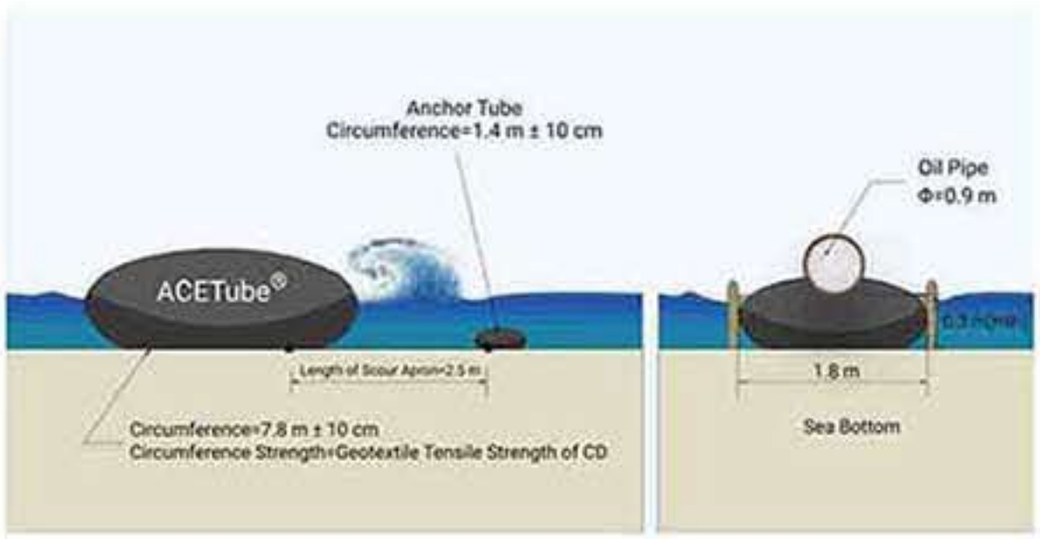
Oil Pipeline Support and Beach Nourishment, Tabasco, Mexico

Products: ACETube® -hydraulic structures

The marine facilities of Dos Bocas PEMEX, a major oil corporation in Tabasco, Mexico, suffered progressive beach erosion caused by numerous annual hurricane invasions. The sand foundation under the pipelines in the littoral zone was scoured, leaving dangling pipes. This problem threatened both the conveyance of oil and the integrity of the infrastructure. It also increased the potential risks of pipeline failures which would lead to economic loss and environmental contamination.

In order to deal with the problem, ACETube® geotextile tubes were chosen to support and protect the pipelines. The project was divided into two parts. First, ACETube® of various sizes in circumference were used as pipeline base protection against scouring risk. Afterwards, 30-40 m away from the coastline, ACETube® geotextile tubes with 7.8 m in circumference were filled with in-situ sand and placed beneath the pipelines as supporting system. ACETube® geotextile tubes were also installed as a submerged breakwater alongside the coastline for 1.9 km in length to reduce the wave energy, thus nourishing the beach.

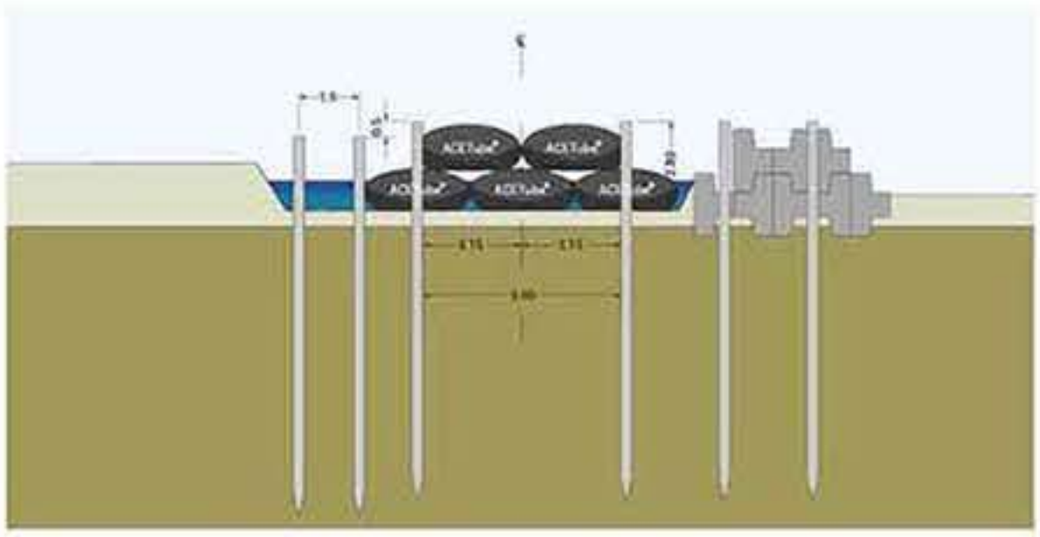
In this project, the flexibility and adaptability features of ACETube® geotextile tubes gave the pipelines a complete protection and gravity support. It also performs excellently as a breakwater, withstanding wave impact. Moreover, as an economical and innovative solution, ACETube® geotextile tubes, not only reduced the construction time and costs, but also performed well as an alternative to traditional construction methods. As the beach evolution surveys indicated, the beach nourishment outcome is also satisfying.



Restoration of No. 6 Groin with ACETube®, Gaoping River Weir, Taiwan

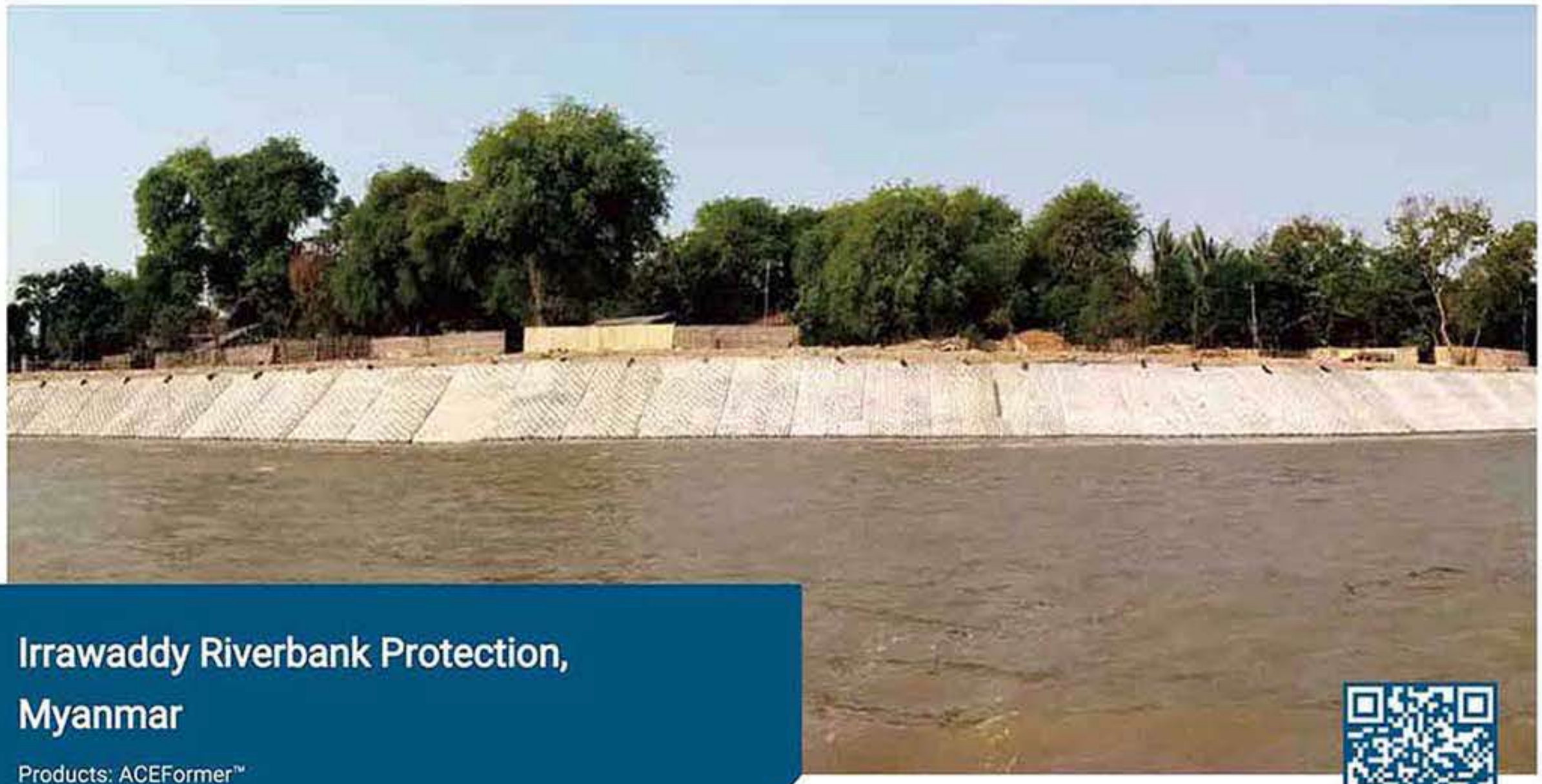
Products: ACETube® -hydraulic structures

The Gaoping River supplies 70% of Kaohsiung's drinking water; however, heavy rainfall in the Gaoping River Basin causes erosion and sedimentation, leading to downstream sediment accumulation. Regular maintenance is necessary to stabilize the river channel. This project targets a vulnerable area located 3 kilometers upstream from the Gaoping River Weir, where severe erosion has impacted the riverbank and existing embankment foundations.



The proposed solution for this project is to use gabion mattresses to reduce the impact of water flow on the vulnerable areas and mitigate erosion. The existing gabion mattresses, which consist of rigid structures using pile foundations and tetrapods, are prone to scouring the underlying soil due to their rigidity. However, the ACETube® geotextile tube method, which utilizes flexible bags that provide both permeability and contains soil, is ideal for this location due to its adaptability to changing topography. The designers have applied ACETube® around and below the gabion mattresses. When water flow encounters the ACETube®, the permeable structure absorbs the energy and reduces the scouring force of the water. Even if some residual hydraulic energy erodes the underlying soil, the ACETube® conforms to the terrain, mitigating the extent of scouring.

In this project, the ACETube® geotextile tubes are utilized to provide erosion protection for the pile foundations. The flexibility of the ACETube® allows for the creation of vertical holes to accommodate the piles. The sand-filled geotextile tubes effectively wrap around the piles, minimizing erosion around the foundations.



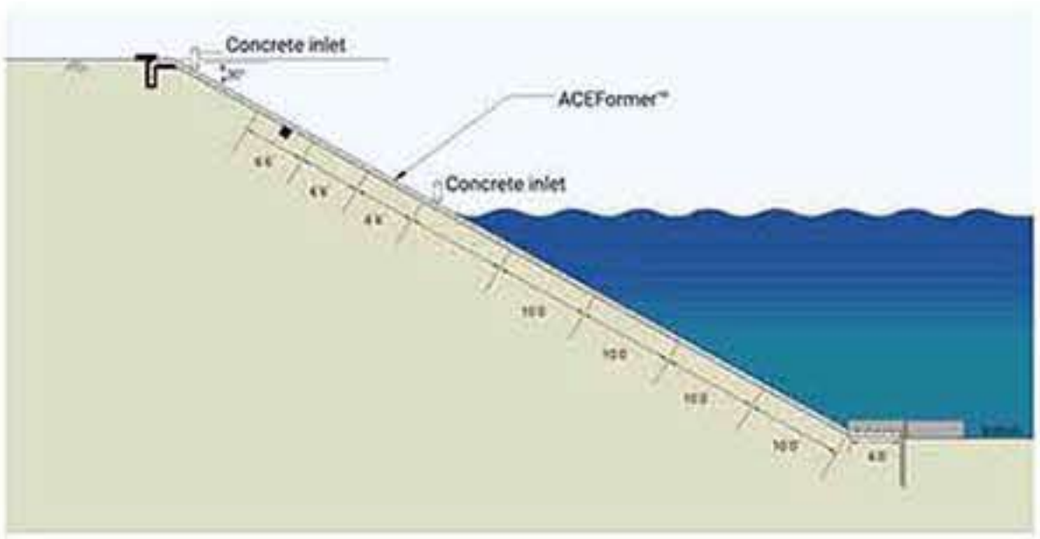
Irrawaddy Riverbank Protection, Myanmar

Products: ACEFormer™

The Irrawaddy River experiences frequent large-scale inundations due to sand and gravel mining, resulting in riverbank erosion and loss of sandbars. The government is actively managing and protecting the river system. High water velocity and weak protection structures make erosion within meander channels challenging. The project faced obstacles including steep slopes, deep water, strong currents, and constraints on schedule and budget.

After careful evaluation of safety, durability, and constructability, the government and designers selected ACEFormer™, a geotextile mattress filled with cement mortar, to protect the slope. It efficiently prevents water flow and erosion of the in-situ soil. The structure's anchoring forces and stability were considered, with vertical and horizontal anchoring implemented. Sandbags filled erosion holes and leveled the jobsite before laying and anchoring the ACEFormer™ mattresses with steel bars. Gabion boxes were used to stabilize the submerged toe. Transportation challenges and turbid water required physical effort and remote detection sonar monitoring. ACEFormer™ proved ideal for the project, saving time with customized factory manufacturing.

