



# Geosynthetics

CASE STUDY COLLECTION

Environmental Protection

# Industrial Sludge Treatment Capacity Improvement with ACETube®

## The Background

Traditional wastewater treatment plants have two methods for sludge dewatering. One is natural exposure in sludge drying beds; the other is to use dewatering machines. Dewatering by means of drying beds entirely takes advantage of sunlight. The shortcoming is inefficiency. Besides, treatment volume also depends upon the area of drying beds. Speaking of dewatering machines, such as belt press filter, it is an industrial machine, used for solid/liquid separation processes, particularly the dewatering of sludge. The machine needs not only electricity, but also regular maintenance. It means operation costs are required, too. Moreover, carbon emission is another issue. In fact it is not beneficial to costs and environment.



## The Problem

The contractor used the sludge buffer pool with depth 3m. The main function is storage of sludge for dewatering treatment. However, if sludge volume is huge and there is no more space to build new buffer pools, it will cause full load to the treatment plant due to low dewatering efficiency and accumulated sludge volume. Now there is a new technology method - ACETube® for sludge dewatering. ACETube® has the following advantages: ACETube® can be installed properly according to practical conditions of the job site; fast dewatering process can promote treatment efficiency and capacity of the buffer pool.



## The Solution

While dewatering process with ACETube®, there are four stages: pumping, dewatering, solidification and disposal. In the first stage a dredging boat with capacity 230m³/hr was used to pump sludge into ACETube®. In order to promote dewatering efficiency, flocculant or polymer were pumped into sludge. Before that, jar test/ cone test should be done for the best dosage. Polymer dosing system could mix polymer with sludge for keeping them well-mixed and dewatering efficiency. To meet requirement of the project, filling ports and the tube size were customized. Its circumference is 11.5m; length – 45m; tube capacity is about 500m³. 30 pcs of ACETube® are used in this project.

## The Contribution

One of the advantages of the new technology - ACETube® is installation is possible in a job-site with the limited area. Besides, initial dewatering efficiency is excellent. Carbon emissions of ACETube® cause less harm to the environment. Efficient dewatering means taking less space in the job-site. After finishing safety analysis, the contractor made sure that there is no problem about it and continued using ACETube® for 2.5 months. What is more important - ACETube® not only saved time, but also made more space for the buffer pool.

# Landfill Construction

## Reinforced Earth Dike, Class B Waste Landfill Expansion Project, Kaohsiung, Taiwan, ROC



### The Problem

The capacity of Kaohsiung Class B Waste Landfill has become insufficient due to the increase of population over the years. Therefore, the managing authority issued an immediate project to prompt for an expansion for the facility. The construction required to build a new containment system to accommodate future refuse. Because the area of the site was very limited, the perimeter dike of the containment must be built as steep as possible.



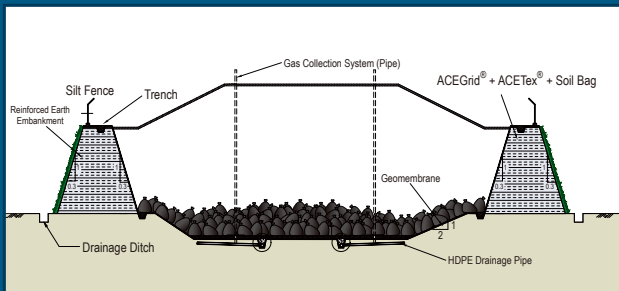
### The Solution and Innovation

Based on a careful 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<sup>®</sup> was adopted as the geogrid reinforcement so as to maintain a steep slope of 1:03(V:H). Geogrid 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 ACEBag<sup>™</sup> was stacked and ACETex<sup>®</sup> was placed for the face protection of exterior slope. The vegetation has been displaying pleasant greenery with time and turning into an eco-friendly environment because of the evidence of local species. The area of the site was about seven hectares and the construction was completed within five months only. The landfill operation has been initiated since January 2011 and by far it functions very well.



### Eco-Materials

Geogrid (ACEGrid<sup>®</sup>), Soil Bag (ACEBag<sup>™</sup>), Drainage system (Drainage Pipe, Drainage Ditch), Geotextile (ACETex<sup>®</sup>)



## Flood Detention

# Landscape Engineering of the Maple Garden – Taichung, Taiwan

The Maple Garden project is the first and only recreational park below ground level in Taiwan. It is a local landmark on the busy Taiwan Boulevard in Taichung City. With a land area of 30,000m<sup>2</sup>, it was the proposed site for the Taichung International Expo Center; however, for some reasons the project was ceased and cancelled after excavation. As a result, a huge and dangerous boomerang-shaped ground opening, with a depth of about 20m, was left on site. The opening was seriously affecting the city's appearance, threatening citizen's safety, and limiting the usage of the land, landform-wise and budget-wise. The local government was under the pressure of the general public. Something had to be done in a short time and within the budget.

A creative, exciting, and feasible idea was proposed to solve all concerns with given constraints and conditions. The idea was to make use of such landform to build a multifunctional park below ground level; serving the functions of flood detention, exhibition, recreation, park, and regulation of air quality of the city. Environmentally-friendliness and concrete reduction were the main foci of the landscape engineering concept for the project. This idea was adopted by the Taichung City Government, and hence the land was re-planned accordingly.

