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The Influence of Geosyntetic Materials on the Strength in Uniaxial Compression of Soils of Railway Embasses

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Abstract

Many specialists were engaged in ensuring the stability of the soils of the embankments of the railway track. Most of them propose to ensure the stability of embankments due to its reinforcement. There is a need to generalize and adapt individual features of different calculation methods in order to obtain a single calculation model of the system "embankment - reinforcing layer - base" and "base site - reinforcing layer - ballast layer". The operation of reinforcing layers depends on the type of soil, the type of reinforcing material, and the shape of the structure. Geotextile layers in embankments perform a reinforcing function. They are used to reinforce the embankment in order to increase the overall stability of the embankment and the local stability of the slopes. The reinforcing function is determined by the ability of the geotextile layer to improve the working conditions of the soil for displacement due to its perception of tensile forces, friction of the layer against the soil and changes in the stress state in the soil massif.

KEY WORDS: *soil, railway track, uniaxial compression, geosynthetic materials*

1. Introduction

The issue of ensuring the stability of the embankment slopes of the railway track was dealt with by many specialists, in addition, many proposals were offered by foreign specialists. In general, they propose to ensure the stability of slopes by reinforcing the embankment. But the analysis of literary sources revealed the dependence of calculation methods on specific conditions and materials used. It is also important that the calculation methods proposed by foreign specialists (for example, from England, Italy, Germany, etc.) cannot be applied in our country. This is due to differences in calculation methods and experimental tests [1-3].

Thus, there is a need to generalize and adapt individual features of various calculation methods in order to obtain a single calculation model of the system "embankment-reinforcing layer-base" and "main platform-reinforcing layer-ballast layer". It should be noted that the general deformations of the ground surface (including the stability of slopes) are not always associated with a weak foundation. This allows us to assume that the use of means of increasing the stability of embankment slopes is important not only in the presence of a weak foundation, but also in case of high embankments, especially under the conditions of increasing the steepness of the slopes in order to reduce the area of the embankment sole and save construction materials [6, 7].

The operation of reinforcing layers in the soil depends on the type of soil, the type of reinforcing material, and the shape of the structure. Geotextile layers in high embankments perform a reinforcing function. They are used for transverse reinforcement of the embankment in order to increase the overall stability of its slopes. The reinforcing function is due to the ability of the geotextile layer to improve the working conditions of the soil for displacement due to its perception of tensile forces, friction of the layer against the soil and changes in the stress state in the soil massif [4-8].

2. Analysis of Ballast Layer Work Research

Uniaxial compression is the simplest test method strength of soils: the major principal stress is equal to the vertical stress load on the sample, the small principal stress is equal to "0".

Only cohesive soil samples can be subjected to such a test. The test is carried out in the conditions of a closed system, with a constant soil moisture. This requires fast sample loading (the duration of the test should not exceed 10-15 minutes).

The shear resistance is assumed to be independent of the normal load and is equal to half of the destructive compressive stress. Thus, the displacement graph is conditionally drawn parallel to the abscissa axis tangential to Mohr's circle. Shift graph parameters: coupling, angle of internal friction.

The uniaxial pressure test device consists of a metal disk (base), a frame, a rod and a cover that is placed on top of

the sample. The frame is used for fixing the indicator and has a sleeve that guides the movement of the rod. The device is installed on a universal lever press, with the help of which a vertical load is transmitted to the rod through rods with a rocker arm[1, 2].

Performance of work

The sample is installed in the device, fixing the indicator on the "0" mark in the compressed position. Then the degrees of vertical load are transmitted with a time interval of 1 minute.

The following levels of pressure on the sample are recommended depending on the consistency of the soil: for soft-plastic consistency - 0.125 kgf/cm^2, for semi-hard and rigid-plastic consistency - 0.25 kgf/cm^2, for hard consistency - 0.625 kgf/cm^2. The above degrees of pressure are made by setting the weights to 0.1; 0.2 and 0.5 kg per suspension lever. Degrees of load are applied after every minute until the failure of the sample.

Soil deformations are entered in the test log, which are recorded by the indicator at the moment of time before applying each new level of load.

Measurements of the absolute deformation of samples are presented in Table 1.