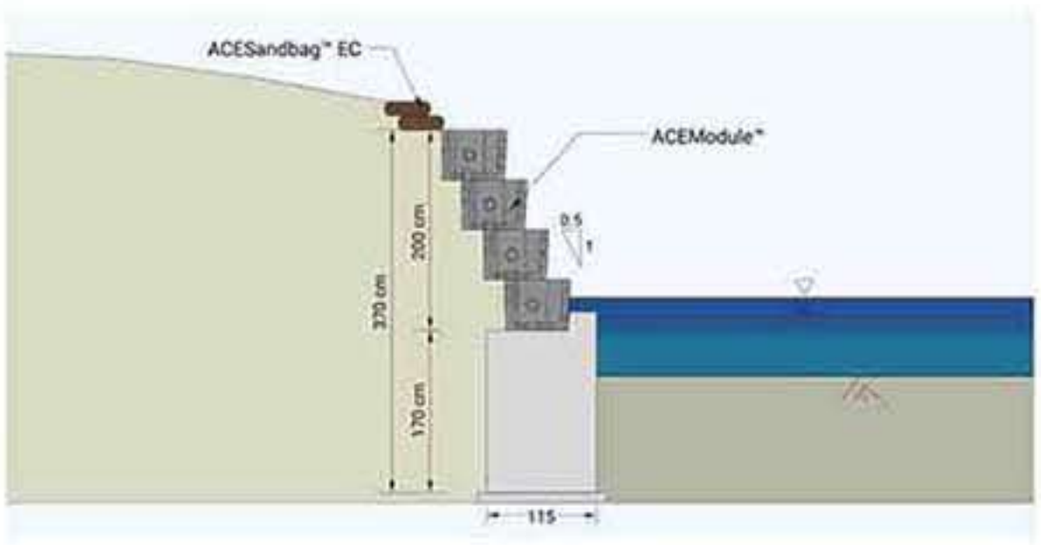
Upon completion of the project, the river experienced heavy rainfall, causing the water level to rise. After the floodwaters receded, officials and residents inspected the new structure, which remained intact. After successfully implementing the erosion control method, local residents no longer felt that living near the river was a threat. The Myanmar government's investment and collaboration among designers, manufacturers, and contractors played a crucial role in achieving this seemingly impossible mission of riverbank protection.



ACEModule™ for Creek Restoration at the Upstream of Shubu Concave Bridge, Taiwan

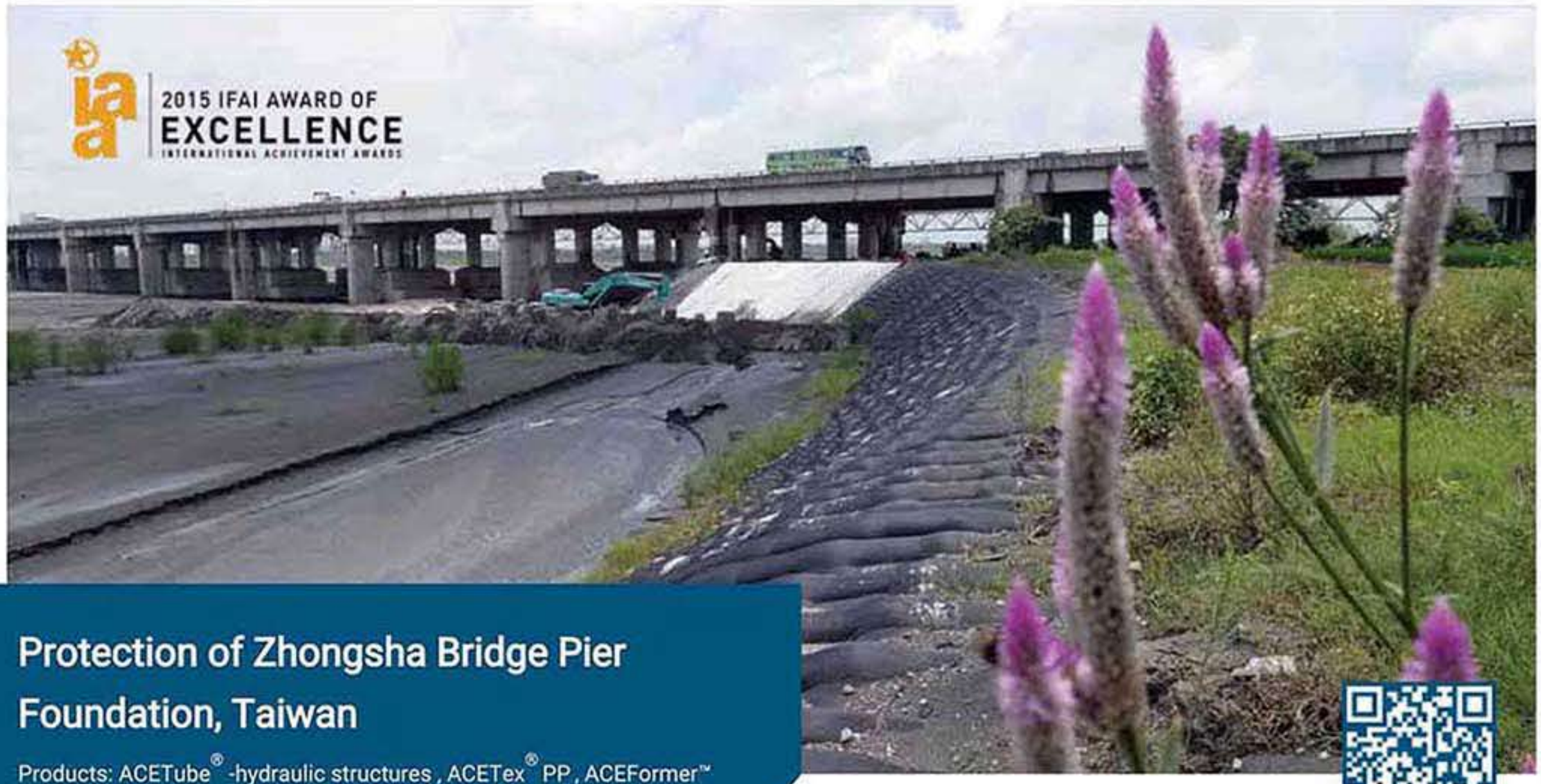
Products: ACEModule™, ACESandbag™ EC

The project aimed to enhance the creek basin by widening the channel and implementing eco-friendly revetment. Overgrown vegetation and severe siltation caused flooding disasters during heavy rains. It emphasized the importance of balancing flood control, drainage, and environmental impact. The creek collected farmland drainage and surface runoff, damaging crops and properties, while also supporting diverse wildlife and creating an eco-friendly environment.



The restoration project widened the creek's drainage section and implemented a reliable revetment system along the creek. The system included traditional reinforced concrete and ACEModule™, stackable precast hollow concrete blocks, for curved sections. Four layers of ACEModule™ were stacked on a reinforced concrete foundation. It provided stability, protection against water flow, and reduced scouring. The lower three layers had porous units for aquatic organisms, while the top layer had non-porous units for planting. Existing reinforced concrete culverts were incorporated into the revetment to support biodiversity. Geotextile layers and anchor rebars were used for stability during construction, and ACEModule™ elements had unique mortise and tenon structures for easy assembly.

The ACEModule™ system ensures safety, simple construction, aesthetic landscape, and ecological restoration. Its precast concrete structure provides resistance against scouring and erosion, reducing flooding disasters. Construction is straightforward with unit modules and mortise and tenon assembly, minimizing site disturbance. The system's flexibility allows for customized designs to match different site conditions. The hollow design promotes ecological habitat and species diversity, creating an eco-friendly environment.

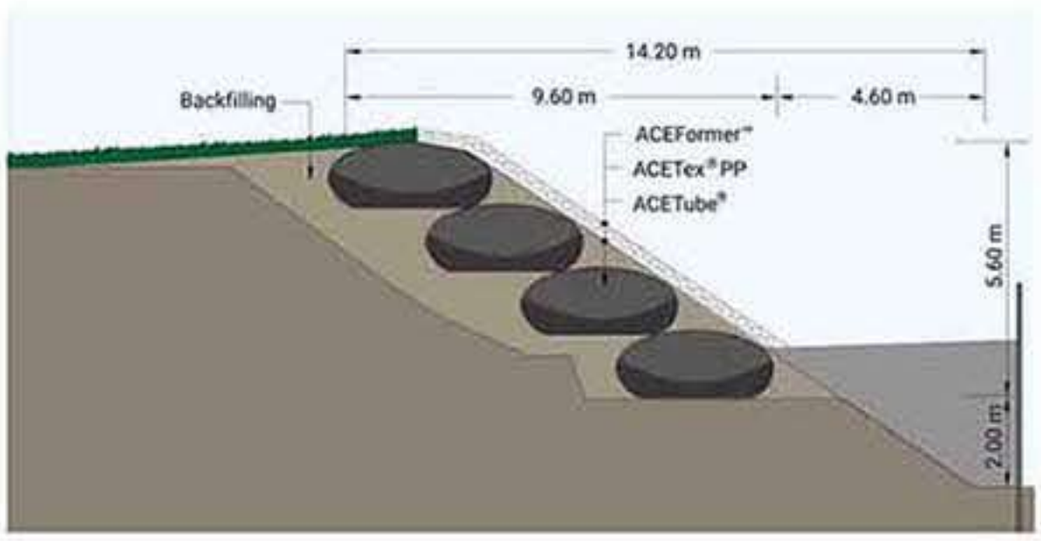


Protection of Zhongsha Bridge Pier Foundation, Taiwan

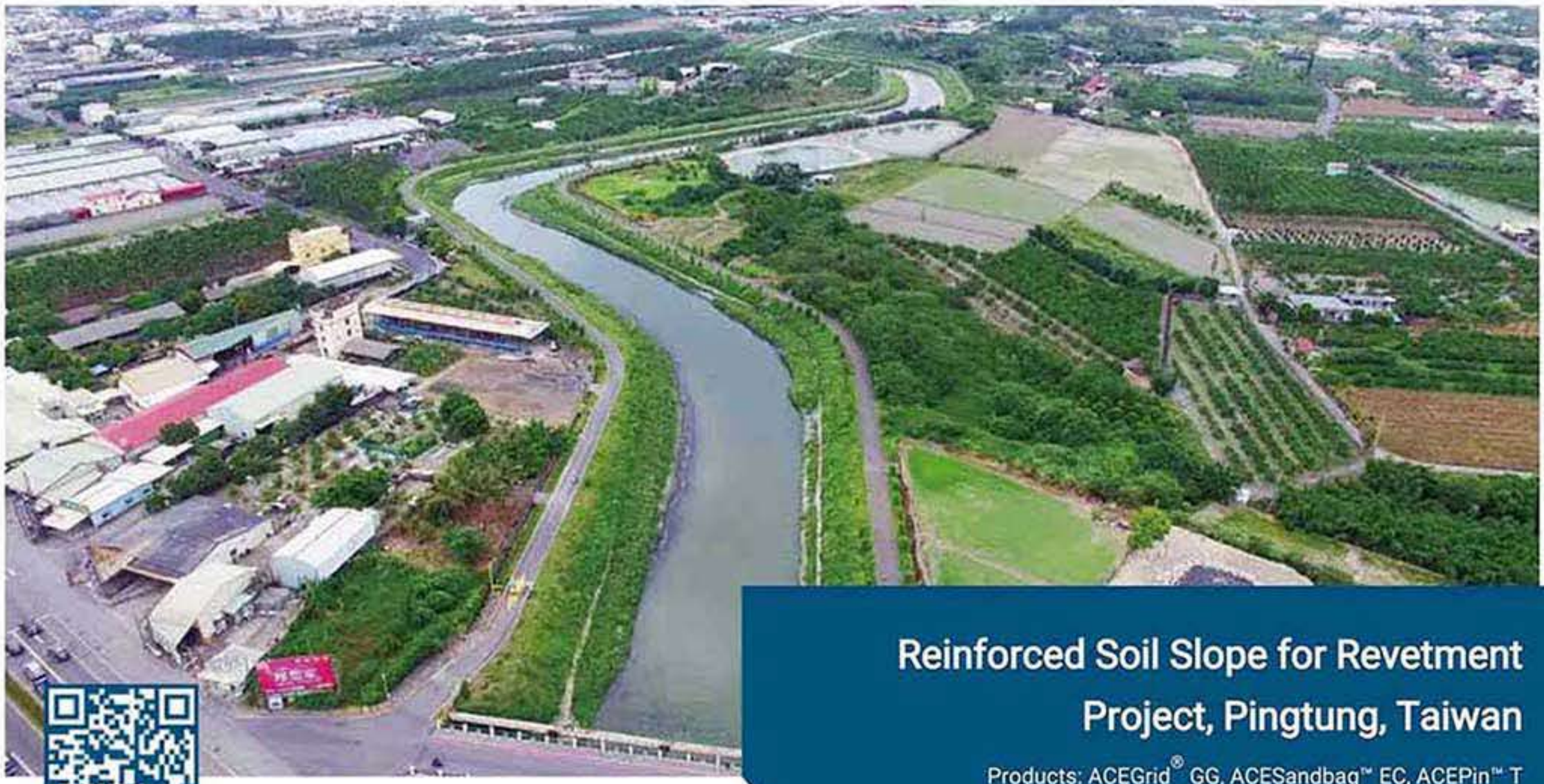
Products: ACETube® -hydraulic structures , ACETex® PP , ACEFormer™

Zhongsha Bridge, a 2345 m pre-stressed concrete structure spanning the Zhuoshui River, connects Yunlin County and Changhua County. To address pier foundation instability caused by fluvial processes, remediation measures were implemented. These included riverbank revetment rehabilitation, submerged weir groundsill reinforcement, and apron protection. The aim was to ensure bridge stability, traffic safety, and flood prevention along National Freeway No.1.

ACETube® geotextile tubes and ACEFormer™ geotextile mattresses were adopted in this project. The 5.6 m high protection structure was designed with four stacks of ACETube®. After filling each ACETube® with in-situ sand, additional fill was placed on top to create a flat surface for the subsequent layer's installation. The four-layer structure was covered with concrete-filled ACEFormer™ to enhance impact resistance and protect the ACETube® from external damage caused by drifting wood or river debris. The concrete-filled ACEFormer™ not only enhanced the stability of the pier foundations and levees but also reduced flow velocity due to its uneven surface, which in turn slowed the surface erosion process.



