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Another Reinforced Fill Slope Versatility at HKZMB – BCF Vehicle Clearance Plaza

A steep slope is necessary to provide space for both an access road at the toe and a cover walkway at the crest. Retaining wall and reinforced panel wall are considered too heavy to have an impact to potential settlement and vegetation facing finds limitation. Reinforced green fill slope was conceptualized as viable at the design stage in 2012, eventually the concept was put forward to tender.

Discussion with the main contractor first took place in February 2016 and it has taken one year to get design and construction approval from the authority, including nomination of designer, ICE and Cat I supervision engineer, to design submission, to choice of material, to method statement and to testing procedures.

Reinforced earth slope is 8 m high, at a gradient of 70° and runs 300 m, one end merges into a 1:2 rockfill slope and the other end tails at a staircase structure. Tenax geogrid wrapped back system was adopted and the design method and

construction management follows GEO's Geoguide 6. Testing of the geogrid was carried out by TRI in California and the direct sliding test was commissioned by Central Lab. Construction started in February 2017 and is targeting in phase completion before end 2017.

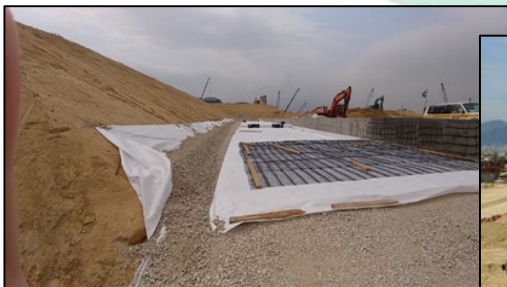
Reinforced earth construction utilizes geogrid which are placed in layer in the backfill so that earth pressure can be balanced by the geogrid and backfill inter friction. Tenax geogrid has been endorsed in GEO since 1997 and is widely used this application. It is a simple, economical, efficient and effective solution in forming steep filled structures. Steven can tell you more with the concept, design, and construction stories at site, steven@g-and-e.com. 



Formation and temporary cut



Layout of geogrid



Geogrid placement at formation over drainage layer



Backfilling in operation



Facing with planting medium sand bag to support vegetation



Geogrid changes direction in construction



Completion to about 5 m

New Product / Application

Concrete Canvas (Geosynthetic Cementitious Composite Mat or GCCM)

Concrete canvas (Geosynthetic Cementitious Composite Mat or GCCM) is a flexible, cement and fiber impregnated fabric that hardens on hydration to form a thin, strong, durable, waterproof and fire resistant concrete layer. It is essentially concrete in a roll, developed and patented in UK.

Concrete Canvas is ideal for slope protection, erosion control, channel drainage lining, concrete structure remediation, bund & culvert lining and submarine pipe protection, particularly in remote area with difficult access to mixer, plant and equipment or limited working space. It is fast to install, requires little skill and very cost effective.



Concrete in a roll for erosion control

Concrete Canvas comes in batched roll that can be handled manually and bulk roll that weighs 1½ tons, in 1.0 m roll width & up to 200 m roll length with 5, 8 and 13 mm thickness. The roll conforms to irregular profile very well, being as easy to install as geotextile. Once unrolled and laid, water can be sprayed on and it will set in a few hours, hardened in 24 hours and will continue to gain strength up to 40 Mpa. Concrete canvas exhibits concrete performance characteristics as supported by post set performance testing on compressive, flexural and puncture strength and resistance to impact, flame, chemicals, weather and root. Contact Steven for product details and sample – steven@g-and-e.com. 🌴



Erosion protection trial at Liantang



Channel lining trial at WENT Landfill



Channel lining surface application

Technical Note

Long Term Performance of HDPE Geomembrane

High density polyethylene (HDPE) waterproofing geomembrane is recognized to have a design life of 120 years, a tall order. UV can affect the long term performance, regardless of light inhibitor. A study is being undertaken to appreciate the residual characteristics by testing the samples exhumed from projects where HDPE has been used under full UV exposed condition. While we have 21 such installations as of today, not all of them are available for sampling, most are in operation. Maintenance and repair service provides the opportunity. At the moment, five locations have been revisited.