Table 1

Measurements of the absolute deformation of samples

Load on the lever H	Pressure	absolute deformation Sample without anything 1	absolute deformation Sample without anything 2	absolute deformation Sample PEC 55/50F (2 layers)	absolute deformation Sample PEC 55/50F (1 layer)	absolute deformation Sample C40/17 (2 layers)	absolute deformation Sample C40/17 (1 layer)	absolute deformation Sample TS-65(2 layers)	absolute deformation Sample TS-65(1 layer)
0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
2,0000	0,0250	0,0700	0,0500	0,8500	0,5700	0,3900	0,1100	0,3900	0,6000
4,0000	0,0500	0,2600	0,1900	1,6000	1,2000	1,0800	0,2000	1,1000	1,2500
6,0000	0,0750	0,5200	0,4200	2,6000	1,9300	1,9200	0,4800	1,9000	2,0000
8,0000	0,1000	0,8600	0,7400	3,6500	2,7000	2,9000	1,0500	2,9100	2,7500
10,000	0,1250	1,2400	1,4000	4,8500	3,5800	4,0500	1,8800	4,1500	3,5500
12,000	0,1500	1,7100	1,9500	6,1600	4,5300	5,3800	2,9600	5,8500	4,5500
14,000	0,1750	2,2500	3,0000	8,2000	5,7500	7,1500	4,2000		5,9200
16,000	0,2000	2,8500	5,0000		6,8000	11,0000	5,6800		
18,000	0,2250	3,5000					7,6800		

Dependences of Q movement on E are presented in Fig .1 and Table 2.

Table 2

Dependence of *Q* movement on *E*

	Q mov.	Q mov. 3	Ɛo	E
Sample without geotextile 1	0,30	0,10	0,01	8,33
Sample without geotextile 2	0,20	0,07	0,01	9,52
PEC 55/50F(2)	0,18	0,06	0,03	2,08
PEC 55/50F(1)	0,20	0,07	0,01	11,11
C40/17(2)	0,20	0,07	0,02	3,51
C40/17(1)	0,23	0,08	0,01	15,00
TS-65(2)	0,15	0,05	0,02	3,33
TS-65(1)	0,17	0,06	0,02	2,83

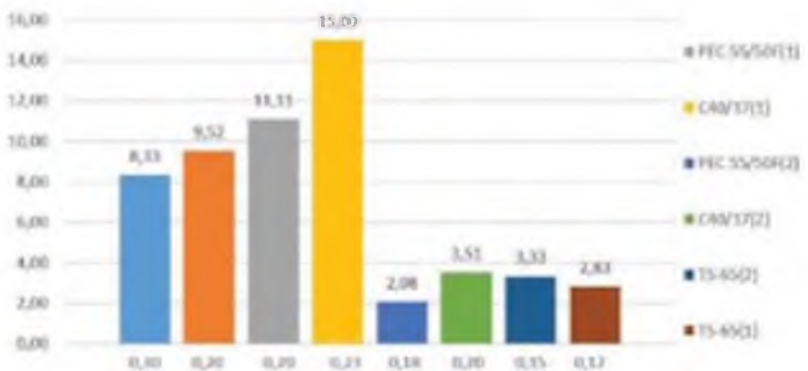

Fig. 1 Dependence of Q movement on E

Dependences $\mathcal{E} = f(\sigma)$ of the absolute strain sample are presented in Fig. 2-9

Fig. 2 Dependence $\mathcal{E} = f(\sigma)$ of the absolute strain sample without anything