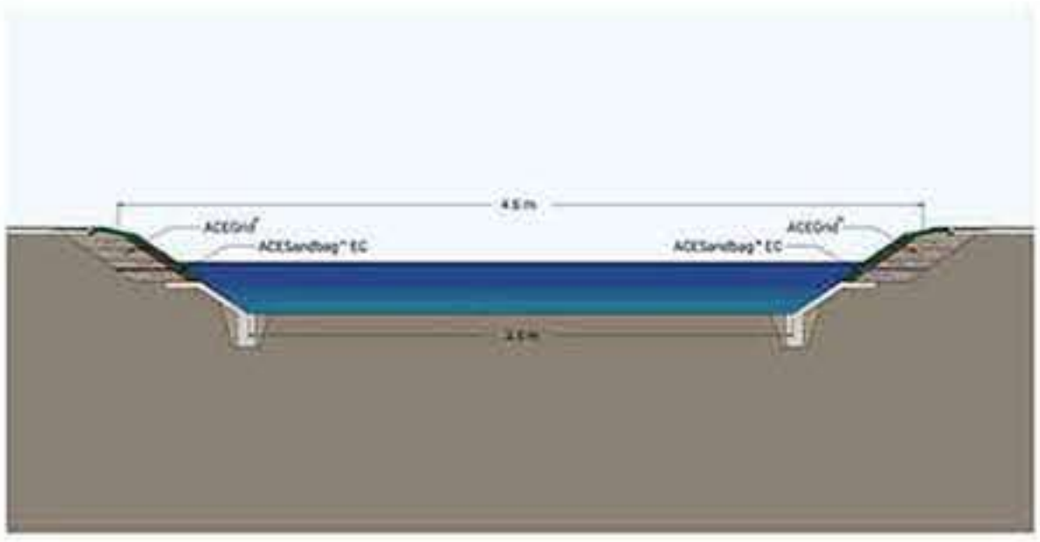
Compared to the traditional concrete structure, the ACETube® and ACEFormer™ framework has more advantages, including low energy consumption, low carbon emissions, cost effectiveness, and environmental sustainability. In addition to that, the flexibility features make them adaptable to different kinds of landforms and site conditions. These structures effectively prevent erosion and control pier foundation scouring. Moreover, the newly formed, lush land has become a habitat for vegetation, seamlessly integrating the site with the surrounding landscape.



Reinforced Soil Slope for Revetment Project, Pingtung, Taiwan

Products: ACEGrid® GG, ACESandbag™ EC, ACEPin™ T

Pingtung Plain, influenced by monsoon and ocean circulation, suffers from frequent heavy rainfall. Land subsidence and narrow channels hinder drainage, resulting in low-lying areas prone to flooding during storms. This project serves as a prime example, with a narrow stream running through farmland and rural settlements lacking sufficient revetment. Given the impact of climate change and the stream's inability to cope with high flow, immediate stream regulation is imperative.



Under the plan, the stream was dredged and widened to 35 meters, and the revetment was heightened to 3.9 meters. For reasons of safety, ecology, and landscape aesthetics, reinforced concrete was used to build the anti-scouring foundation beneath the revetment base. The revetment slope under the high-water level was protected by the concrete; the upper portion of the revetment employed ACEGrid® geogrid-wrapped reinforced slopes. ACEGrid® GG geogrids have optimal grid structures to accommodate different sizes of soil particles. The stacked and soil-filled ACEBag™ for reinforced slope face was functioned as the medium of planting; the vegetated slope not only improved the landscape but also effectively controlled erosion. The crest of the revetment was paved with asphalt concrete to prevent seepage and serve as a recreational area for local residents.

Despite facing the challenges posed by Typhoon Morakot, the structure remains intact and has received praise from both residents and officials. The revetment has become a lush green landscape over time, thriving with vegetation. The project not only performs well but also enhances the aesthetics of the area.

Organic Sludge Treatment in a Coffee Factory, South America

Products: ACETube® - dewatering system

A coffee factory in South America produces a large amount of organic sludge during its process which is normally placed in the lagoon for long-term precipitation to separate the solid and liquid. The efficiency of the current treatment method is low, leading to rapid sludge accumulation and quick filling of the lagoon. Additionally, the factory has limited space to expand the storage lagoon area. Finding a better solution to reduce sludge volume is imperative.

The solution was to convert the existing lagoon into a series of platforms within the available space, where ACETube® dewatering systems would be installed to reduce sludge volume and separate solid-liquid waste. Constructed from ACETex® PP 70/105, the ACETube® utilized measured 12.9 meters in circumference and 30 meters in length. This geotextile material exhibits high permeability, optimal apertures, and resistance to ultraviolet light, acids, and alkalis. The sludge is pumped into the ACETube® system, and flocculants are added to facilitate the separation of solids and water. 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. Once the geotextile tube is full, it can be easily disposed of.

ACETube® dewatering system efficiently reduces sludge volume with flocculants and speeds up the separation process. This solution effectively addresses the challenge of limited space and provides a more efficient method for sludge management. Additionally, the installation and use of ACETube® are cost-effective and time efficient.

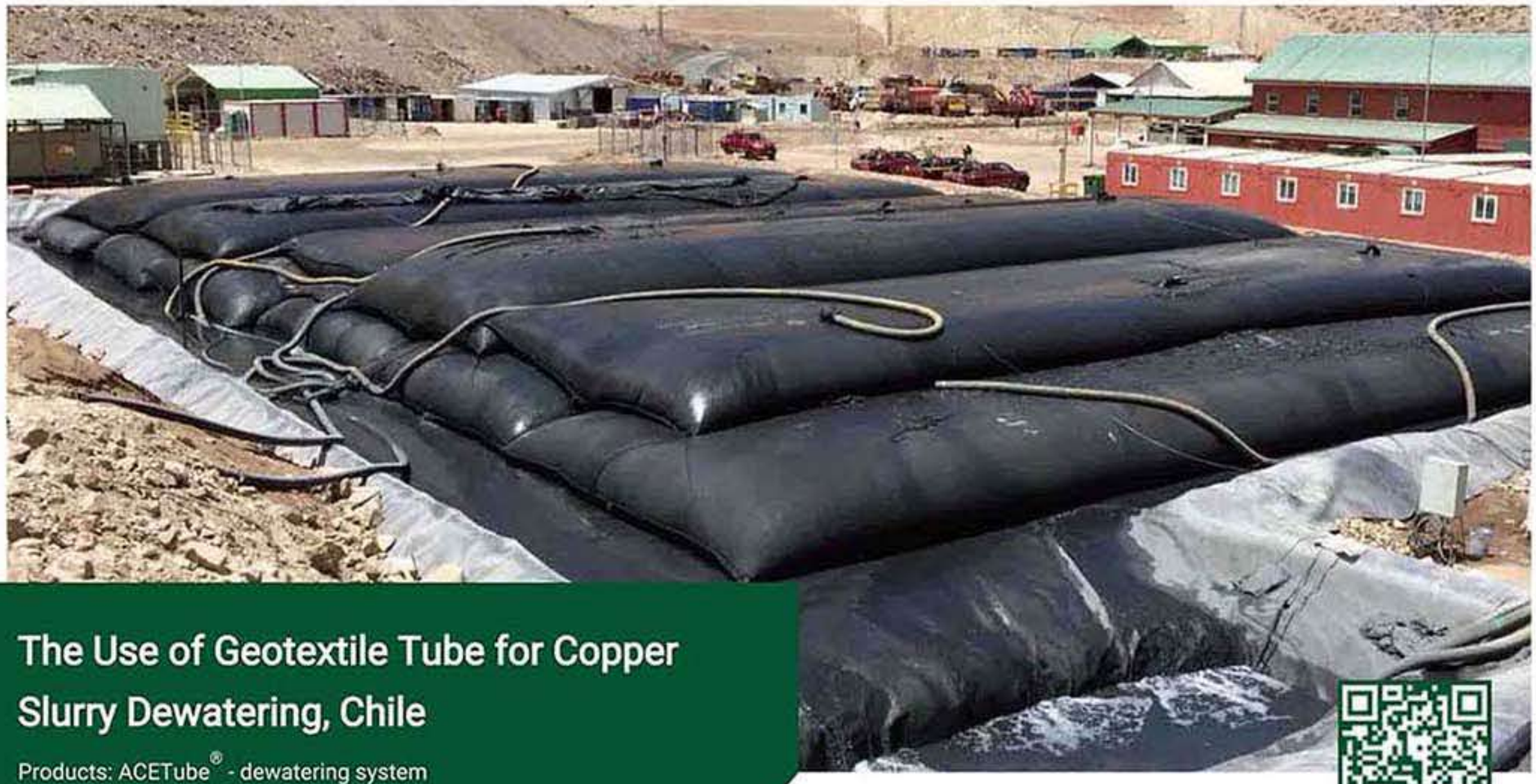
Oily Sludge Treatment in Eastern Europe

Products: ACETube® - dewatering system

This case is in the oil-contaminated region of Agan River in Eastern Europe. The local Research and Design Institute for Environmental Management is undertaking efforts to restore the river ecosystem. Due to the site's location and the need to treat contaminated sludge, a cost-effective solution is preferred. Thus, a temporary, low-cost, and eco-friendly method was required.

The ACETube® dewatering system offers an effective and convenient alternative to conventional mud/pit sludge treatment methods. After pumping the sludge into ACETube® geotextile tubes, the water dissipates through the fabric while the solid particles are retained with low moisture contents. The system requires simple equipment and has high adaptability for the in-situ environment but performs better dehydration function with low energy-consuming. It is especially suitable for the temporary sludge dewatering treatment. In this specific case, ACETex® GT 70-I PP was used to fabricate the dewatering tubes which measured 17.2 meters in circumference and ranged in length from 10 to 55 meters. A total of 44 pieces were employed, further showcasing the system's versatility and scalability.

After an initial dehydration period of 4 to 7 days, the sludge's water content decreased to approximately 90 percent. The final dehydration phase lasted between 30 to 45 days, achieving an efficiency of about 70 percent. The successful treatment of oily sludge by the ACETube® dewatering system not only prevented additional environmental contamination but also showcased its high effectiveness.



The Use of Geotextile Tube for Copper Slurry Dewatering, Chile

Products: ACETube® - dewatering system

In the mining sector, sludge dewatering and water recovery are challenging. Limited water resources and insufficient capacity in tailing ponds severely impact mining operations. To address this issue, approximately 100 geotextile tubes measuring 17.2 m in circumference and 24-30.5 m in length were employed. The treatment processed approximately 40,000 m³ of copper slurry, with a water content rate of around 80% and a specific gravity of 3.

With the aim of preventing wastewater from infiltrating the soil, a geomembrane was first placed on the ground, and a channel was dug all around to collect the water. Due to the limited working space, the large geotextile tubes were stacked in three layers to accelerate the drainage and solve the problem of insufficient site area. After dewatering, the water was drained out and then pumped into the pool. The collected water will be reused after undergoing treatment. After a month of the dewatering process followed by exposure, the moisture content in the geotextile tube can be quickly reduced to 20% or less, allowing the solid waste to be further refined for use.

The high permittivity of the geotextile tube offers advantages over traditional methods, which can take several years for dewatering and consolidation in tailing ponds. In this project, dewatering of the copper slurry was achieved within 4 to 5 months. The recycling of water during this process reduced the need for new tailings dams. Additionally, mining waste can be repurposed into valuable resources.

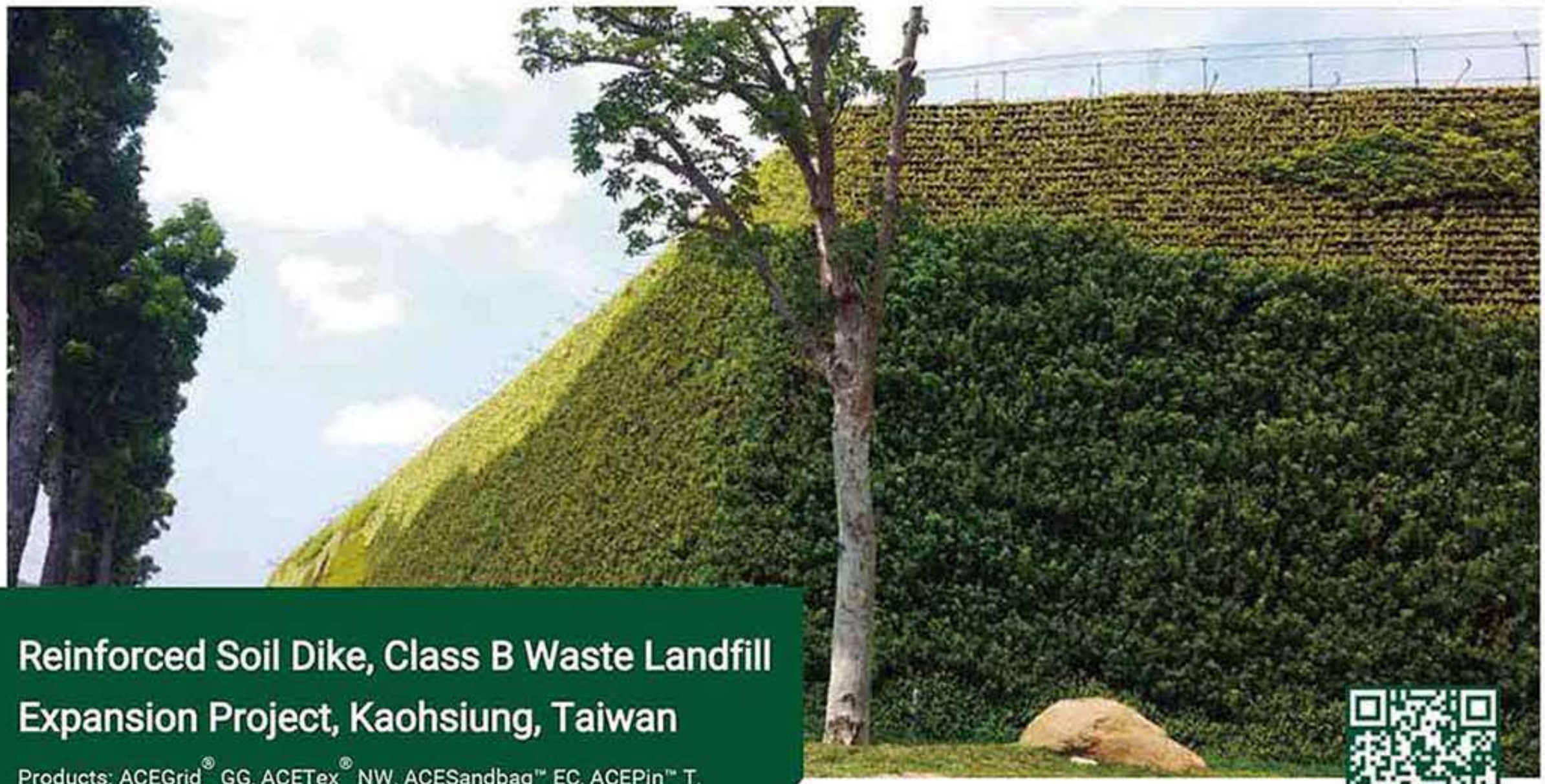
Municipal Sludge Dewatering by Using Geotextile Tube, Moldova

