Romanian geocomposite - producing and utilization in construction works

M. Boştenaru
Textiles Research Institute, Bucharest, Romania

I. Siminea
Faculty of Land Reclamation and Engineering Environmental, Bucharest, Romania

G. Dragomir
Environmental Engineering Research Institute, Bucharest, Romania

Keywords: Geocomposites for drainage, Hydraulic properties, Laboratory research, Reinforcement, Roads

ABSTRACT: This paper presents technology of production and the utilisation of one geocomposite, which have been produced in Romania, used in construction works. The geocomposites are generally produced in three layers, with different technologies, which depends on the structure of geocomposite fibres.The three layers of non-woven materials are overlapped and consolidated. From this geocomposite are made drainage wicks, which have been experimented in consolidation works of foundation soil, railway and roads fills. After field measurements are found that:
- considerable reduced setting of ground at 60 days from execution finish;
- physical and mechanical proprieties of foundation soil are improved.

1 INTRODUCTION

The research work was conducted to obtain geocomposites used in construction work.

The geocomposites utilization has the following advantages:
- rapidity at work implementation;
- the permeability to water in compare with classical geotextile;
- transmissivity to water in compare with ordinary geotextiles;
- resistance pressure stamping that reflects resistance at deposition of granular material.

The principal domains for geocomposites application are roads and motorways. For our country integration in European structures it is necessary to participate to the international transport system. For view planning of the national roads and for motorways building, through modern technologies are necessary also geocomposites materials.

2 THE TECHNOLOGICAL PROCESS FOR FABRICATION OF GEOCOMPOSITE

In this research work were realized 4 types of non-woven materials from polyester fibres of 4 den/60 mm and polyamide of 200 den (Boştenaru et al, 1998).

The geocomposites are generally produced in three layers, with different technologies, which depends on the structure of fibres.

The technological process for the first and the third layer is made through carding-needle punching and has the following stages (in case of using synthetic offals).

Cutting
Antistatic dressing
Opening
Blending
Making up fibre layer through carding
Mechanical consolidation by pre-needle punching machine
Mechanical consolidation by needle punching machine

If the first and the third layer are made of 100% polyester fibres, the technological process doesn't include stages as: cutting and unweaning.

The second layer is realized from technological polyester fibres from chemical industry, with 200 den fineness, through the process of pneumatic formation of fibre layer and interweaving, with the following:

Cutting with guillotine
Antistatic dressing
Opening on opener with three tambours
Blending
Pneumatic formation of fibre layer
Mechanical consolidation by pre-needle punching machine

The three layers of non-woven materials are overlapped and consolidated on the needle punching machine.

3 THE PHISICO-MECHANICAL CHARACTERISTICS OF OF THE GEOCOMPOSITE

Variants of geotextiles were realized and analyzed in physic - mechanical laboratory of Textiles Research Institute (TRI) and Environmental Engineering Research Institute (EERI) (Boştenaru, M., et al, 1998). Within the Textiles Research Institute were determined physical and mechanical resistance, mass and thickness of geocomposites. At the Environmental Engineering Research Institute were determined hydraulic characteristics of geotextiles, according to C227-88 standard (Kellner, L. et al., 1994). Physic-mechanical results obtained are presented in table 1. Hydraulic characteristics determined are permeability and holding capacity of sediment discharge (HC). In table 2 is presented the normal permeability (kn) that was determined by the tests made. Permeability in the plane (kp) of geotextile was determined and has the following values.

Variant I kp = $4.51x10^{-1}$ cm/s
Variant II kp = $5.20x10^{-1}$ cm/s
Variant III kp = $5.06x10^{-1}$ cm/s
Variant IV kp = $5.06x10^{-1}$ cm/s

Holding capacity of sediment discharge (HC) for the variants performed is presented in table .3

Due to the table calculations made with coefficients values obtained from determinations made in laboratory on material samples of geocomposite, on different level tests, resulted values of permittivity and transmissivity coefficients for four variants. Their values are presented in table 4.

Draining wicks were executed., within an experimental reach, on a real scale, in construction works of the foundation soil of a railway back file, in Fetesti-Constanta area.

