G and E Times

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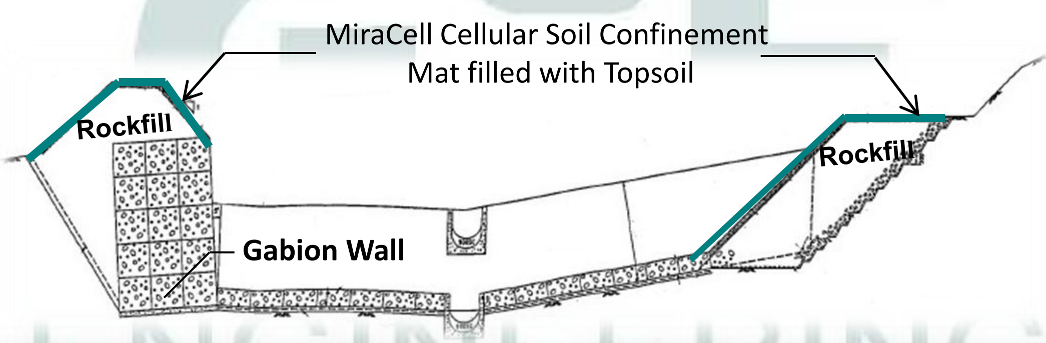
Vegetation on Rockfill Slope

Check dam was designed at Wang Hang Village, Tai O as mitigation measures in September 2008 after the astonishing mud slide devastated Northern Lantau earlier. A channel, 90 m run and 32 m elevation was constructed to contain and control debris flow. The invert and face buttress was built with gabion and along the side run, rockfill embankment, 5 m high 1:1 gradient, was formed. Vegetation was sought to landscape the rock face.

A thick growing medium was necessary to be confined along the rock slope surface to support vegetation. MiraCell was introduced as reinforced cellular compartment matting, where a 150 mm layer of soil can be permanently retained. This was done successfully at Tung Tau Cottage, Kowloon City and vegetation has thrived, over 10 years now. Geocell is very common erosion control system with universal design methodology and worldwide applications.

A geotextile was used to separate the backfill soil and rockfill. On the fabric, MiraCell (in 10 m x 5 m panel) was secured with steel peg on the entire embankment surface. Growing medium was deposit into the cell and kept stabilized by the MiraCell. Grass was established by hrydroseeding and protected by erosion control mat. Work was completed in April 2011 and mature grass growth is seen with the least aftercare.

Wang Hang Village Section Schematic




Miracell applied on rockfill embankment

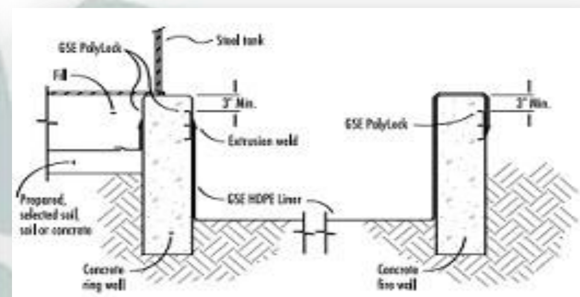

Laying down and anchoring of MiraCell

New Application

Versatility of Polylock to Membrane Concrete Interface

GSE Polylock is a rugged, durable, extruded HDPE concrete embedment strip for geomembrane attachment, that can be cast or inserted into wet concrete leaving the welding surface exposed upon completion of concrete preparation. The embedment of anchor fingers provides a high strength mechanical anchor to the concrete, which provides an outstanding barrier to leakage. GSE Polylock is the most effective and economical cast-in-place mechanical anchor system for HDPE.

Polylock provides a wide welding surface to attach geomembrane



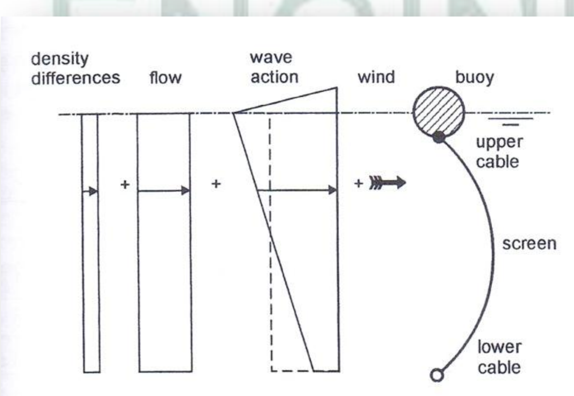
Typical secondary containment lining showing geomembrane attached to GSE Polylock