Products: ACETube® - dewatering system

In Moldova, ACETube® was used for municipal sludge dewatering and related pollution issues. A simple and cost-effective solution is to pump the polymer-conditioned sludge into a specially fabricated geotextile tube, where dewatering occurs naturally over time due to gravity. Once the dewatering process is complete, the solid waste will be contained inside the tube and then taken to a controlled facility for disposal.

The ACETube® dewatering system offers a versatile, cost-effective method for handling municipal sludge, providing a comprehensive solution for liquid-solid separation to streamline further treatment and transport. This system utilizes a three-step approach: extraction, dewatering, and consolidation. Municipal sludge is pumped into a specialized geotextile tube made of ACETex® PP, which has a circumference of 20.5 to 21.6 meters and a length of 30 to 45 meters. Enhanced by polymer conditioning, ACETube® stands out for its unique feature—high permeability paired with an optimal aperture size. This results in superior filtration efficiency and effectiveness, enabled by the combined forces of pressure and gravity, ensuring a consistent consolidation rate within the tube.

In this application, ACETube® successfully treated an impressive volume of over 600,000 cubic meters of municipal sludge. Not only did the system deliver a high dewatering rate, but it also achieved a significant filling volume. The filtrated liquid was clean, and our client expressed high satisfaction, particularly noting the system's economic benefits, making ACETube® an excellent choice for large-scale sludge treatment projects.



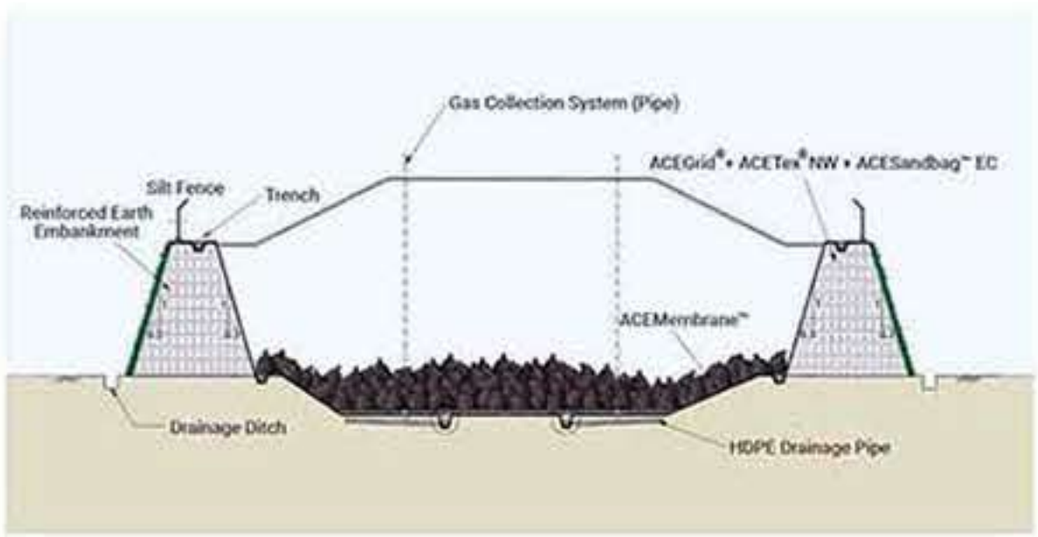
Reinforced Soil Dike, Class B Waste Landfill Expansion Project, Kaohsiung, Taiwan

Products: ACEGrid® GG, ACETex® NW, ACESandbag™ EC, ACEPin™ T, ACEDrain™ S, ACEMembrane™

Increasing population growth has significantly diminished the remaining capacity of the waste landfill. The managing authority initiated a comprehensive expansion project which includes the development of a new containment system designed specifically to accommodate a greater volume of additional refuse. To optimize and maximize the landfill capacity, the design mandates that the perimeter dike slope must be constructed as steep as engineering standards allow.

Based on a site evaluation, the in situ silty sand could be utilized as fill material for dike construction. The excavation of existing material also led to an increase in the capacity of the containment. Considering the requirement of service volume, the designer finalized a reinforced earth structure as the perimeter for the containment. ACEGrid® geogrid was adopted as the geogrid reinforcement so as to maintain a steep slope of 1:0.3 (V:H). The geogrids also provided necessary friction so that geomembrane could be securely fastened on the surface of interior slope as the impermeable liner. Soil-filled and hydro-seeded ACESandbag™ EC soil bags were stacked; ACETex® NW nonwoven geotextile were placed for the face protection of exterior slope.

Within five months, the construction of seven hectares landfill area was completed. The landfill has been operated since January 2011, and for over seven years, it still serves its function perfectly. Vegetation has grown to make a pleasant greenery and eco-friendly environment for local species habitat. The overall performance has proved an accomplishment for geosynthetic implementation in this project.



Slope Surface Protection, Keelung, Taiwan

Products: ACECell™

Keelung is densely populated and surrounded by mountains; therefore, most residential districts are built on slopes. Daching community in Keelung, with a population of 7,000, is accessed only by an 8-meter-wide road, so residents fear it could be inconvenient and perilous during disasters. Thus, the Keelung government was asked to propose constructing another road through a hill to improve transportation convenience.

Faced with the challenge of constructing a new road through a hilly terrain, the need for a secure and eco-friendly slope stabilization method became paramount. Given budget constraints and favorable geology, the contractor chose the benching open-cut technique. The engineered slope, with a gradient of 20 to 40 degrees, is 40 meters high. Essential for slope integrity is ACECell™ HDPE geocells. Deployed over the incline, these geocells form a honeycomb grid, anchoring the soil. Filled with a specialized soil blend, they bolster erosion control and provide a base for rapid vegetation. The emerging foliage adds another layer of soil stability, effectively cooperating with the geocells to reinforce the slope as if it were an extended, living root system.

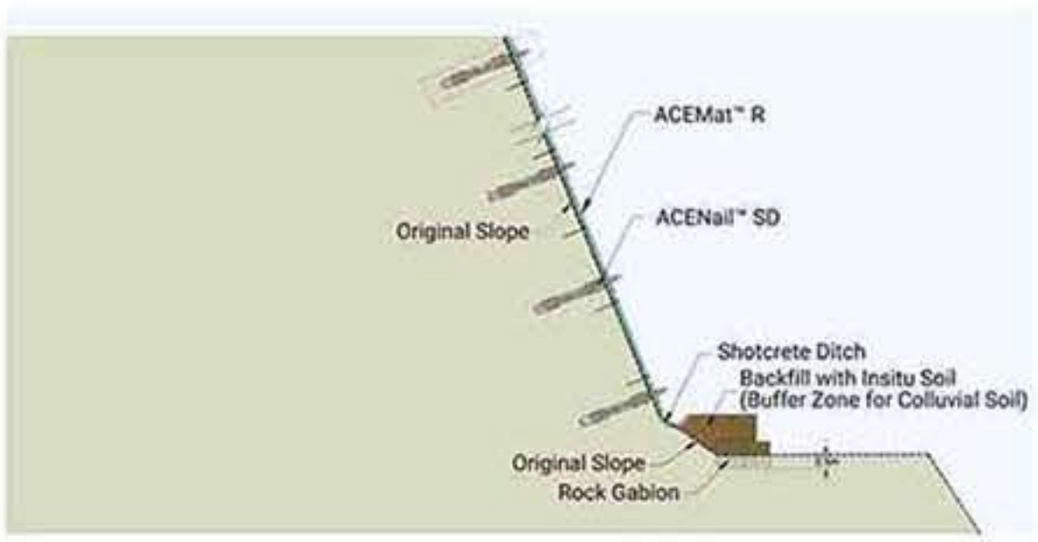
The easy, efficient installation of ACECell™ geocells boosts cost-effectiveness and speeds up project timelines without sacrificing sustainability. The results are evident: a remarkably stable, vibrant slope adorned with flourishing vegetation that enhances its natural look. This approach sets a gold standard in green engineering, offering robust erosion control and elevating the site's eco-friendly impact.

Shallow Landslide Treatment Project, Ba Deo Park, Ha Long City, Vietnam

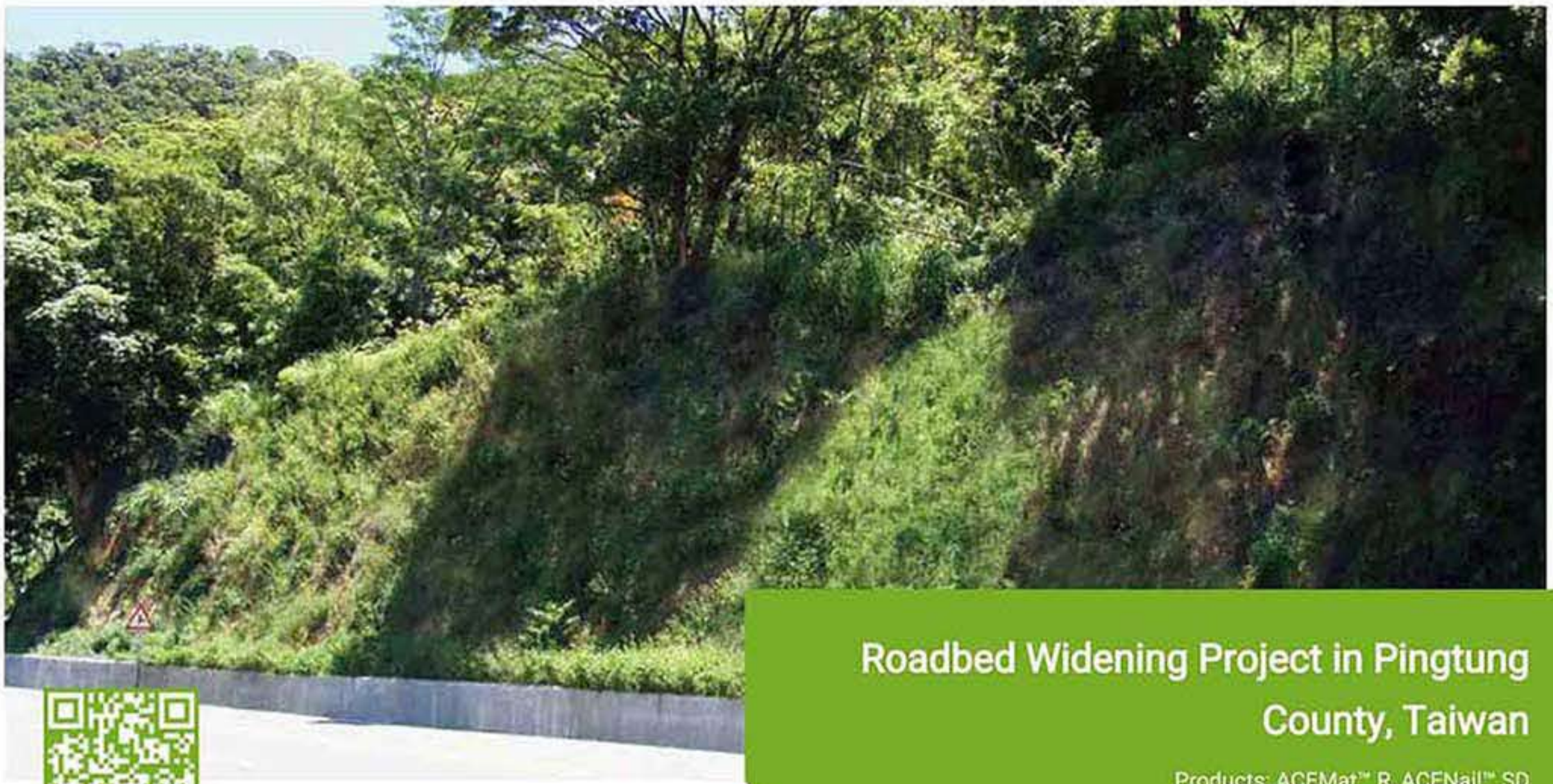
Products: ACEMat™ R, ACENail™ SD

An entertainment park was built on Ba Deo Mountain, where the unstable sandstone slope is susceptible to sliding, especially during heavy rainfall. This poses a risk to nearby residential areas. Poor geological and drainage conditions increase the landslide risk. In 2018, a significant landslide measuring 20 meters in width and length occurred, necessitating immediate rehabilitation efforts. The goal is to stabilize the slope while ensuring durability, aesthetics, and environmental friendliness.

