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A REVIEW ON USE OF SYNTHETIC GEOGRIDS FOR SOIL REINFORCEMENT

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Abstract: A type of geosynthetic material named geogrid plays a pivotal role in the behaviour of concrete by implementing them as an additional reinforcement. Geogrids have good tensile strength as they are formed by the reticulation of tensile elements with an opening of an ample size which allows interlock with the nearby fill materials. These grids are flexible mesh which is highly effective and enhances the life of the structure. The prime constituents of geogrid are polyester, high-density polyethylene, and polypropylene. More often, in the field of civil engineering,uni-axial, bi-axial and tri-axial geogrids are used. As the cost and duration of construction are nominal, geogrids can be optedfor cost-effective and resilient construction. They are frequently used as reinforcement and for stabilization in structures like retaining walls, pavements, foundations, slopes, and embankments. The geogrids are employed in various construction which results in sustainable development. The present study reviews the available state of the art knowledge on use of synthetic geogrids in soil reinforcement purposes including their types, initial development and use areas.
Keywords: Geogrids, Geosynthetics, reinforcement, slope, structural elements.

INTRODUCTION

Early in 1982, Frank Brian Merce invented geogrids. Later, geogrids were popularized among engineering community by a conference held at the United Kingdom in the year 1984 . Geogrids, commonly known as geosynthetics and polymer grids, are commonly used for stabilization (pavements), protection (slope stability), and drainage and strengthening. For instance, geogrids are used for reinforcing retaining walls -, pavements , foundations in soft soil , slope stability , embankments and for structural components such as beams and columns. The usage of geogrids may be considered as highly economical and safe towards the environment as it creates less environmental effects. Generally, three types of geogrids such asuni-axial (strength in one direction), bi-axial (strength in two directions) and tri-axial (strength in three directions) geogrids are used in the construction field. The tri-axial geogrids with ribs extended in three directions are found to be more effective compared with uni-axial and bi-axial geogrids . The application of geogrids in civil engineering projects depends on the factors such as cost, purpose and tensile strength of geogrids. Geogrids with high-tensile strength are successfully used in recent times in the structural applications. The performance of geo grid in pre-fabricated construction proves to be effective. For the construction of steep slopes, high strength geo grids are used. Geo-grid reinforcement increases the strength and stiffness of soil . Based on the past credit performance of geo-grids, a detailed review on the previous studies in the field of geogrids with structural applications is presented.

The life and quality of flexible pavements are greatly affected by the type of subgrade soil as it serves as the foundation for pavement. It is always recommended to use locally available materials if their strength and hydraulic characteristics permit. In India more than 8 lakh square kilometers of area is covered with soils having low strength and stability, high settlement and liquefaction potential. Moreover the demand of good quality aggregates is increasing day by day with present need of 3000 million tons annually. The use of geo synthetic products significantly reduces the thickness requirement of pavement thus saving costly sub-base and base aggregate materials. The present paper reviews the work of various researchers on use of geo grids for soil stabilization purpose.
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LITERATURE REVIEW

Mena I. Souliman and Claudia Zapata (2011), This papers researches Geo synthetics have become well established construction materials for geotechnical applications in most parts of the world. Because they constitute manufactured

materials, new products and applications are developed on a routine basis to provide solutions to routine and critical problems alike. Results from recent research and from monitoring of instrumented structures throughout the years have led to new design methods for different applications of geo synthetics. Because of the significant breath of geo synthetics applications, this paper focuses on recent advances on geo synthetics products, applications and design methodologies for reinforced soil using geo synthetics reinforced walls.

Zornberg and Gupta (2009) studied the effect of geogrid reinforcement in mitigation of longitudinal cracks induced in pavements constructed over highly plastic, expansive clay subgrades. Three field evaluations are done on pavements constructed in the Forth Worth-Dallas area, Texas. It was found that geogrid reinforcement in FM 1915, Milam County, Texas significantly reduces the longitudinal cracks in the reinforced portion. In FM 542, Leon County it was observed that cracks are present outside the reinforced area and in FM 1774, Grimes County cracks developed even in the reinforced zone due to low junction efficiency of geogrids.

TYPES OF GEOGRID

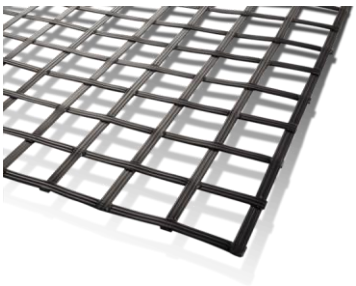
Broadly there are three types of geo grids namely unitized/homogeneous, coated yarn type and bonded strap/rod type geo grid. All the three types of geo grids are discussed in the following sections

1 Homogeneous/Unitized Geo-grids

The polymers used to manufacture unidirectional homogeneous geo grids are high density polyethylene (PE), whereas polypropylene (PP) is used for bidirectional and tridirectional products. Holes are punched in polymer sheet and passed over rollers to get the desired shape. Uniaxial products are stretched longitudinally, whereas biaxial products are stretched in both longitudinal and transverse directions thus improving strength in both the directions. Fig. 1 shows the homogeneous polyethylene and polypropylene geo grids.

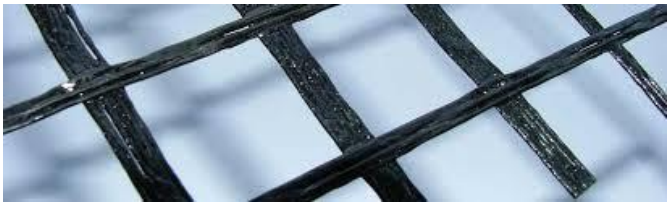
2 Coated Yarn Geo-grids

These geo-grids are formed by weaving high tenacity polyester yarn bundles on conventional textile machinery. The junctions are knitted together to connect transverse and longitudinal ribs together. By varying the number of filaments per yarn in machine and cross machine direction, strength can be varied giving rise to uniaxial and biaxial products. These geo-grids are coated with polyvinyl chloride, latex or bitumen for durability, dimensional stability and resistance to installation damage. These geo-grids are more flexible than other two. Fig. 2 shows coated yarn type geo-grid.



3 Bonded Rod/Strap Geo-grids

These geo-grids are formed from high tenacity polypropylene or polyethylene rods or straps. The individual rods are 1mm thick and 10mm wide. The junctions formed by overlapping machine and cross machine direction ribs are connected by laser or ultrasonically. They are stiffest of all types of geo-grids. Fig. 3 shows the bonded strap geo-grid.



USE AREAS OF GEOGRIDS

Geo grids primarily work as a reinforcement material. however, it can be used for separation purposes for very coarse gravels and other materials having large size only. geogrids can be used as basal reinforcement over soft soils, facing of retaining walls, erosion control in slopes, embankment fill reinforcement, asphalt and concrete reinforcement in pavements.

CONCLUSION

Thus it can be concluded that geogrids can be used in various engineering applications such as embankments, pavements, landfills, as mattresses, as facing panels in retaining walls, stabilize leachate, within ballast in railroad construction. Due to versatility of functions like reinforcement and separation it can used effectively in various civil engineering works as compared to other conventional materials such as lime, cement and fly ash. Their use in subgrade will significantly reduce the thickness requirement of pavement thus saving costly base and sub-base aggregate materials which are neither easily available nor economical. Non-biodegradable behavior of such synthetic geogrids provides additional benefits. Thus it's time to support more and more use of geogrids.

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