USAGE SPECIFICS OF GEOGRIDS

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ABSTRACT

Geosynthetics and their variants play a major role in soil protection whether it is a landfill, a landslide, a road route or some other surface pollution.
Geosynthetics has experienced its development in recent decades, and all products in this field can still be considered relatively new, which does not mean that they have not proven themselves in many demanding projects (fields of activity) on different occasions and requirements, especially in mining and construction and ecology.
A special part of this area refers to geogrids and geotextiles made of organic material (from nature) in combination with more commonly used synthetic materials and the main topic of this paper. By crossing (combining) these types (materials) of geogrids (geotextiles, etc.) in the form of a certain hybrid technology of making these products, we get usage parameters suitable in the field of environmental protection and the necessary mechanical and temporal usability.
This would, seemingly contradictory requirements (appropriate - usage conditions), lead to a compromise, but at the same time effective fulfillment of the same in appropriate situations.
Keywords: Geogrids, geosynthetics, geomaterials, landfills, stability

1. INTRODUCTION

Geogrids are mainly made of polymeric materials such as polyethylene, polyester and polypropylene and are characterized by high tensile strength. The original geogrids were made by drilling holes in the sheet of material. Today, such geogrids are made by the so-called extrusion process. We now have geogrids made of polyester fibers coated with polyethylene. A multitude of continuous fibers are joined into a thread, which is then woven in the longitudinal and transverse direction with a certain distance between the ribs, and the folds are additionally strengthened, and then the fibers are coated.
Geogrids (Fig. 1.) are most often used to strengthen and stabilize poorly bearing soil. In some cases, the material, the size of the fraction of which is larger than the mesh opening of the mesh, is poured on the geogrid and the material is trapped in the geogrid openings and a system resistant to external forces is formed. In addition to stabilizing and strengthening poorly bearing soil, geogrids are also used to strengthen asphalt by installing a geogrid between the layers of asphalt. In this case, it is important to mention the use of geogrid in road rehabilitation, in order to prevent the reaction of existing cracks on a new layer of asphalt. The geogrid takes over the action of forces and prevents the formation of cracks on the newly installed layer of asphalt. The third important purpose of geogrids is to protect against soil erosion. For this purpose, there are two-dimensional geogrids that have small eye openings and three-dimensional geogrids. Depending on the manufacturer, geogrids may differ, but their primary function and mode of operation are the same.
• absorb the kinetic energy of erosive elements (rain, wind) and stabilize the soil surface, creating numerous micro-dams over it,
• keeps seeds and hydrosowing materials in place, even on a steep slope of the soil, which leads to successful seed germination
• helps water penetrate through the soil and retain moisture, leading to better seed germination and good grass growth.

Figure 1. Setting up a geogrid

The use of anti-erosion geotextiles can increase and support the effect of erosion control in areas with particularly steep slopes or in substrates susceptible to erosion [1,2,7,8].

1.1. Organic geogrids

The greatest role of vegetation in the protection of slopes from erosion and its stabilization is provided when its surface enables the establishment of a given vegetation and allows water to flow at a certain speed and intensity on the surface and thus prevents the degradation of vegetative cover.

Organic geogrids have unique characteristics, consisting of biologically and chemically photo degradable natural fibers. They are designed to keep the land in place until vegetation is established.

The organic geogrid has the following roles:

• To absorb the kinetic energy of erosive elements (rain, wind)
• To facilitate the penetration of rain into the ground
• To retain moisture from rain: In addition to being eco-friendly, they can absorb water about five times the dry weight
• Allows to avoid loss or dispersion of seeds necessary for revegetation
• Provides radical establishment of plant species
• Allows control of soil temperature by mitigating its natural oscillations: so that they can mitigate extreme temperatures and create a pleasant micro-climate for vegetation growth.
• Allows to reduce the loss of soil moisture

Organic geogrids are more flexible than most types of synthetic geogrids. This allows them to easily follow the contour of the soil surface. The ability to make direct contact between the fibers and the soil, enables the reduction of soil loss by 90% or more. In addition to the above, organic geogrids act as "mulch" and thus improve the establishment of vegetation. After degradation, they do not leave any toxic material in the soil [4,6,7,8].

1.2. Synthetic geogrids

Synthetic geogrids are synthetic products (geosynthetics) used to stabilize the terrain. The polymeric nature of the products makes them suitable for use in a country where high levels of durability are required. This type of geogrid is available in a wide range of shapes and (synthetic) materials.

In difficult conditions (such as slopes with a critical angle, channels with high flow, etc.), the vegetative cover, even when it is well placed, will not be able to survive under the erosive power of water.

Therefore, for the purpose of stabilization and strengthening of the terrain, the law should define the obligation to use (install - install) geogrids or geosynthetic networks and thus increase the resistance to erosion and thus the protection of the natural environment [7].

