



Geosynthetics

CASE STUDY COLLECTION

Riverbank and Channel Protection

Bridge Piers Protection, Zhongsha Bridge, National Freeway No. 1 Taichung, Taiwan, ROC



The Background

Zhongsha Bridge, a 2,345m-long, traditional pre-stressed concrete structure, located on the Zhuoshui River in Central Taiwan between Changhua and Yunlin Counties. It had been the longest bridge in Taiwan when it was built in 1978. As the important link of north and south, the accomplishment of the bridge finalized the construction of the National Freeway No.1, the arterial which connects all the major cities on the west coast of Taiwan.

The river at the bridge has been facing continuous impact of fluvial processes. After its service of several decades, recently, because of long-term persistent severe scouring, some bridge pier foundations and their surrounding areas had shown extremely unstable and required an immediate remediation. Considering the importance of the bridge, the design and construction of the remediation were strictly required to follow the highest level of engineering performances. The remediation consisted of riverbank revetment rehabilitation, repair and reinforcement of submerged-weir ground sill and aprons protection. The remediation was mainly to secure the bridge stability and ensure the necessary traffic safety. In addition, flooding always submerged the farmland adjacent to the river and put the residents and their property in great danger. The mitigation project also provided necessary protection for the farmland in that area against damage.

The Solution

In this project, geotextile tubes, ACETube[®] and geotextile mattresses, ACEFormer[™] were adopted to solve the abovementioned problem. The protection was designed to be 5.6m high with four layers of ACETube[®]. After each layer of ACETube[®] was filled with in-situ sand, local fill was then placed and leveled on the top to make an even surface for the installation of the following layer. Such procedure was repeated until the four layers were finished.

At the end of construction, the four-layer structure was covered with ACEFormer[™] filled with concrete, which not only increased the impact resistance of the structure and kept ACETube[®] from external damages caused by driftwood or debris coming down the river, but also enhanced the stability of the pier foundations and dikes. Furthermore, the mattresses used here were pervious which allowed the excess water in the structure to discharge into the river, thus making the structure more stable. The uneven surface of ACEFormer[™] also helped reduce flow velocity and slowed down the erosion process.

ACETube[®] and ACEFormer[™] proved to be a better solution also because of their flexibility, which allowed them to easily adjust to various landforms in the process of construction. In this case, such property was especially advantageous when the construction was located at river curves. Both materials showed higher applicability than other rigid structures under such conditions. As a result, the combination of these two materials provided more reliable protection to the pier foundations and the dikes and essentially improved the structural safety of the bridge.



The Contribution

The construction was completed in 2012. Since then, regular maintenance has been conducting to ensure the performance of the structure and therefore to secure the safety of local residents and the commuters on the bridge. Both ACETube[®] and ACEFormer[™] are products of low energy consumption and low carbon emissions. In comparison with traditional concrete structural system, uses of ACE materials herein not only present eco-friendly sustainability, but also save the cost of expensive concrete material. In addition, the flexibility of these materials makes them adaptable to different kinds of landforms and site conditions, not only making construction much easier, but also helping the structures to accommodate to the environment. Even typhoons that bring disastrous floods were unable to cause any damage to them. The completed structures are beneficial for erosion prevention. The scouring of the pier foundations is now under control. The fertile newly-formed land even luxuriantly grows vegetation, making the site totally integrate into the surroundings.

Revetment Protection, Anliang Harbor Canal Taichung, Taiwan, ROC

The Background

Anliang harbor canal, one of the most important waterways in Taichung area, is responsible to discharge the collected water from the upstream basin of Grand Metropolitan Taichung. However, due to the accumulation of silt and trashes and the randomly overgrown weeds, the volume of the waterway had significantly reduced. Therefore, the discharge capacity of flooding had decreased, led to the scouring effect more and more severe with time. Such malfunction not only jeopardized the stability of the canal, but also caused local residents vulnerable to flooding risks. The poor canal condition must be improved in a timely manner.

ACE Revetment Composite System – A Novel Remediation Solution for Waterfront Environment

Considering the importance of the canal, Taichung City Government called for a remediation project, including dredging, widening, and remodeling of the canal. The purpose was not only to resume the flooding protection capability but also to reinstate the canal as an eco-friendly environment for residents and visitors. Based on the client's objectives, the designer developed the scheme of the project: safety, durability, aesthetic, and sustainability.