A base layer comprising mixed seeds, fertilizer, and water-retentive material was hydro-sprayed onto the slope surface. This surface was then covered with ACEMat™ R, a product made from polymer yarns with a three-dimensional textured structure, designed to tightly integrate the soil and fertilizer, thus supporting vegetation growth. Subsequently, a 3D diamond-shaped steel wire mesh was affixed over the ACEMat™ R using grouted ACENail™ rock nails. To enhance this setup, a drainage ditch system was incorporated to prevent runoff and seepage. This comprehensive approach effectively mitigates soil erosion caused by rainfall and aids in stabilizing the shallow slope.



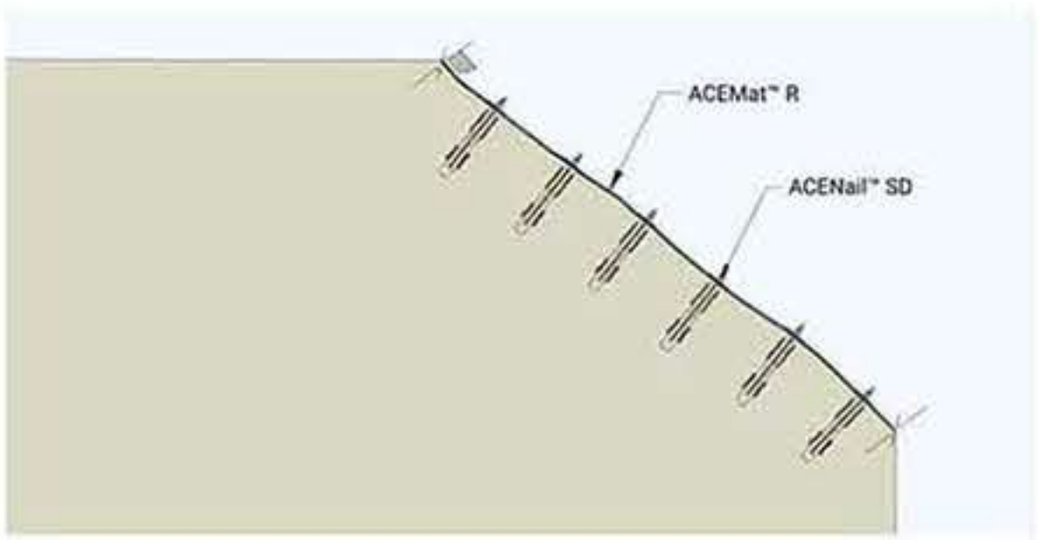
After construction, the composite protection system for shallow slope sliding treatment completely secures the vulnerable slope. Thanks to ACEMat™ R, the surface became well-vegetated, achieving not only aesthetic improvements but also effective erosion control. In addition, the flexible characteristics of ACEMat™ R allow it to adapt to local terrain conditions and facilitate easy installation. The design of this composite slope protection system featuring ACEMat™ R fully meets eco-friendly requirements, benefiting the neighboring environment.



Roadbed Widening Project in Pingtung County, Taiwan

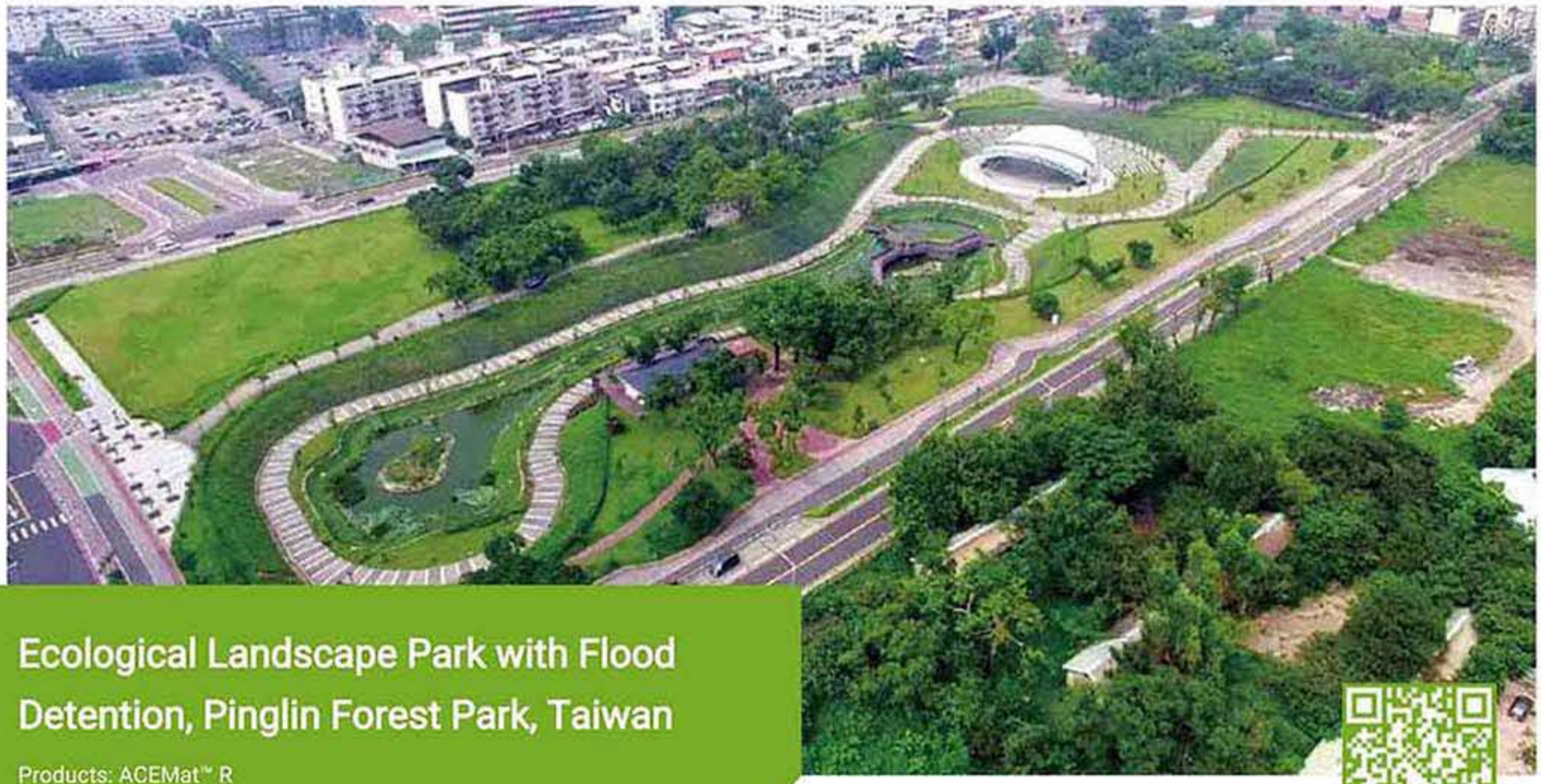
Products: ACEMat™ R, ACENail™ SD

This case is located along the slopes of Taijiu Line in Pingtung County, characterized by steep hillside and mountainous terrain with heavy concentration of agricultural farmland. The slope, steepened due to road expansion, currently stands bare, lacking any plants or vegetation. This has led to erosion and abrasion from surface run-off water from rains with occasional falling rocks, which affects the safety of passers-by.



ACEMat™ R is a High-Performance Turf Reinforcement Mat that effectively controls erosion and protects channels. Its woven mesh structure, featuring rectangular pyramid patterns, offers superior performance compared to traditional methods such as shotcrete or hard armor protection. The mat functions by decelerating and filtering runoff water, thereby reducing erosion and being environmentally friendly. The slope remediation project aimed to replace rigid concrete slopes with green vegetation slopes, creating a low-carbon road environment and supporting native wildlife. Hydro-seeding planting and ACEMat™ R installation were used to promote slope planting, increase slope roughness, and mitigate erosion caused by rain runoff. This approach enhances slope stability and contributes to a sustainable erosion control solution.

Upon completion of the project, the vegetation on the slopes flourished, effectively safeguarding the slopes and contributing to enhanced road safety. These green slopes are aesthetically pleasing and offer environmental benefits, including reduced carbon emissions and support for biodiversity. The combined use of hydro-seeding and ACEMat™ R in this project exemplifies an eco-friendly approach to slope remediation, underscoring the significance of incorporating sustainable practices in civil engineering projects.



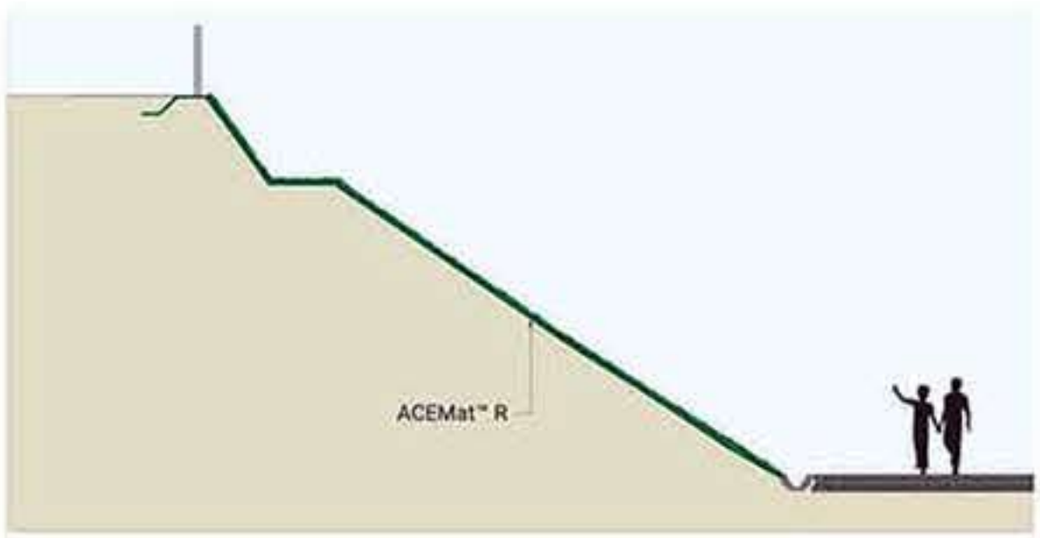
Ecological Landscape Park with Flood Detention, Pinglin Forest Park, Taiwan

Products: ACEMat™ R

The government planned to reconstruct an old military camp into Taichung Pinglin Forest Park, a multifunctional ecological park covering 11.7 hectares. The park is designed to provide recreational space, a scenic environment, and a water-detention basin. To meet the government's objectives and enhance the area's greenery, the plan includes a 3.7-hectare forest area and a 3.2-hectare water-detention basin to mitigate nearby flood risks.

In this case, ACEMat™ R High Performance Turf Reinforcement Mats (HPTRMs) were chosen to establish a green ecological landscape park covering approximately 8,000 m². ACEMat™ R, made of polypropylene yarns and featuring a three-dimensional structure, effectively works with soil and fertilizer to facilitate vegetation growth. Due to the increased surface roughness of the textured mat, soil erosion caused by rainfall can be minimized. The mat interlocks with soil to create a solid base, helps dissipate run-off and stream erosive forces, and protects the soil surface from water splash and erosion. ACEMat™ R safeguards slopes and prevents the expansion of naturally formed erosion ditches. The mat's flexibility simplifies installation across various terrains.

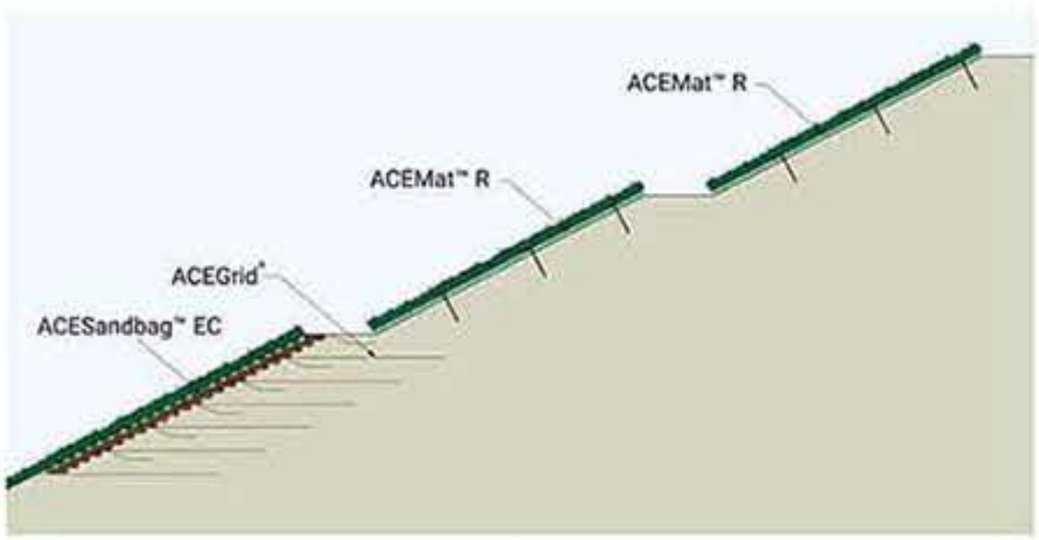
The construction of Pinglin Forest Park serves a vital role in ecosystem preservation by conserving water, regulating atmospheric temperatures, creating wildlife habitats, and maintaining the existing landscape. By employing ACEMat™ R as a green engineering solution, the park not only improves its visual appeal compared to traditional concrete structures but also establishes a multifunctional, ecological, and sustainable environment that effectively reduces air pollution.