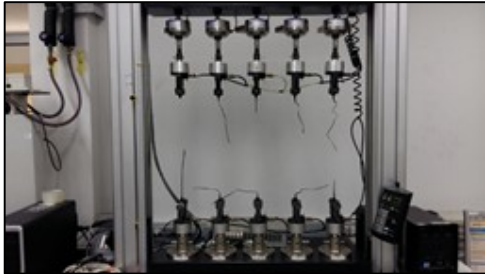
Artificial lake at Penfold Garden received waterproofing lining back in 1993 and was last serviced in June this year, this gives a historical reference of 24 years. Other takings are Venetian Lagoon in Macau first completed in 2007, last cleaned in 2015, Airport Sky City Golf course which was opened in 2006 and closed in 2014, HKZMB marine mud temporary storage pit which was decommissioned last year after one year operation and Ma Yau Tong Landfill cover sheet which was redundant since 1998.

Samples were retrieved at selected spots from each site and tested at the manufacturer's laboratory at Rayong factory, Thailand (courtesy of GSE) as per production line standard QC testing procedure. Physical properties are

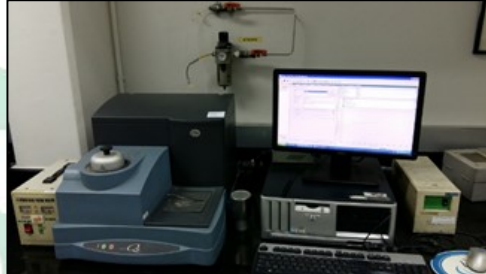
Technical Note (Con't)

expected to reduce but the level of deterioration is considerably mild, retained tensile properties are close to 90% but oxidation induction time is inconsistent, several fall drastically. Even a welding seam was tested with flying color. In general, HDPE geomembrane seems to be quite durable over time.

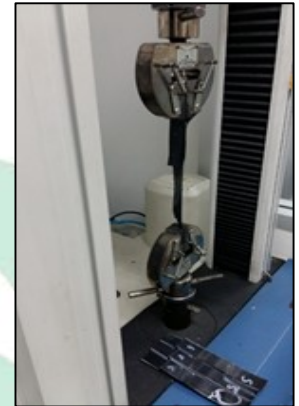
The study is ongoing, new projects will be included and current projects will be reassessed when opportunity arises. There is also plan to publish the findings in 11th International Conference on Geosynthetics in Seoul, 2018. For full detail, call Gary at nannettegary@gmail.com. 🌴



Tensile failure with multi head Instron tester



Oxidation Induction Time testing



Welded seam test



Sky golf Course decommissioning



Penfold Garden desilting and cleaning



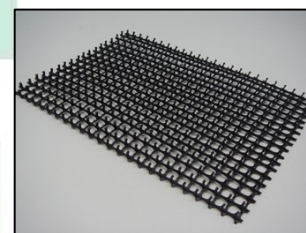
Venetian Lagoon, Macau desilting and cleaning

Opinion Column

Geocomposite Structure

Geocomposite is a synthetic drainage sheet composed of a plastic drainage core on which geotextiles are laminated on one or both side. The porous core provides a drainage path and the geotextile filters fines from entering and blocking the flow path. This common and simple synthetics performs more scientifically than natural granular drainage layers where a coarse material is placed between two layers of fine material.

The core is usually made from polyethylene extruded into a matrix net or polystyrene stamped or molded into a cusped board. Each structure has its own characteristics and therefore appropriate drainage application. Cuspate board core normally resembles egg shell and is quite rigid, brittle to bending, impermeable on one side and has little elasticity to accommodate substrate movement. The drainage path is therefore easily snapped or distorted to reduce flow capacity. As such, it is best used against hard rigid surface such as retaining wall. When permeability is sought on both sides, the core has to be pinned to allow flow.



