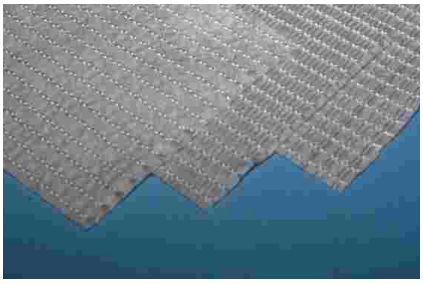
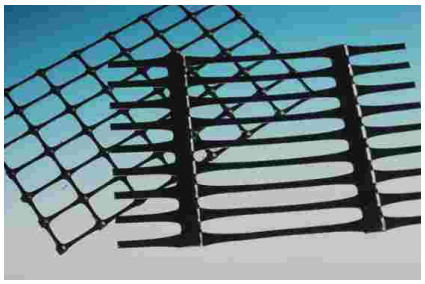
TENCATE Polyfelt

TECHNICAL NOTE

Comparative pullout tests on Polyfelt PEC reinforcement geotextile and extruded geogrids in weathered clay

The increasing unavailability of good granular soil required engineers to utilize fine grained marginal soil as backfill in geosynthetic reinforced soil structures. Tests to determine the comparative pullout resistance of Polyfelt PEC reinforcing geotextile and commonly available extruded geogrid reinforcement in weathered clay have been conducted, and results summarized below:





Figures 1 and 2: Investigated geosynthetics: Polyfelt PEC reinforcing composite (above) and conventional extruded geogrids (below).

Overview

The increasing unavailability of good granular soil requires engineers to utilize fine grained marginal soil as backfill in geosynthetic reinforced soil structures. Conventional geosynthetic design theory presumes that granular interlocking between the soil and geogrid is the primary mobilizer of tensile strength in the geosynthetic. However, with fine grained soils and soils with a high percentage of clay particles, tensile strength is primary mobilized by friction between the soil and the geosynthetic.

The design of adequate pullout resistance of the reinforcement element is an important part of the design of geosynthetic reinforced earth structures. In order to quantify the pullout resistance of extruded geogrids and Polyfelt PEC composite reinforcement geotextile, large scale pullout tests were carried out at the Asian Institute of Technology, Bangkok (A.I.T).

2. Materials investigated

2.1. Soil

Poor drainage soil namely Bangkok weathered clay was used as the backfill material. The clay consisted of 49% clay, 36% silt and 15% sand. The values of plastic limit and liquid limit were 27% and 62% respectively. The tests were carried out with a water content of approx. 28.5%.

2.2. Reinforcing geosynthetics

Two types of reinforcement were investigated: Polyfelt PEC, and a conventional geogrid (as illustrated in Figures 1 and 2). The basic properties of these products are presented in Table 1.

3. Test configuration

The tests were carried out using a special large pullout cell having the dimensions of 1.25 x 0.75 m. The surcharge was applied by means

Longitudinal section of test box

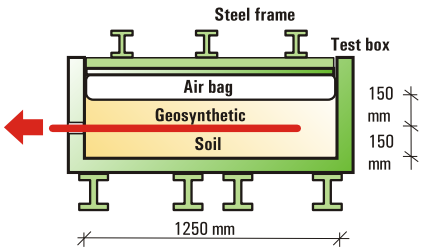


Figure 3: Schematic drawing of the test setup

4. Results

The results of the pullout tests as illustrated in Figure 4, Figure 5 and table 2 confirmed that in fine grained soils the pull out resistance of Polyfelt PEC geotextile is superior than that of extruded geogrids.

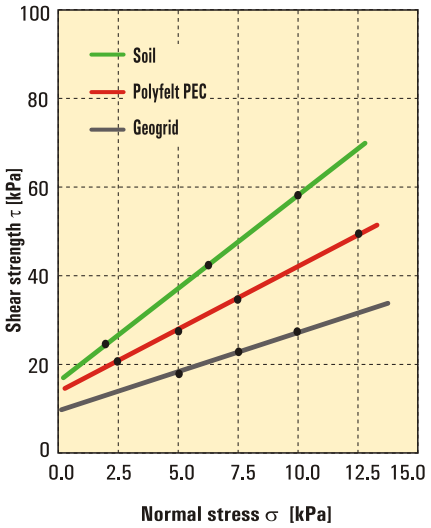
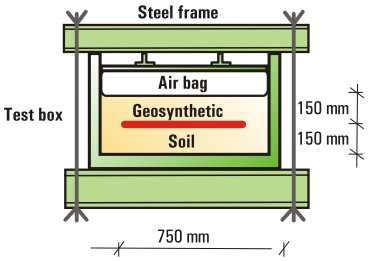


Figure 4: σ|τ-Diagram of the pullout tests

Cross section of test box



TenCate Geosynthetics Asia Sdn. Bhd. (264232-U)
14, Jalan Sementa 27/91, Seksyen 27
40400 Shah Alam, Selangor Darul Ehsan, Malaysia
Tel +60 3 5192 8568, Fax +60 3 5192 8575
info.asia@tencate.com, www.tencate.com

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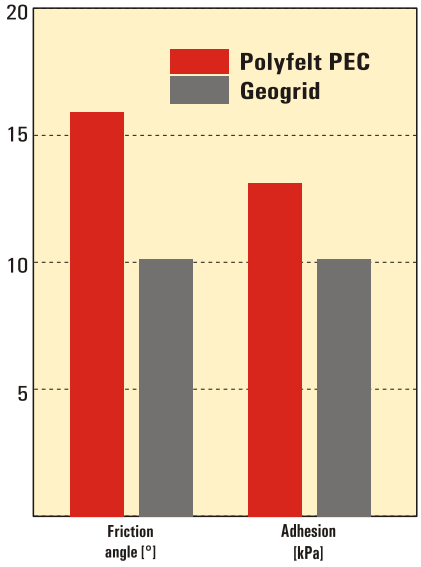

Figure 5: Summary of test results

Properties	Unit	Polyfelt PEC 200	Geogrid
Unit weight	g/m²	700	450
Tensile strength	kN/m	200	45
Elongation at break	%	13	12

Table 1: Properties of the investigated geosynthetics

Properties	Unit	Soil	Polyfelt PEC	Geogrid
Friction angle φ and $\delta_{P/G}$	°	22.8	15.9	10.0
Adhesion c and $c_{P/G}$	kPa	15.5	13.5	10.0
$\tan \delta_{P/G} / \tan \varphi$	–	–	0.68	0.42
$C_{P/G} / c$	–	–	0.87	0.65

Table 2: Summary of test results

5. Summary

– The friction angle and the adhesion at the interface Polyfelt PEC / Bangkok Clay was measured with δ_G = 15.9° and c_G = 13.5 kPa. The corresponding values for the geogrid were δ_G = 10.0° and c_G = 10.0 kPa. This means that the shear strength at pullout interface of Polyfelt PEC is about **50% higher** than that of the geogrid.

– Compared to large direct shear test results of the Bangkok clay, the following ratios were achieved: $\tan \delta_P / \tan \varphi$ = 0.68 and c_P/c = 0.87 for Polyfelt PEC, and $\tan \delta_G / \tan \varphi$ = 0.42 and c_G/c = 0.65 for the geogrid. Again the values of Polyfelt PEC are **50% higher** than that of the geogrid.

– This results in a technical and economical benefit of Polyfelt PEC compared to conventional geogrids, as the required anchoring length Can be reduced accordingly.

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