Opinion Column

Silt Curtain Requires Engineering Design

The Dutch company, Gouderak, first brought silt curtain in the 80' to confine turbidity, to limit extent of affect zone, to reduce current speed, to accelerate sedimentation and to encourage settlement of particle drifted underneath the curtain skirting. Early simple applications at Sha Chau were ineffective until the Penny's Bay reclamation where engineering design to system integrity was considered. Effectiveness was remarkable, evidence by much less S/S migration and the durability against severe marine condition over extensive time (usually 24 months). Design on reduction of pollutant and structural durability in corrosive high sea environment can be analytically tabulated. The result is the necessity of high buoyancy, special strong steel tension member and reinforced fabric. Such premium product requires heavy initial investment.

Common practice is therefore to fabricate a primitive curtain from heavy woven geotextile, steel wire or rope and polystyrene float, risking heavy maintenance/replacement, constant damage repair, downtime and effect of poor water quality, which may cost as much if not more by the time of completion. The dilemma is to find the justification between the overall merits and the premium price.



Penny's Bay Reclamation Stage 1, May 2003 (CV/99/12)

Technical Note

Flow Capacity of Geocomposite

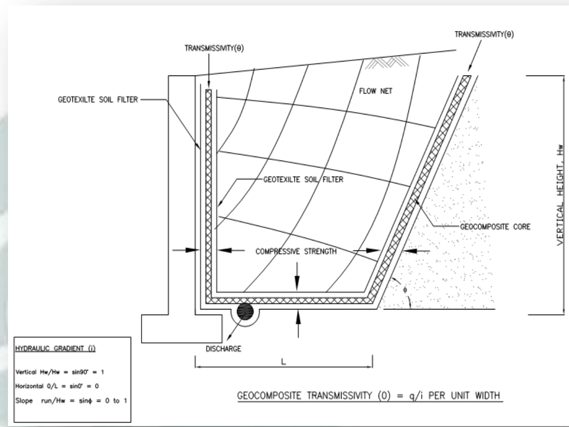
Sheet drain widely used behind retaining wall is technically referred as geocomposite, a geosynthetics generic term to represent a polymeric sheet core laminated on both side with filter geotextile. The core provides drainage flow while the geotextile allows water but not soil particle entering the drain path. This has become an economical, effective and simpler construction alternative to granular drainage layer.

The core can be made from a variety of polymer (HDPE or polystyrene) in different thickness (4 - 60 mm) and configuration (bi-planar or tri-planar grid, filament mat, cuspation, waffle or nub). Geotextile is non-woven type in various mechanical and hydraulic properties.

Drainage capacity is represented by transmissivity based on the classic Darcy's flow rate equation and is determined according to index testing ASTM D4716 or ISO 12958 under a controlled saturated laminar flow condition at specific applied loading, hydraulic gradient, boundary surface condition and sitting time.

$$q = kiA = ki(w \times t) \text{ and } q/w = (k \times t) \text{ or } kt = \theta = \frac{q}{iw}$$

where
q = volumetric flow rate (m³/s),
k = coefficient of permeability (m/s),
i = hydraulic gradient
(dimensionless minimum 0.01 represents level & maximum 1.0 to vertical)
A = flow cross-sectional area (m²),
θ = transmissivity (m²/s)
w = width (m), and
t = thickness (m).



Design of geocomposite takes into consideration the long term drainage capacity. Applying reduction factors (performance affected with creep, chemical & biological and construction damage) to the index transmissivity, a suitable geocomposite can be identified to match specific project flow requirement. In reality, geocomposite should be able to discharge any water infiltrated through adjacent soil.

Flow rate per unit width, at $i = 1$	0.3m thick granular filter	$Q_{granular} = kit = 1 \times 10^{-3} \text{ to } 1 \times 10^{-4} \times 0.3m = 3 \times 10^{-4} \text{ to } 3 \times 10^{-5}\ m^3/m/s$
	Typical geocomposite	$Q_{geocomposite} = 7 \times 10^{-4} \text{ to } 3 \times 10^{-3}\ m^3/m/s$

The coefficient of permeability of this soil, therefore governs the required transmissivity. Excessive high flow of a geocomposite is often not necessary. Flow rate of geocomposite is 2 to 100 times that of a 300 mm granular layer.