Cusped polyethylene core



Cusped polystyrene stamped core



Extruded polyethylene core



Cusped net geocomposite

Opinion Column (Con't)

Matrix or net type core is more flexible and is more accommodating to irregular profile. Because of the core symmetry, permeability behaves the same on both sides. It is therefore best used in geotechnical engineering and drainage against soil backfill and deformable subgrade. There are details in geosynthetics drainage design and suitability assessment, Gary at nannettegary@gmail.com has more. 🌴

For Your Information

Airfreight Option

Tight milestone, misjudgment and accelerated program are common issues in nowadays contracting. Sudden demand of material becomes a nightmare and air freight is often sought as an option, literally to buy time. Such delivery requires collecting of goods, custom declaration, airport security clearance, cargo flight/transit, import duty, terminal charge and delivery to site. This normally takes a few days when direct flight is available but several more days when a transit is necessary. We have lined up with experienced air freight forwarder to check quick budget and lead time. Call Shan at shan@g-and-e.com to check how dearly it is to fly in material. 🌴



Need More Information or to Know Where to Find Products & Service

In Europe, the updates of the standards for geotextiles within the scope of CE contain modifications to BS EN 13249:2016 (geotextile and geotextile related product, characteristics required for use in construction) on the durability determination. There have been changes in the test method and in what can be declared by the geotextile manufacturers.

The new test method to allow a producer to declare durability of 100 years for polypropylene geotextiles following EN ISO 13438 with the modifications from BS EN 13249:2016 Annex B, consists of 2 parts: 1) 28 days in a water bath (WB) at 80°C and 2) 112 days in an oven (O) at 100°C.

The evaluation is based on the residual tensile strength of the material after these 2 exposure steps. If the product has a residual tensile strength of 50% after this test, the declaration of 100 years can be made. As of 26 April 2017, Low & Bonar has completed all relevant tests and their geotextile carries now a declaration of 100 years design life. Check with Wing@g-and-e.com on latest technical data sheets. 🌴

bontec woven and nonwoven geotextiles			
Bontec® SNW 120 Superior Needle Punched Nonwoven Geotextiles			
Technical data sheet			
Product description			
Polymer	Density	Melting Point	Construction
PP	0.91 kg/dm ³	165 °C	Fibres
Properties			
Mechanical Properties		Standard	Performance
Tensile strength - MD	EN ISO 10319	20 kN/m	21 kN/m
Tensile strength - CMD	EN ISO 10319	20 kN/m	21 kN/m
Elongation at maximum load - MD	EN ISO 10319	70 %	+23.61 %
Elongation at maximum load - CMD	EN ISO 10319	70 %	+23.61 %
Static puncture resistance (CBB)	EN ISO 12234	11.5 kN	2.3 kN
Dynamic perforation resistance (cone drop)	EN ISO 13433	0 mm	40 mm
Hydraulic Properties		Standard	Performance
Water permeability normal to the plane (WVNO)	EN ISO 11058	20 l/m ² /s	<5 l/m ² /s
Waterflow in the plane, 800 kPa	EN ISO 12958	8.3x10 ⁻⁶ m ² /s	<2.3x10 ⁻⁶ m ² /s
Characteristic Opening Size (O90)	EN ISO 12956	55 µm	+/- 16.5 µm
Physical Properties		Standard	Performance
Thickness under 2 kPa	EN ISO 9843-1	4.5 mm	+/-1.20 mm
Weight	EN ISO 9844	1900 g/m ²	+/-300.0 g/m ²
Length (+/- 1%) x width (+/- 1%)		35 x 3.25 m	
Roll diameter (+/- 10%)		5 m	
Durability		Standard	Performance
Predicted minimal durability in years in natural soils with 4 < pH < 9 and soil temperatures < 23°C	Applicable application standard: Annex B	100	100
Maximum allowed time between installation and covering of the geotextile	EN 12224	2 weeks	2 weeks

Performance **100** years

Reader's Response

Let us hear from you. Write to us at newsletter@g-and-e.com. For back issue, please write to nannette@g-and-e.com or visit our website at www.g-and-e.com.

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G and E Company Limited

14th Floor, Kiu Yin Commercial Building, 361-363 Lockhart Road, Wanchai, Hong Kong
Tel: 2570 0103 Fax: 2570 0089 e-mail: wing@g-and-e.com website: www.g-and-e.com



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