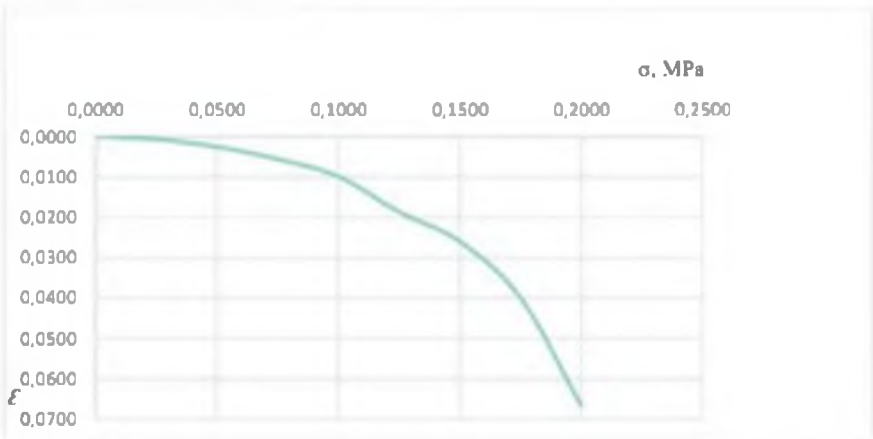

Fig. 3 Dependence $\mathcal{E} = f(\sigma)$ of the absolute strain sample without anything 2

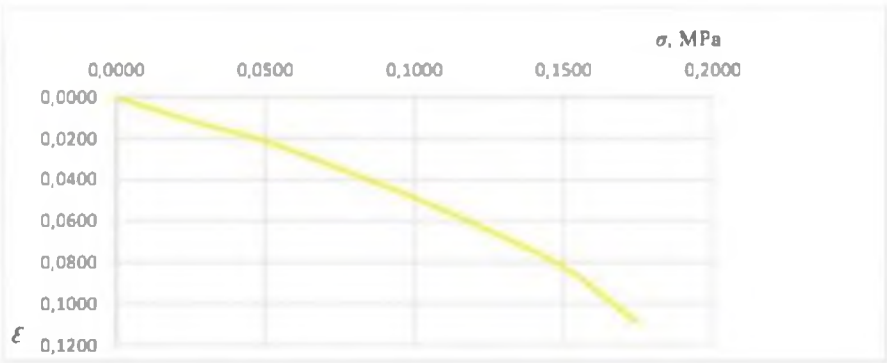

Fig. 4 Dependence $\mathcal{E} = f(\sigma)$ of the absolute deformation sample PEC 55/50F (2 layers)

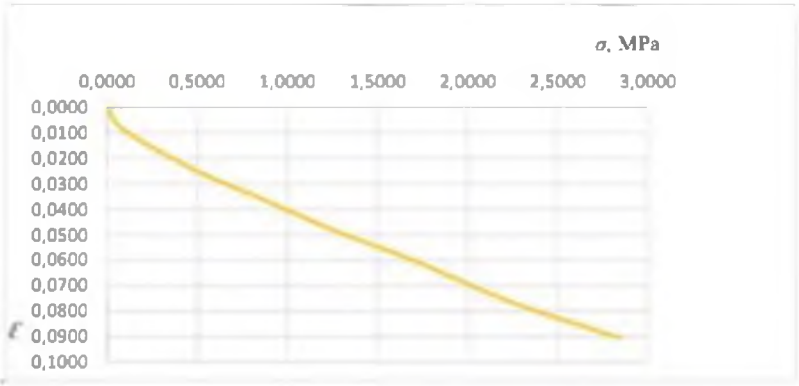

Fig. 5 Dependence of $\varepsilon = f(\sigma)$ of the absolute deformation sample PEC 55/50F(1 layer)

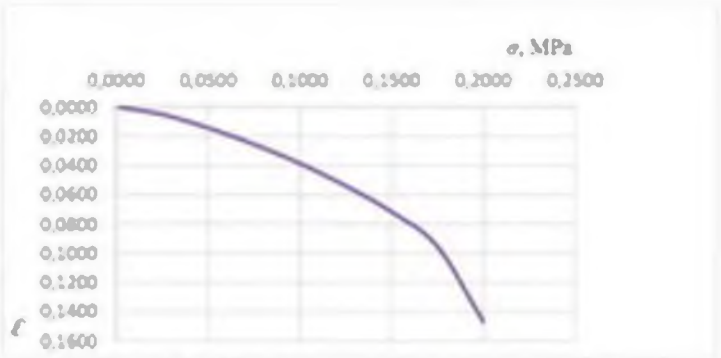

Fig. 6 Dependence $\varepsilon = f(\sigma)$ of the absolute deformation sample C40/17 (2 layers)