Considering the overall project requirements in cost-efficiency, construction convenience, environmental friendliness, and landscape beautification, the applications of geosynthetic products and relevant engineering methods were the most suitable and feasible approach to carry out the work. The project largely adopted the various geosynthetic products such as flexible woven geogrid (ACEGrid<sup>®</sup>), geotextile fabric (ACETex<sup>®</sup>), soil bag, vegetation mat (ACEMat<sup>™</sup>), geomembrane, etc. in reinforcing and enhancing the landscape. Rather than building traditional RC retaining wall, the surrounding wall and slope of the opening were built with wrap-around reinforcing method with geogrid (ACEGrid<sup>®</sup>), geotextile (ACETex<sup>®</sup>), and soil bag forming mechanically stabilized earth wall (MSEW) and reinforce soil slope (RSS), to support the loading coming from the road and sidewalk above and around the Maple Garden, and to provide rooms for vegetation on the wall and slope surface. This method took advantage of in-situ soil to cut down the construction time and cost, and greatly reduced the use of concrete. Moreover, geomat (ACEMat<sup>™</sup>) and gabion were incorporated in the green landscape building, to serve as a medium for vegetation and erosion control and shape the outline of the landscape. Various trees and shrubs were planted to further beautify and enrich the appearance of the park.

Furthermore, a detention pond of 200,000m<sup>3</sup> was to be constructed and connected to the city drainage for regulation of flood. In order to merge with the landscape naturally, geomembrane, soil bag, and gabion were used to construct an ecological detention pond to fulfill this demand. A restaurant with a circular design front was built at the inner corner, merging with the reinforced wall and facing the pond; an artistic exhibition center was built at the entrance of the park beside the Taiwan Boulevard; these building structures not only enhanced the function of the park, but also added some elements of civilization and culture to the atmosphere. Walkways were constructed with different methods at different sections in the park. Crushed aggregate, timber, and wood chips were used in permeable pavements beside the pond. The perimeter sidewalk built around the pond was about 388m. All these artificial, but natural, settings built up the beauty and spirit of the Maple Garden.



Geosynthetic product applications play a major role in building the park, and significantly contribute to the concrete reduction and environmental friendliness demand of the Maple Garden project; and the use of in-situ materials and geosynthetic products brings convenience to the construction and brings down the cost at the same time. Reshaping by the ecological engineering methods, the project has successfully converted a problematic ground opening to an attractive and environmentally-friendly scenic site. It not only provides a recreational place for the general public, but also serves as an urban drainage regulator in case of flood. Moreover, the vegetation planted throughout the garden has increased the city's green coverage by 28,000m<sup>2</sup>, and contributed to lowering the urban heat island effect. This creative thought and construction of turning a problem into an achievement has gained many awards and recognitions from the construction and geosynthetic industries in Taiwan. And it further wins the 2013 FIABCI Prix d'Excellence Award in the Public Infrastructures/Amenities Category at the 65th FIABCI World Congress (2014), Luxembourg. Started as a remedy and ends up with glory, the Maple Garden project is beyond construction, it is in fact a meaningful and remarkable art.

# Flood Detention

## One Ecological Landscape Park with ACEMat™ R – Taichung Pinglin Forest Park



### The Background

Taichung Pinglin forest park covering about 11.7 hectares, is located opposite the Taichung Armed Forces General Hospital, near to the National Chin-Yi University of Technology. This park sits on the land originally reserved for military use. In recent years, due to the decrease of the military, reducing the demand of land, and the governments urban plan policy, the government intended to reconstruct this area as a multifunction ecological park providing recreational space, a scenic environment and a water-detention basin.

### The Problem

In this case, in order to achieve the government's policy objectives and improve the greening rate, the owner intends to plan a forest area exceeding 3.7 hectares, plus a water-retention basin of 32,000m<sup>2</sup>. It not only provides the function as a detention basin, water collection during the flood but also offers a pleasant forested place for the residents to enjoy their time in normal period, moreover promotes the development of this area.

### The Solution

In this case, the area start up to construct the green park and ecological water-retention basin, in order to make a green landscape, using the rectangular pyramidal geomat, ACEMat™ R to do the green work. The area covered by the ACEMat™ R is about 8,000m<sup>2</sup>. ACEMat™ R manufactured by polypropylene yarns, with the three-dimensional structure can closely integrated with the soil which supporting vegetation. Furthermore, thanks to the increase of the surface roughness, surface soil eroded by the rainfall can be avoided. ACEMat™ R can protect slope and also prevent the erosion rill formed naturally to expand. In addition, ACEMat™ R with the flexibility characteristic can be adapted to the local terrain condition and be installed easily.

### The Contribution

The construction of the Pinglin forest park provides an environment which can not only conserve water, adjust temperature, provide a biological habitats but also maintain the current landscape. The use of the green materials ACEMat™ R avoid the visual oppressive of concrete and form a multifunctional ecologically sustainable green park to adjust the temperature in the near region and effectively decrease the air pollution.



**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<sup>®</sup>, ACETex<sup>®</sup>, ACETube<sup>®</sup>, ACEFormer<sup>™</sup> and ACEBag<sup>™</sup> 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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