Slope Protection in Malaysia

Products: ACEGrid® GG, ACEMat™ R, ACESandbag™ EC

In October 2019, heavy rainfall triggered a 300-meter landslide on a mountainous road in Malaysia. The affected area includes a route to a tourist attraction, requiring immediate slope rehabilitation. The goal is to both restore the road and stabilize the 30-meter-high, 300-meter-long slope. A cost-effective, easy-to-install, and sustainable slope protection system is needed to address transportation, tourism, and economic concerns.



The project consists of two stages. In the first stage, the downslope was addressed first. The in-situ soil was effectively compacted layer by layer using ACEGrid® to achieve optimal reinforcement, ensuring reliable stability and safety. ACEGrid® has excellent long-term design strength and interface friction, making it durable. In the second stage, the upper slope section is backfilled at the same slope angle as the downslope, followed by the installation of ACEMat™ R high performance turf reinforcement mats throughout the entire slope. ACEMat™ R is a three-dimensional woven green PP fiber material that enhances bonding between vegetation and aids plant growth. Its surface roughness slows erosion from heavy rain, protecting topsoil and preventing enlargement of erosion channels.

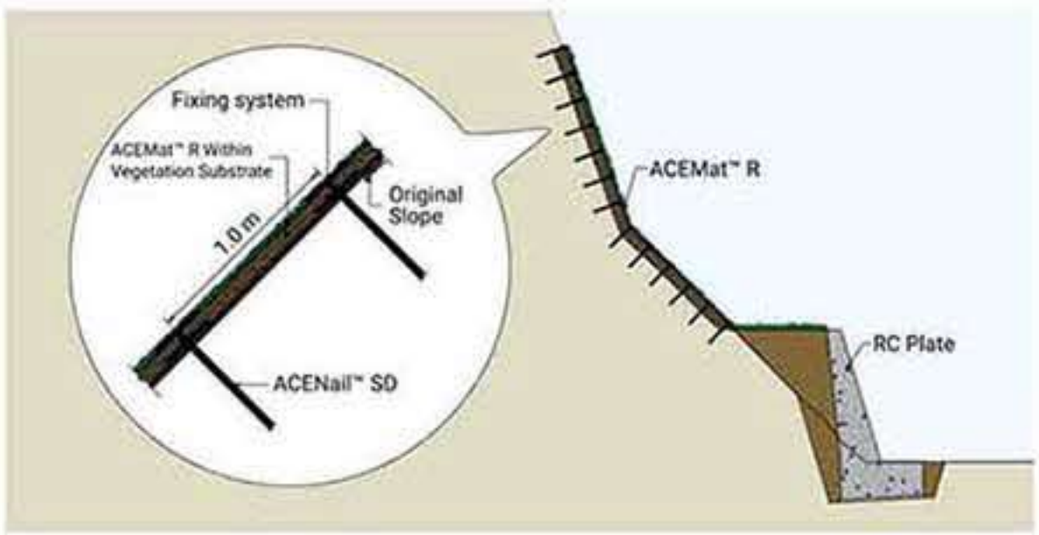
The reinforcement method ensures structural safety and adaptability, with site-specific designs based on local topography. It uses local soil and rock materials, thereby promoting sustainability, energy efficiency, and carbon reduction. It contributes to achieving net-zero carbon emissions and helps mitigate climate change. The erosion-resistant method improves slope stability and provides a visually appealing green aesthetic. Integration of vegetation enhances the overall beauty of the area and minimizes visual impact.

Treatment and Erosion Protection, Upper Slope of Tunnel Portal Taichung, Taiwan

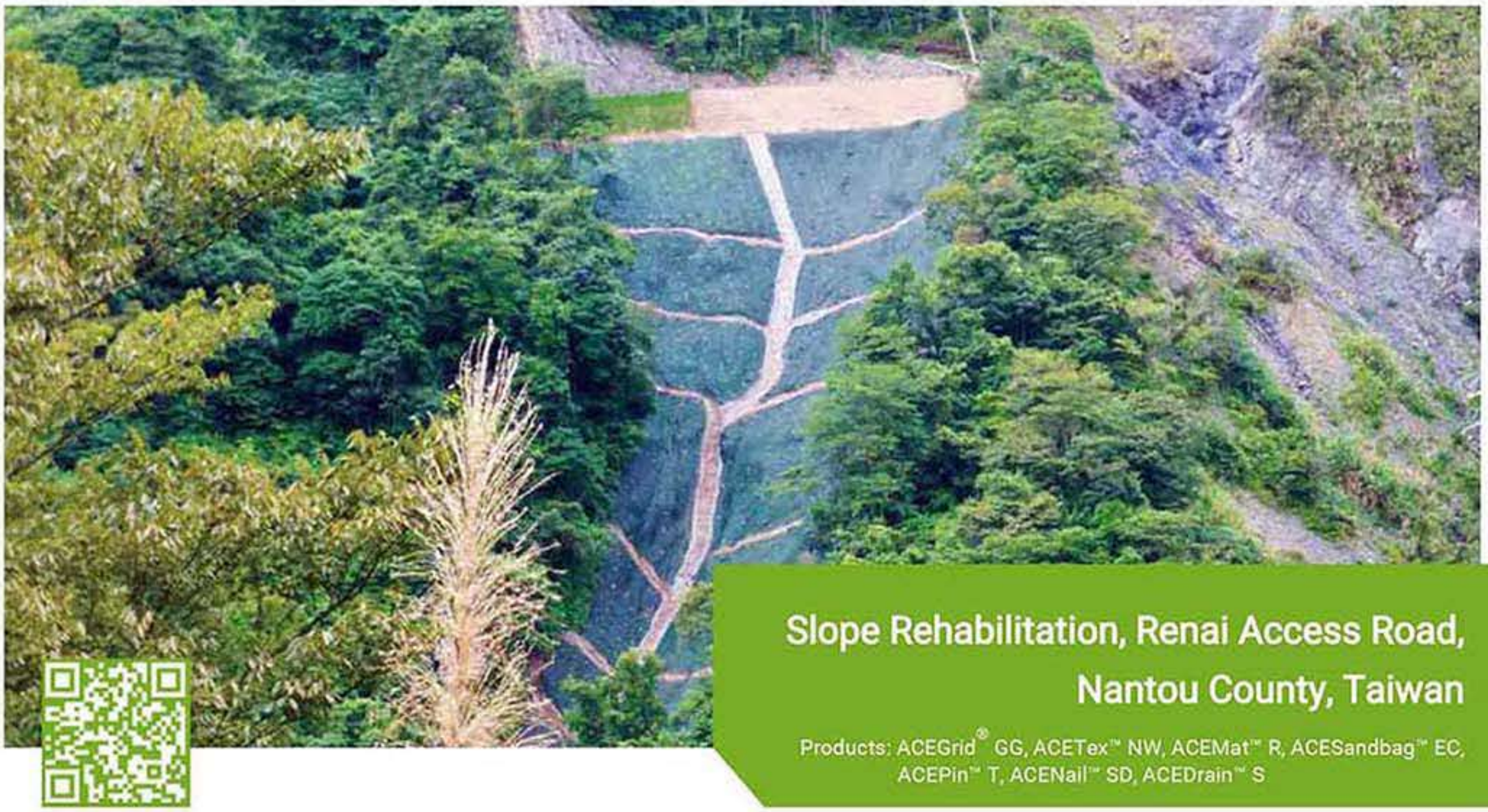
Products: ACEMat™ R, ACENail™ SD

This project took place at the portal area of tunnel No.9 in Taichung where an abandoned railway transformed into a scenic bike path. The upper slope surface, covered by weathered and fractured sandstone, posed an instability risk. In 2006, heavy rainfall saturated the slope, triggering a shallow plane failure and endangering traffic safety. The managing authority sought immediate rehabilitation to stabilize the slope and enhance the scenic quality of the portal area.

The slope rehabilitation process involved securing 3D diamond-shaped high-tensile steel wire mesh to the bare slope using grouted soil nails. A base layer consisting of a mixture of seeds, fertilizer, and water-bearing material was hydro-sprayed onto the wire mesh networks. ACEMat™ R turf reinforcement mat, known for its effectiveness in controlling erosion in various environments, was applied. The mat interlocks with the soil, dissipates run-off and erosive forces, and protects the soil surface from water damage. It also retains seeds and plants, providing exceptional erosion control and vegetation enhancement. It was fixed in conjunction with the steel wire mesh using ACENail™ soil nails.



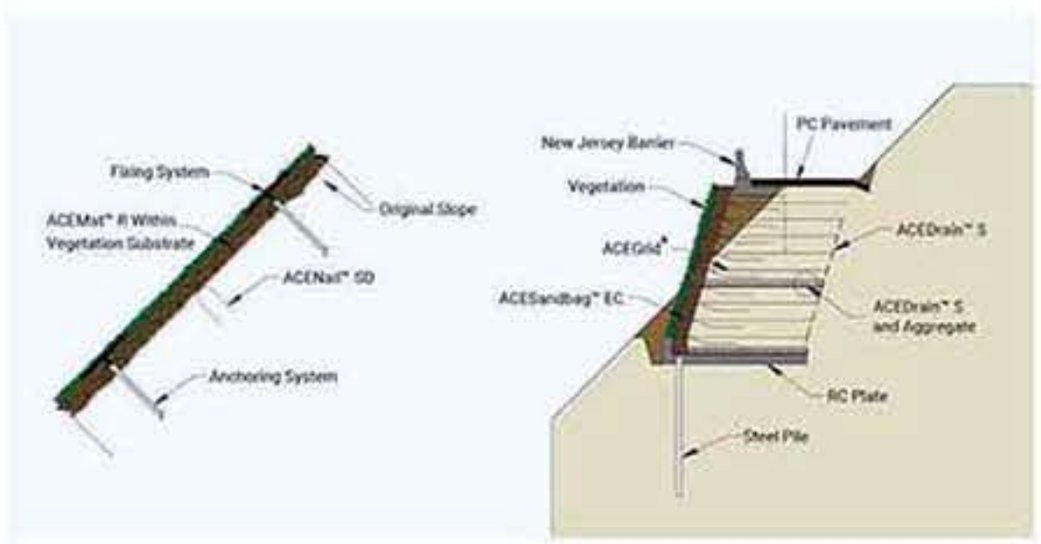
This composite slope protection system not only ensures the stability of the weathered sandstone but also adds a vibrant green aesthetic to the portal area. The design of ACEMat™ R provides ample space for vegetation growth, attracting a diverse range of local species. Despite facing challenges from strong typhoons and torrential rainfalls, the rehabilitated slope remains stable, boasting lush vegetation. The success of this design scheme demonstrates that the composite slope protection system incorporating ACEMat™ R fulfills the requirements of an eco-friendly environment with robust stability.



Slope Rehabilitation, Renai Access Road, Nantou County, Taiwan

Products: ACEGrid® GG, ACETex™ NW, ACEMat™ R, ACESandbag™ EC, ACEPin™ T, ACENail™ SD, ACEDrain™ S

The site is located in Renai Township, a mountain indigenous village in Nantou County, Taiwan. It is famous for its aboriginal cultural products and beautiful natural scenery. The slope was disrupted due to torrential rainfall, exacerbated by its poor geological and hydrological conditions. The slope suffered severe damage, with a collapse depth of over 30 meters. This resulted in a total loss of road structures and subsequent disruption to local traffic.



The rehabilitation project prominently featured the ACEMat™ R High-Performance Turf Reinforcement Mat (HPTRM) and ACEGrid® geogrid as essential components. The design incorporated a reinforced concrete mat foundation, supported by steel H-piles as the base. Then, a mechanically stabilized earth wall (MSEW), 5 m in height and 6 m in width, was built to serve as the embankment for the access road. Stacked soil-filled sacks with ACEGrid® wrap-around facing profited the slope. The step-back inclined ratio of the MSEW allowed for a wider access road. For downslope protection, ACEMat™ R high performance turf reinforcement mat (HPTRM) was used instead of rigid structures. ACEMat™ R was secured with ACENail™ soil nails and steel wire meshes, creating an eco-friendly solution for slope protection.

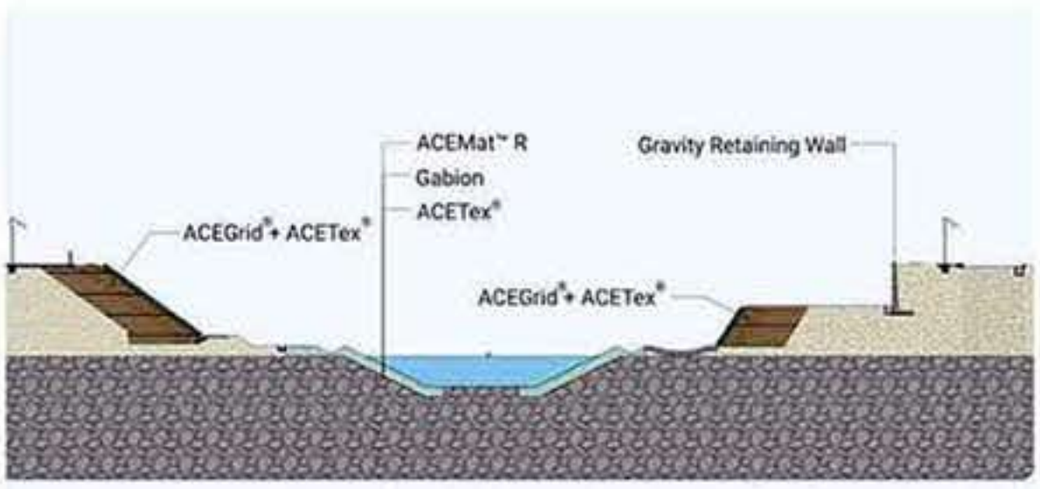
ACEMat™ R fosters vegetation growth, attracting local species, enhancing the slope's stability, and improving site aesthetics. Despite typhoons and heavy rainfalls, the composite system remains functional, ensuring slope stability. The eco-friendly approach using turf reinforcement mats instead of traditional structures garnered praise for the project's success.