Table 1. Physic and mechanical proprieties

Characteristics	U.M	Direction	Variant			
			I	II	III	IV
Mass	g/mp	-	1894	1137	498	410
Thickness	mm	-	25.6	13.9	6.0	4.5
Traction resistance	kgf	L	15. 9	32.7	58.6	200
		T	40.7	6.5	45.8	426
Elongation an failure	%	L	123	116	99.5	196
		T	79.1	69. 3	104	133

*test specimens width of 20cm

Table 2 Normal permeability

Variant of material	Level 1	Level 2	Level 3	Level 4
	0.01daN/cm^2	0.10daN/cm^2	1.00daN/cm^2	4.00daN/cm
V I kn (cm/s)	2.71x10^{-1}	1.66x10^{-1}	5.55x10^{-2}	2.04x10^{-2}
V II kn (cm/s)	2.83x10^{-1}	1.56x10^{-1}	5.04x10^{-2}	2.00x10^{-2}
V III kn (cm/s)	3.06x10^{-1}	1.75x10^{-1}	3.50x10^{-2}	2.53x10^{-2}
V IV kn (cm/s)	1.33x10^{-1}	9.02x10^{-1}	3.04x10^{-2}	2.10x10^{-2}

Table 3. Holding capacity of sediment discharge

Variant of material	Level 1	Level 2	Level 3	Level 4
	0.01 daN/cm^2	0.10daN/cm^2	1.00daN/cm^2	6.00daN/cm
V I kp (cm/s)	3.68x10^{-1}	2.61x10^{-1}	1.59x10^{-1}	1.17x10^{-2}
V II kp (cm/s)	2.81x10^{-1}	1.76x10^{-1}	6.085x10^{-2}	3. 38x10^{-2}
V III kp (cm/s)	1.12x10^{-1}	7. 73x10^{-1}	3.45x10^{-2}	1.80x10^{-2}

Table 4 Values of permittivity and transmissivity coefficients

Variant of material	Coefficient		Level 1 0.01daN/cm^2	Level 2 0.10daN/cm^2	Level 3 1.00daN/cm^2	Level 4 4.00daN/cm^2
I	Permittivity	initial	5.42x10^{-1}	4.19x10^{-1}	2.42x10^{-1}	8.60x10^{-1}
		after HC	5.04x10^{-1}	4.16x10^{-1}	3.33x10^{-1}	3.29x10^{-1}
	Transmissivity	initial	2.26x10^{-1}	-	-	-
		after HC	3.24x10^{-1}	-	-	-
II	Permittivity	initial	5.58x10^{-1}	3.86x10^{-1}	2.16x10^{-1}	1.34x10^{-1}
		after HC	4.32x10^{-1}	3.28x10^{-1}	1.93x10^{-1}	1.36x10^{-1}
	Transmissivity	initial	2.63x10^{-1}	-	-	-
		after HC	3.33x10^{-1}	-	-	-
III	Permittivity	initial	6.06x10^{-1}	4.57x10^{-1}	1.85x10^{-1}	1.61x10^{-1}
		after HC	2.22x10^{-1}	1.74x10^{-1}	1.13x10^{-1}	8.45x10^{-1}
	Tranmissivity	initial	2.35x10^{-1}	-	-	-
		after HC	3.33x10^{-1}	-	-	-
IV	Permittivity	initial	4.26x10^{-1}	3.48x10^{-1}	2.17x10^{-1}	1.34x10^{-1}
		after HC	-	-	-	-
	Transmissivity	initial	8.16x10^{-2}	-	-	-
		after HC	-	-	-	-

4 CONCLUSIONS

Taking into account tests results and measurements executed and exposed above, the following conclusions can be drawn regarding the application of geocomposite.

- the solution can be used in good conditions using materials and equipments found in the country;
- rate execution of a wickdrain is about 1.00m/min, in the presence of a gravel sand bed;
- settlements with a decreasing tendency up to 60 days from the end of execution;
- results an improvement of physical and mechanical properties of the foundation soil.

REFERENCES

Boştenaru, M.,Dragomir, G., Pătru ,M., 1998. Producing of new romanian geocomposites. In The Bulletin of ARGG, no. 3, page 12-14, Bucharest.

Kellner L., Gazdaru, A.,Feodorv, V., 1994. Geosynthetics in Construction Works, Bucharest, Romania.