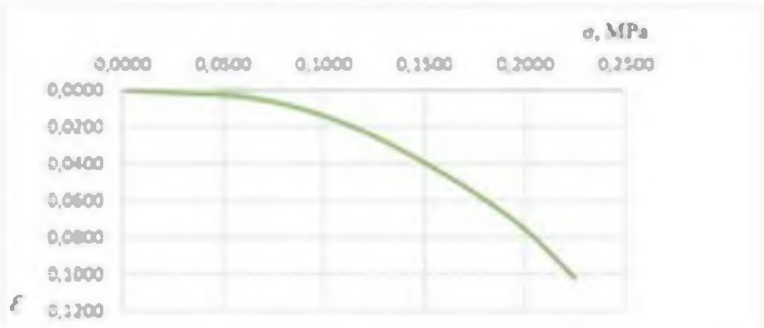

Fig. 7 Dependence of $\varepsilon = f(\sigma)$ of the absolute deformation sample C40/17 (1 layer)

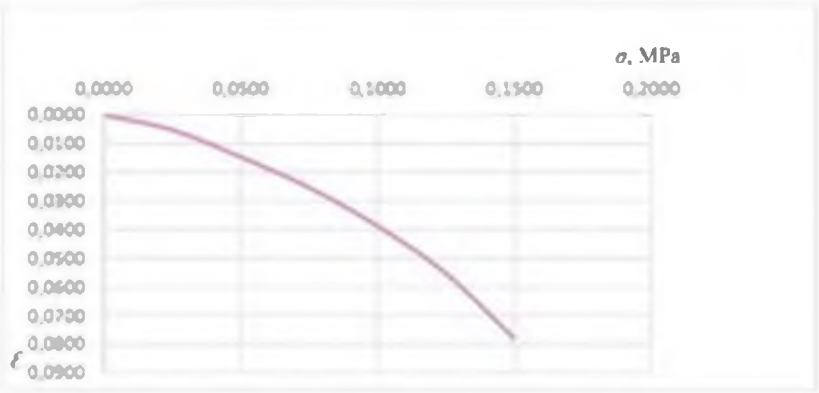

Fig. 8 Dependence of $\varepsilon = f(\sigma)$ of the absolute deformation sample TS-65 (2 layers)

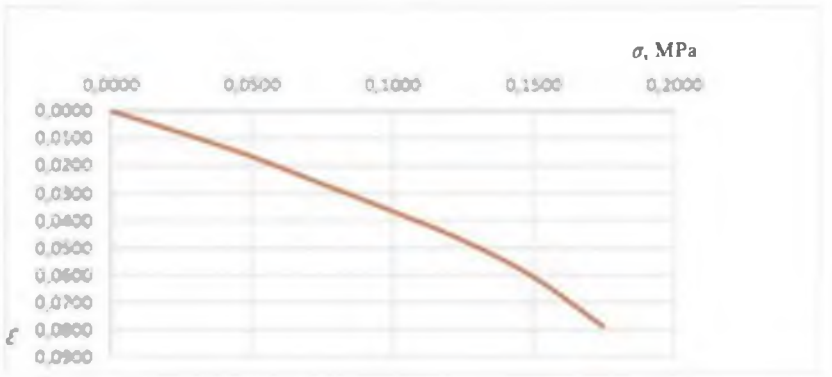

Fig. 9 Dependence of $\mathcal{E} = f(\sigma)$ of the absolute deformation sample TS-65 (1 layer)

3. Conclusions

There are certain requirements for the bearing layers of the ground sheet in relation to the size, type of soil, its density, humidity and filtration capacity. At the same time, preference should be given to canvas and soil that has sufficient bearing capacity.

The analysis of the use of geosynthetic materials to strengthen embankment soils revealed the following:

When carrying out static studies of unreinforced and reinforced soil samples, the Qruyn. unreinforced is within (0.20-0.30), and reinforced - (0.15-0.20).

Absolute deformation - unreinforced samples - 2.25 - 3.00; armored - 5-11.

Graphs of the dependence of Qruyn on E, and $\mathcal{E} = f(\sigma)$ were constructed.

Reinforced soils increase the bearing capacity by 25-35% compared to non-reinforced one.

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