Maple Garden, a Recreational Park with Flood Detention, Taichung, Taiwan

Products: ACEGrid® GG, ACETex® PP, ACETex® NW, ACEMat™ YS, ACESandbag™ EC, ACEPin™ T

The Maple Garden project is an underground recreational park with a land area of 30,000 m². Originally intended for the Taichung International Expo Center, the project was abandoned after excavation, leaving a hazardous boomerang-shaped ground opening of approximately 20 meters deep. This opening adversely affected the city's appearance, posed safety risks, and constrained land use. The local government faced public pressure to address the situation promptly and within budget constraints.

To meet demands, the project utilized geosynthetic products like ACEGrid® geogrids, ACETex® geotextiles, ACESandbag™ EC sand bags, and ACEMat™ YS vegetation mats for reinforcement and landscaping. Opting for a wrap-around method with ACEGrid® GG, ACESandbag™ EC, and ACEDrain™ drainage boards were employed to mechanically stabilized earth walls (MSEW) and reinforced soil slopes (RSS) to support loads from adjacent roads and walkways, facilitating vegetation growth on surfaces and reducing time, costs, and concrete use. A 200,000 m³ detention pond, integrated with city drainage for flood control, was built ecologically using geotextiles, soil bags, erosion mats, gabions, and gravel. The pond's gravel base was topped with ACETex® PP geotextile for filtration, with ACEMat™ YS mats and gabions above for plant support and erosion prevention, contouring the landscape.

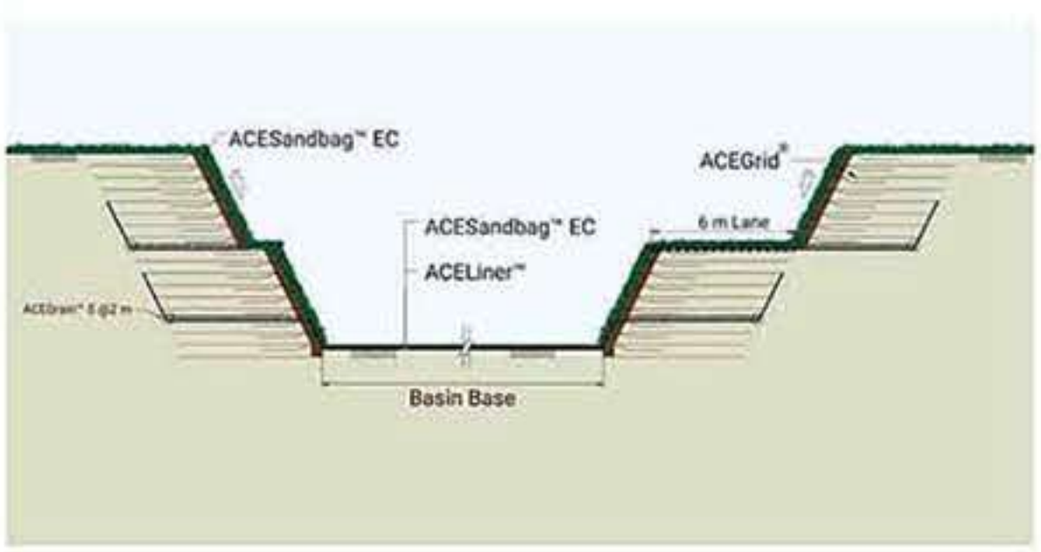


Geosynthetic products played a major role in the environmentally friendly construction of the Maple Garden project. Using in-situ materials and geosynthetics reduced costs and promoted convenience. The project transformed a problematic ground opening into an attractive scenic site, providing recreation and serving as an urban drainage regulator. The vegetation increased green coverage, reducing the urban heat island effect. This achievement received awards and recognition, including the 2013 FIABCI Prix d'Excellence Award.

Geosynthetic Detention Basin at Shalu Interchange, Taichung, Taiwan

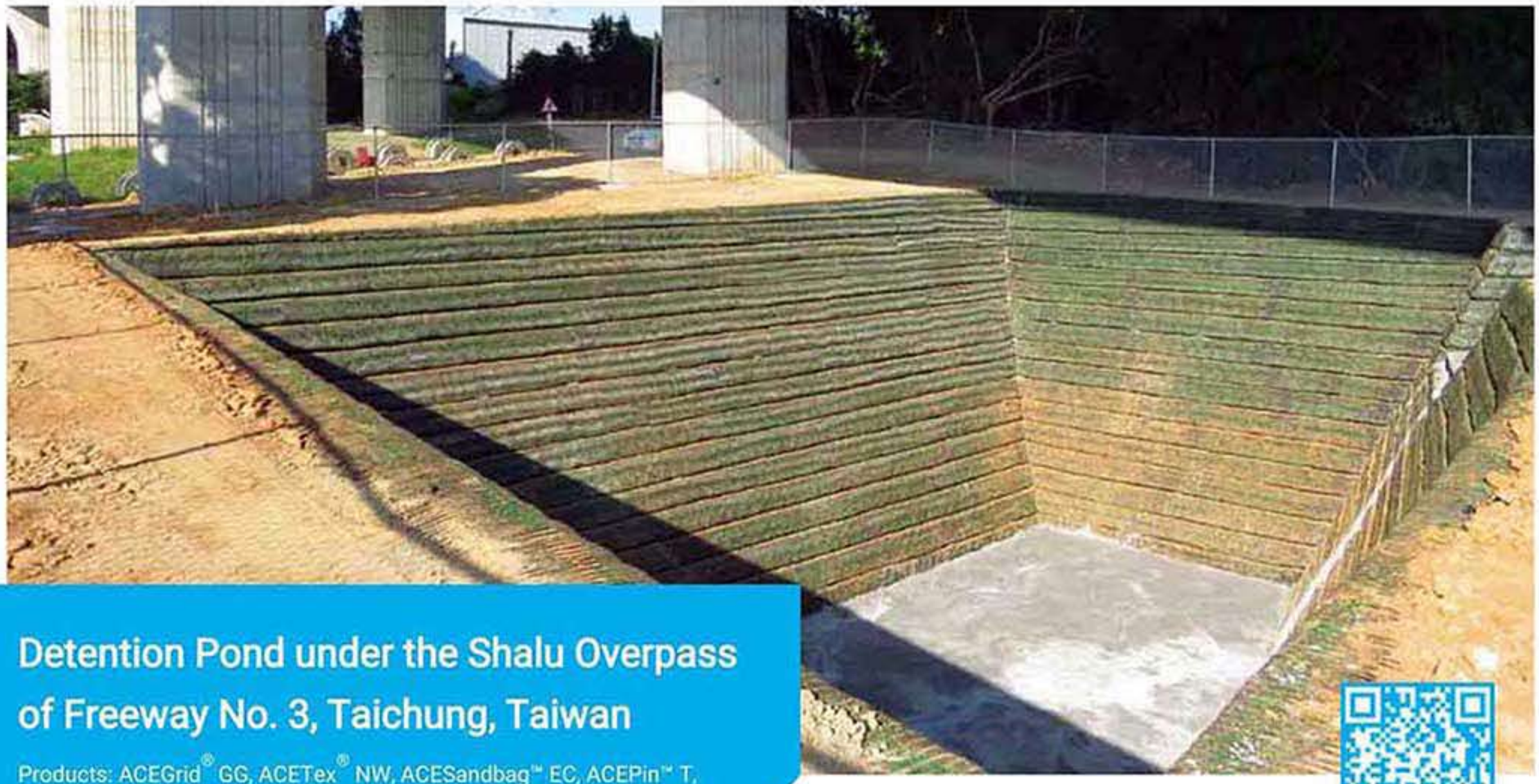
Products: ACEGrid® GG, ACETex® NW, ACESandbag™ EC, ACEPin™ T, ACEDrain™ S, ACELiner™

Over the past several decades, extreme climate change has led to more frequent heavy rainstorms, overwhelming the area's existing drainage systems and heightening flood risks due to the region's steep terrain. To mitigate this issue, the local municipality converted unused space at the Northbound Ramp of Shalu Interchange into a large detention basin specifically designed for disaster prevention. The project emphasized green engineering principles to ensure environmental sustainability.



The project unfolds in several phases. First, the existing drainage canal is removed due to insufficient capacity. Next, the site is excavated 10 m deeper. A reinforced soil structure is then constructed along the 300 m perimeter of the excavated area, using ACEGrid® geogrids for reinforcement and ACESandbag™ EC for soil confinement and erosion prevention. The basin's 3,500 m² bottom is lined with ACELiner™ GCL and anchored with soil-filled ACESandbag™ EC, supporting both vegetation and pond ecology. The basin also connects to a rainwater recycling system, offering flood control and environmental sustainability.

Since its completion, the project has successfully managed numerous torrential rain events, effectively capturing surface runoff and preventing casualties. The detention basin not only alleviates flood risks but also provides gradual downstream water release, reducing the area's overall burden during heavy rains. Beyond flood control, the geosynthetic solution enhances local ecology by offering a suitable habitat for plants and animals. The project is exemplary in maximizing land use and integrating seamlessly with the surrounding environment, all while emphasizing environmental sustainability.



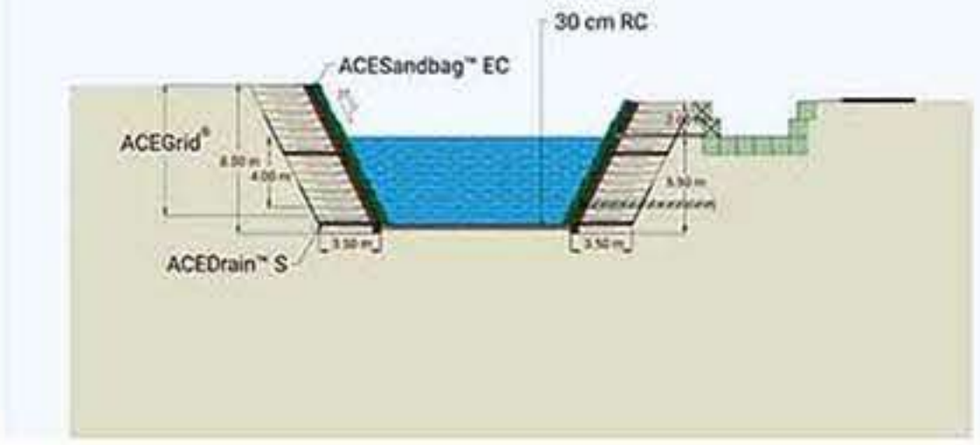
Detention Pond under the Shalu Overpass of Freeway No. 3, Taichung, Taiwan

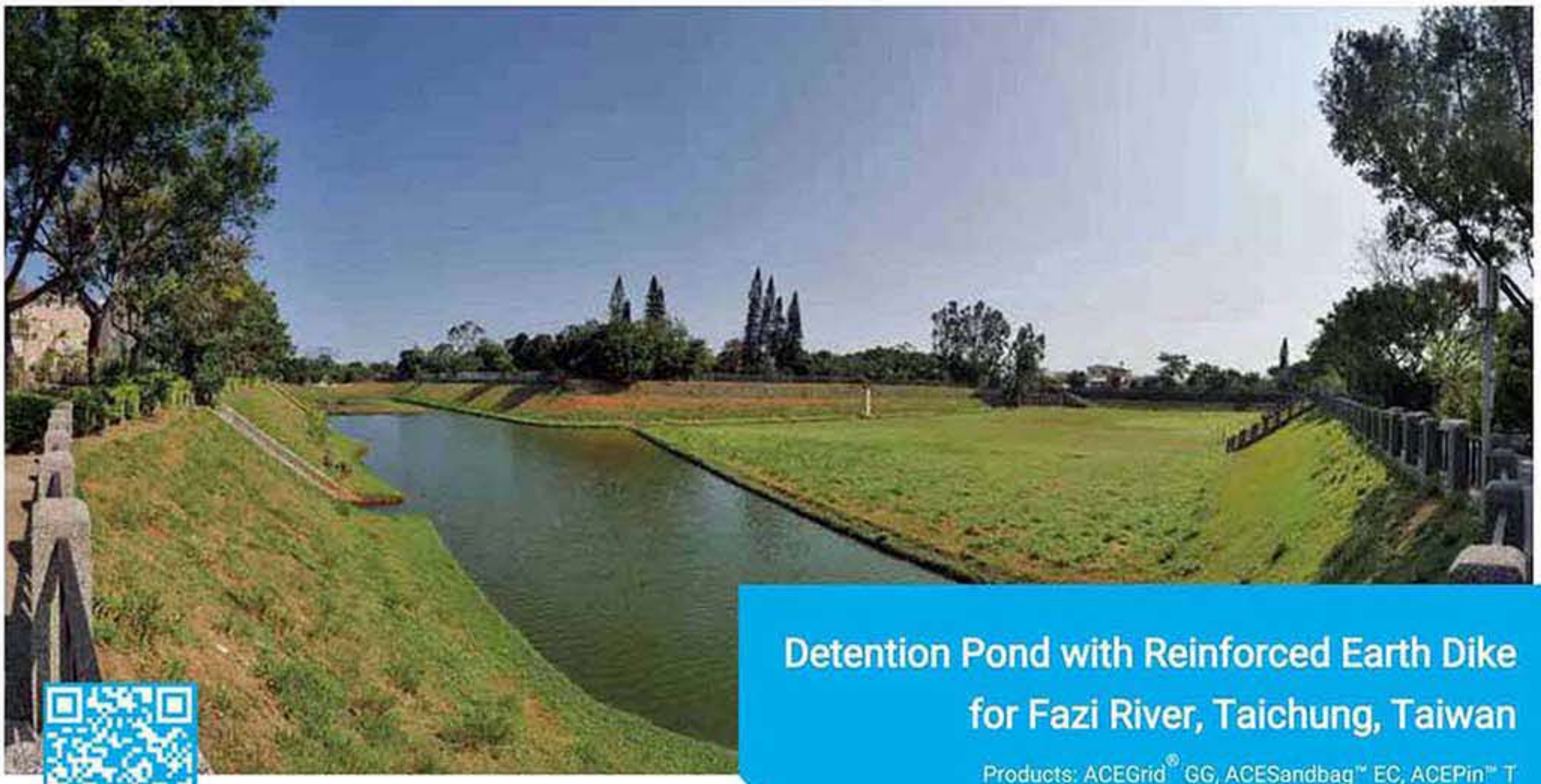
Products: ACEGrid® GG, ACETex® NW, ACESandbag™ EC, ACEPin™ T, ACEDrain™ S

Typhoons cause mudflows and flooding in Dadu Mountain's west side, impacting Shalu District, Taichung City. To address this, the government launches a drainage project to treat the upstream slope and improve downstream urban drainage. A 1,026 m³ detention pond is planned to be built beneath the Shalu overpass on Freeway No. 3, utilizing the space between bridge piers. It will store runoff temporarily, reducing peak flood flows and mitigating downstream flooding during rainy seasons.