Retaining wall drainage, Sept 2011 (DC/2006/09)

Replacement to granular filter system, July 2001 (ST/86/2000)

For Your Information

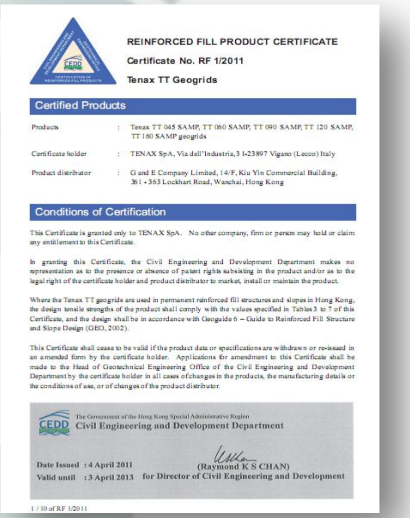
VSRS by CIC

VSRS stands for **V**oluntary **S**ubcontractor **R**egistration **S**cheme, and is set up by Construction Industry Council with the aim to build up a pool of capable and responsible subcontractors with specialized skills and strong professional ethics. This scheme is targeted at subcontractors, who can apply for registration in one or more of 52 trades covering common structural, civil, finishing, E&M works and supporting services.

Major supporting clients include Airport Authorities, Housing Authority, MTRC, Development Bureau, Real Estate Developers Association of Hong Kong, Hong Kong Construction Association, Hong Kong Federation of Electrical and Mechanical Contractors.

Geo Geogrid Certification

Soil reinforcement with geogrid has seen its application for over 20 years. Local design largely follows GEO Geoguide 6 – Guide to Reinforced Fill Structure and Slope Design (GEO, 2002) and only geogrid with GEO endorsement certificate can be released from material submission application. Tenax's geogrid certificate RF 1/2011 can be downloaded from www.g-and-e.com/credentials.htm. We will be able to provide quick internal stability analysis and preliminary budget with our spread sheet calculation specially prepared in accordance to Geoguide 6.



REINFORCED FILL PRODUCT CERTIFICATE

Certificate No. RF 1/2011

Tenax TT Geogrids

Certified Products

Products	:	Tenax TT 045 SAMP, TT 060 SAMP, TT 090 SAMP, TT 120 SAMP, TT 160 SAMP geogrids
Certificate holder	:	TENAX SpA, Via dell'Industria,3 I-23897 Vigano (Lecco) Italy
Product distributor	:	G and E Company Limited, 14/F, Kiu Yin Commercial Building, 361 - 363 Lockhart Road, Wanchai, Hong Kong

Conditions of Certification

This Certificate is granted only to TENAX SpA. No other company, firm or person may hold or claim any entitlement to this Certificate.

In granting this Certificate, the Civil Engineering and Development Department makes no representation as to the presence or absence of patent rights subsisting in the product and/or as to the legal right of the certificate holder and product distributor to market, install or maintain the product.

Where the Tenax TT geogrids are used in permanent reinforced fill structures and slopes in Hong Kong, the design tensile strengths of the product shall comply with the values specified in Tables 3 to 7 of this Certificate, and the design shall be in accordance with Geoguide 6 – Guide to Reinforced Fill Structure and Slope Design (GEO, 2002).

This Certificate shall cease to be valid if the product data or specifications are withdrawn or re-issued in an amended form by the certificate holder. Applications for amendment to this Certificate shall be made to the Head of Geotechnical Engineering Office of the Civil Engineering and Development Department by the certificate holder in all cases of changes in the products, the manufacturing details or the conditions of use, or of changes of the product distributor.

CEDD The Government of the Hong Kong Special Administrative Region
Civil Engineering and Development Department

Date Issued : 4 April 2011
Valid until : 3 April 2013

(Raymond K S CHAN)
for Director of Civil Engineering and Development

1 / 10 of RF 1/2011

Reader's Response

In our 1st issue on leak location detection survey, we would like to acknowledge that Professor Albert T. Yeung of the University of Hong Kong, Department of Civil Engineering, was one of the pioneers with LLSI in the early development of the technology in USA.

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