The first step of the construction was to stabilize the base of the canal by installing pile-supported reinforced concrete revetment for areas below the water level. Then, reinforced earth slope (RES) with ACEGrid[®] was placed as revetment in the upper portion of the canal. The RES also functioned as the retaining structure for the service road along the canal. It was constructed with geogrid wrap-around facing with an inclined ratio of 1:2 (H:V). Stacked soil-filled ACEBag[™] was used for slope face protection. They were hydro-seeded and the vegetation has been displayed pleasant greenery with time. ACEGrid[®] and ACEBag[™] are products of low energy consumption and low carbon emissions. They were integrated with local compacted natural soils and finally built together as a totally sustainable structure.

The construction took about four months to complete in the summer of 2011. Since then, the revetment has been through several attacks of strong typhoons and by far still remains in stable condition. The durable service condition together with a variety of valuable species and the attractive waterfront scenery on the site has proved ACE revetment composite system totally meets the demands of the project objectives: safety, durability, aesthetic, and sustainability.



Riverbank Protection

Riverbank Protection, Niaosong Canal, Kaohsiung, Taiwan, ROC

Project Outline

"Niaosong Canal Widening and Improvement Project" was part of the program of "Flooding Mitigation for Flood Prone Area in Grand Kaohsiung Metropolitan Area"

By widening, dredging, and remodeling of the canal, the objectives of the project were to:

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

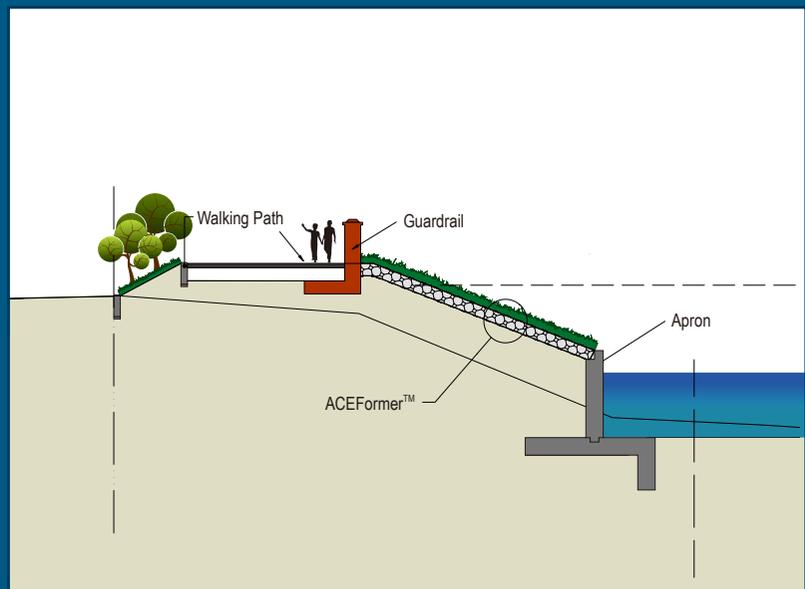
In addition, the construction also entitled the canal to become an eco-friendly environment and a water-accessible area.



Design Concept

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

Since 2010, the completion of the project, the initial palish gray surface of the ACEFormer™ has been changing to richly fresh green and a variety of local species have observed on site. Although the site has experienced several challenges of strong typhoons and torrential rainfalls, the canal stays stable and the flooding damages have ceased completely. The successful experience of this project demonstrated that ACE Revetment Composite System can be beneficial for a site similar to this case.





ACE Geosynthetics, established in 1996, is a leading geosynthetics manufacturer and solution provider headquartered in Taiwan. We develop, manufacture and supply a wide range of reliable geosynthetic products that are approved and certified by CE, BBA, NTPEP. We also customize products to meet clients' various needs. In our company are more than 40 experts in civil, geotechnical, marine, hydraulic and environmental engineering who provides professional technical service and cost-effective solutions that help clients realize projects with success and efficiency.

What We Offer

Structure design and analysis

Our experienced engineers design and conduct analysis with professional engineering software such as MSEW, ReSSA, Reslope, Stedwin and GeoCoPS, and provide drawings or advice to help clients install materials properly.

Product customization

We customize products for clients. Many of our products including ACEGrid[®], ACETex[®], ACETube[®], ACEFormer[™] and ACEBag[™] can be made according to individual specifications to fulfill particular requirements.

Technical Consultation

We work closely with clients and provide advice in every stage throughout the entire process, including selecting optimal products, proposing solutions and giving advice on material installation.

Construction Assistance

We offer on-site technical support on request during construction to ensure proper installation of products and structural stability.



Our experience and achievements:

- Reinforced walls and slopes
- Soil stabilization
- Ground stabilization
- Pavement reinforcement
- Erosion control
- Sewage and sludge dewatering
- Shoreline remediation
- River / wetland remediation
- Coastal protection
- Harbor dredging





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