The geology of Dadu Mountain consists of laterite on Toukoshan formation, primarily composed of permeable gravels. Prioritizing water conservation, landscape, economy, and ecology, the project uses local materials to construct a mechanically stabilized earth (MSE) wall around the detention pond. The pond's bottom incorporates a 30 cm thick RC board for flood interception. A single-stage reinforced slope, 7.5-8.5 m high, utilizes ACEGrid® GG geogrids with a tensile strength of 220*110 kN/m. Vertical intervals of 4 m have a 20 cm thick gravel drainage layer with ACEDrain™ S geocomposite drainage panels to divert seepage water into the pond for slope stability. ACESandbag™ EC filled with selected soils and wrapped in ACEGrid® GG geogrids provide a stable foundation for vegetation, promoting greening and ecological sustainability.

The detention pond, completed in 2014, has withstood multiple typhoons and excels in flood storage. Using mechanically stabilized earth (MSE) meets civil engineering safety and economic standards while aligning with industry goals for carbon reduction and sustainability. Subsequent local projects are modeled after this design. Once other drainage and detention projects in Shalu, Taichung, are completed, they are expected to significantly mitigate flooding with minimal environmental impact.

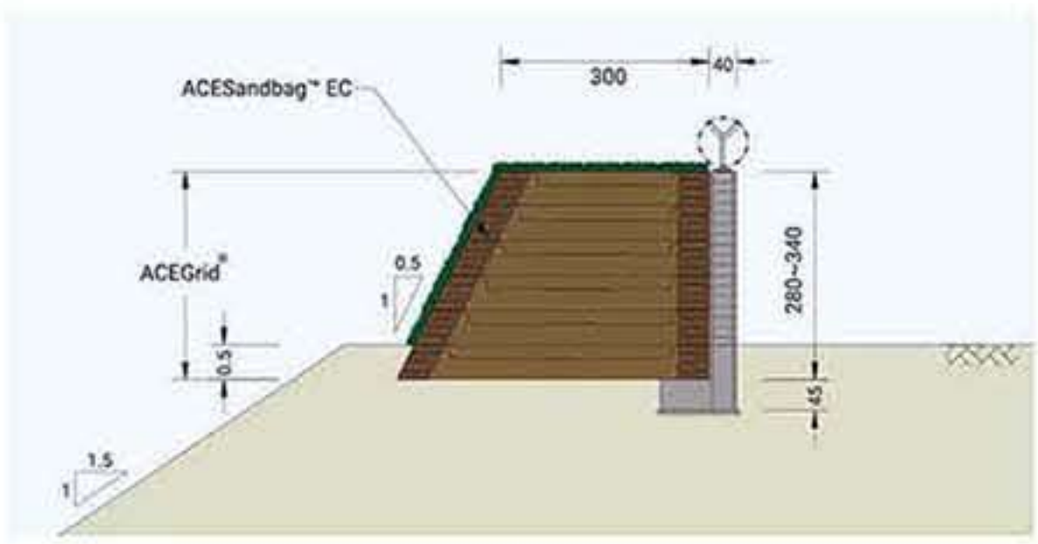




Detention Pond with Reinforced Earth Dike for Fazi River, Taichung, Taiwan

Products: ACEGrid® GG, ACESandbag™ EC, ACEPin™ T

In hillside Shisanliao area, the drainage connecting to the Fazi River is being upgraded due to its limited capacity, leading to floods. A new retention pond will mitigate peak flows and enhance safety. River encroachments and unclear channels reduce flood discharge efficiency. The current system fails under external runoff, risking upstream floods and threatening local agriculture and property. Upgrades aim to lower peak flows, safeguarding residents and land use.



To effectively mitigate flooding, authorities have expanded the drainage capacity by widening its channels and constructing a 2-hectare flood detention pond. This pond, tailored to the site's gentle slope, features a reinforced earth dike that gradually increases in height from 0.5 m to 3.5 m. The use of local materials for the dike not only enhances efficiency but also favors environmental sustainability over concrete structures. Designed as a dry pond with a permeable base, it supports groundwater recharge and soil conservation. The pond is cleverly divided into two zones: one for sedimentation to handle daily drainage and the other, separated by gabions, doubling as a recreational area, thereby managing flood risks while promoting community well-being and ecological integrity.

The project's innovative use of a reinforced earth dike, constructed from local geological materials, has not only bolstered structural stability but also slashed transportation costs and construction time, exemplifying sustainable engineering. This dike, integral to the detention pond, has effectively curtailed the flood risk for over 16 hectares, enhancing local agriculture and land use, and safeguarding the livelihoods and properties of residents.

ACE Expertise

Versatile and Customized Solutions

Our integrated capabilities span from product development and manufacturing to processing, engineering planning, design, analysis, and construction. We tailor our solutions to our customers' specific needs and have supplied products for tens of thousands of practical cases in over 70 countries worldwide.

Globally Recognized Quality

We've earned trust through globally recognized certifications, including ISO 9001 and ISO 14001, and product certifications such as CE, NTEP, BBA, GOSTR, and more. Our commitment to quality is further underscored by our world-class testing laboratory certified by ISO/IEC 17025, TAF and GAI-LAP, which performs accurate, reliable, and comprehensive geosynthetic testing and research.

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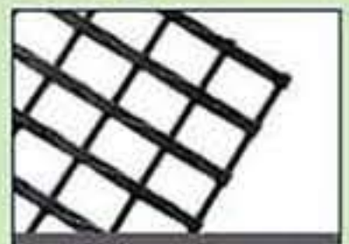
With over 90 approved patents and over 100 technical articles published, our work is globally acclaimed. We've received eight International Achievement Awards from the Industrial Fabrics Association International for practical cases utilizing geosynthetic materials - the most in Asia and second most globally.

Engineering a Sustainable Future

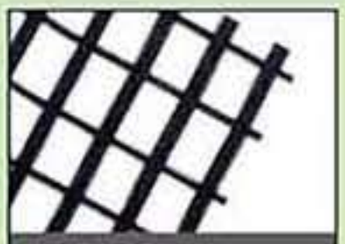
Our sustainability strategy aligns with the United Nations Sustainable Development Goals (SDGs). We're dedicated to providing safe, economical, eco-friendly, and low-carbon solutions in infrastructure construction, ecological and environmental protection, and disaster prevention and recovery, reinforcing our societal contributions and strengthening our business concurrently.

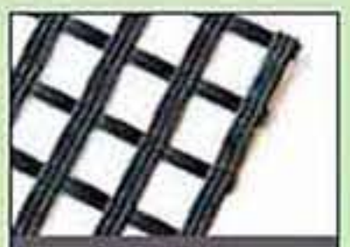
ACE Products

Geogrids


ACEGrid® GG


ACEGrid® FR


ACEGrid® GN


ACEGrid® GA


ACEGrid® GDP


ACEGrid® GDE

Geotextiles


ACETex® PET


ACETex® PP


ACETex® ES


ACETex® SL


ACETex® NW DPF


ACELoop Tex™

Geotextile Bags, Tubes and Containers


ACETube® HS


ACETube® DS


ACEContainer™


ACEBag™ MB


ACEBag™ GB

Erosion and Sediment Control


ACEFormer™


ACEMat™ R

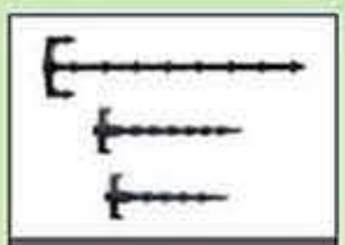

ACESandbag™ EC


ACESandbag™ SB


ACECell™

Anchors


ACENail™ SD


ACEPin™

Drainage and Lining


ACEDrain™ H


ACEDrain™ Y


ACEDrain™ S


ACELiner™


ACEMembrane™

Geocomposites


ACECompo™ GB


ACECompo™ GC


ACECompo™ GS


ACECompo™ PETB

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ACE Geosynthetics Ecopark is designed and constructed by ACE Geosynthetics with a total area of 10,000 m² to demonstrate various geosynthetic applications in civil engineering. Because sustainability has become an essential issue for engineering and environmental projects, geosynthetics are gradually becoming the preferred solutions for sustainable civil engineering applications. It has been proven that construction can be more uncomplicated and environmentally safe with geosynthetics.

When visiting our educational Ecopark, visitors are capable of finding out over 20 geosynthetic applications built in actual dimensions (1:1) for a tangible demonstration. This Ecopark is not only to demonstrate the geosynthetic applications but also to achieve the educational purpose of making more people realize the benefits of applying geosynthetics to our environment.

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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

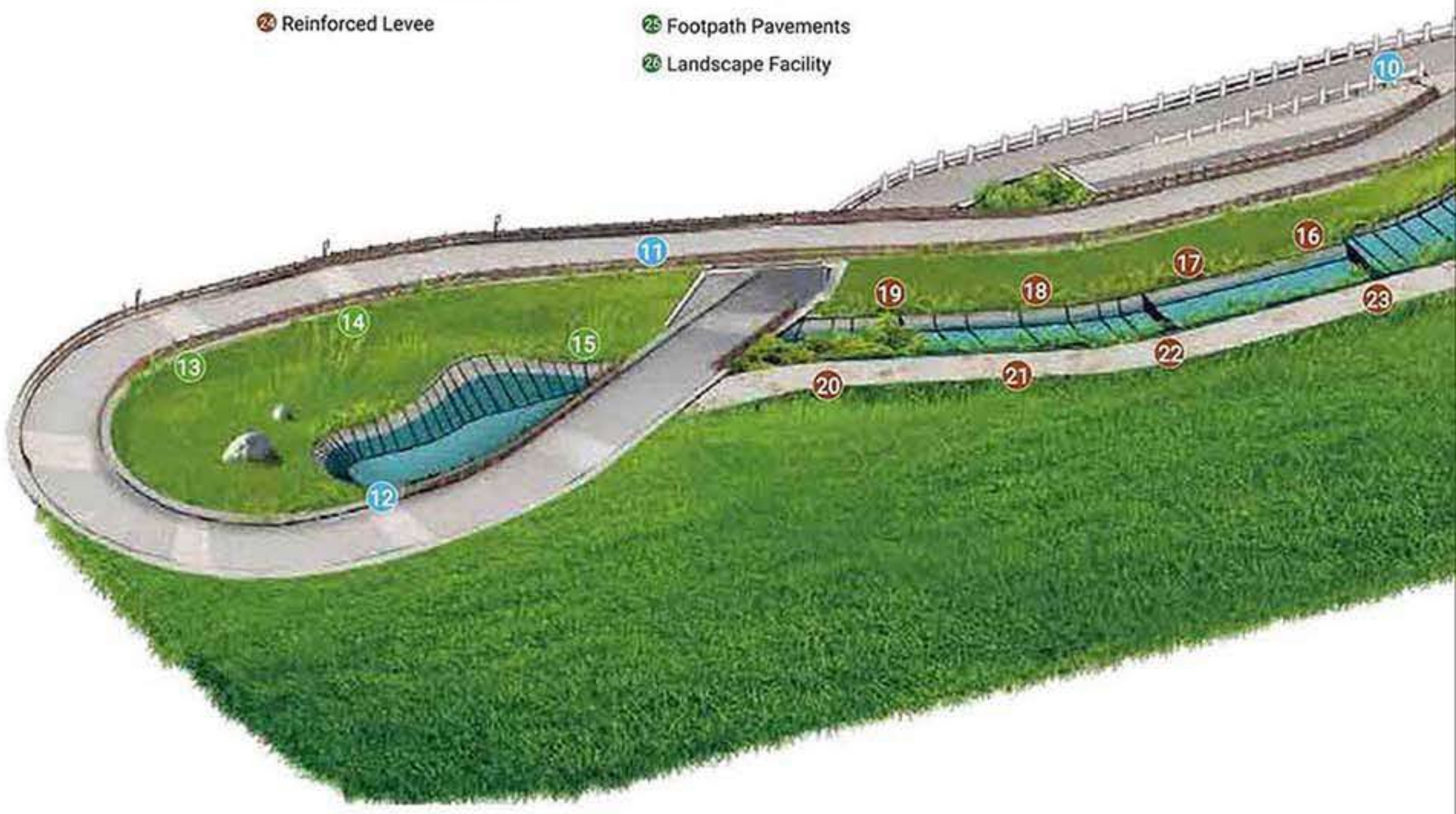
13. Geomat
14. Rectangular Pyramidal Geomat
15. High Strength Geomat

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





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