2. EXPERIMENTAL

2.1 Choosing the right material

Geogrid manufacturers strive to make their products as cheap as possible and make them as easy to use as possible. However, it is advisable not to focus on the manufacturer, but on your immediate tasks.

• For strengthening embankments and slopes - a geopronet made of polypropylene fibers is perfect.

• Railway - It is convenient to reinforce with two axle gratings or geogrids of increased strength. Slavros or his analogues will do their job well.

• Strengthen drainage systems and prevent shoreline turbidity - use geogrids 15-30 mm high or higher.

• In road construction - biased fiberglass and polymer mesh is perfect. For example, the Slavros SD 40 geogrid is perfect for that purpose.

• Parking and parking - designed to work with constant loads. That is why high-strength polyester and fiberglass nets are used here. As an option - instead of a grate, a lawn grate can be used here.

2.2. Application of geogrids in measures of reclamation of degraded land

In Serbia, there are a large number of coal mines, quarries, clays and similar areas that, after exploitation, are left to natural reclamation - a process that is very slow, measured for decades, while in some locations it is not possible. Proper approach to reclamation implies a planned procedure, based on a database.

New materials and technologies enable significant improvements in many areas of mining and construction in the field of faster, safer, more efficient construction, insurance, maintenance and rehabilitation of mining and construction facilities, especially civil engineering, although some materials are widely used in the field of environmental protection. and building construction.

Generally speaking, within the reclamation of degraded areas, it is necessary to apply technical, bio-technical and biological measures.

Technical measures contribute to the improvement of resistant and deformable characteristics of landfills, which directly affect the increase of erosion stability of slopes.

Bio-technical measures, together with technical measures, contribute to faster achievement and maintenance of permanent stability of landfills.

Biological measures include the application of agricultural and forest reclamation, which contribute to the stability and maintenance of reclaimed areas, but are much more important from the aspect of spatial revitalization and the establishment of natural biocenoses. Horticultural species play a significant role in biological measures.

Before the formation of the landfill, the first phase of technical measures is the stabilization of the base for the future landfill and its planning, drainage or installation of drainage systems. After this phase, tailings are dumped and a landfill is formed in phases (Fig. 3) [1,2,7,8].

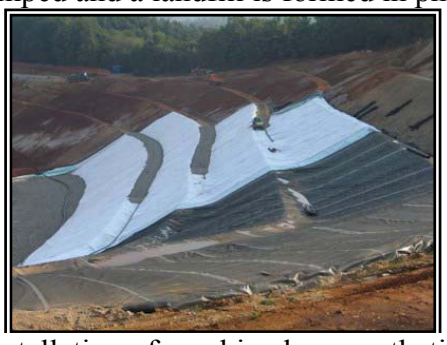

Figure 3. Installation of combined geosynthetic materials

3. CONCLUSION

Geogrids and geotextiles made of organic material (coconut, jute) are a natural and 100% biodegradable solution for erosion control using geogrids or geotextile mats made of coconut

fibers. Organic geogrids have unique characteristics, consisting of biologically and chemically photodegradable natural fibers. They are designed to keep the land in place until vegetation is established. Geogrid or permeable geotextile provides a natural system of assistance (improvement of characteristics) to the soil (soil, landfill…) and vegetation.

Due to a large number of factors that cause directly the negative effects of mining or construction works, special attention should be paid not only to the application of geogrids and other types of geosynthetics, but also to the application and selection of new materials and technologies.

The installation of these efficient systems (geogrids, geotextiles…) in various branches of economy and industry and their expediency directly depends on the materials from which they are made. The application and selection of types and materials in road construction is important because the application of these materials has an impact on savings and improvements in the field of faster, safer and more efficient construction of road construction and elements, their maintenance, as the impact on traffic safety and flow. It also refers to the protection and stabilization (strength) of the surfaces (slopes) of landfills and other mining facilities, where the choice of type and material of the cover layer depends on the deposited material, size and shape of the landfill itself [3].

As a possible saving solution in many cases, where an efficient result is required, both on the ecological and on the construction, safety, field security plan, there is a hybrid approach to the use of construction materials. Using the different types of materials in the production of geogrids or geotextiles, we can solve the seemingly contradictory requirements in their application.

Such hybrid materials, which would contain cross-beams of organic and synthetic origin, can, depending on the need (purpose) and their mutual relationship, be an "ideal compromise", that is, a saving solution. Material of organic origin would have a positive impact on the development and preservation of vegetation and the entire ecosystem, while geosynthetic materials would have the primary application of mechanical stabilization nature, as much stronger and more stable materials. In addition to the above, organic geogrids act as "mulch" and thus improve the establishment of vegetation. After degradation, they do not leave any toxic material.

It should be noted that many of the presented materials have a very wide application in the field of environmental protection, especially the prevention of groundwater and surface water pollution through infiltration control, as well as in the treatment and immobilization of various types of waste, especially hazardous waste.

Special attention in further development should be paid to the use of new natural materials and hybrid technology of geomaterials, as products of the future.

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