SUBGRADE SOIL STABILIZATION WITH GEOSYNTHETICS

Abstract

Subgrade soil stabilization is the process of improving soil properties to develop shear strength, durability, and fill the interparticle space, etc. Geotextile reinforcement is better than other methods of soil reinforcement. These are synthetic and non-biodegradable materials. They are more flexible than metal strips and therefore compatible to fix the deformability of the soil. In addition to shear resistance enhancement, they also improve ductility unlike additives. They are cheap and take less time. They can be used for different applications such as separation, reinforcement, drainage and filtration. Geotextiles are an emerging field in civil engineering and also have huge potential in several applications. Geotextiles play an important role in modern pavement design. Due to its multifunctional features it is widely used in most of the geotechnical applications. This article reviews the work of various researchers on soil stabilization and the use of geo-synthetic materials to improve soil strength.

Keywords: Geotextile, Subgrade soil, geosynthetic products

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I. INTRODUCTION

In the modern world, building construction is progressing at a very fast pace. Geotextiles are in high demand to quickly and safely carry out projects such as the construction of national roads, highways and civil engineering structures. Various soil amendment techniques and materials are used to address these issues. Geosynthetics are used for a variety of applications, from erosion control to enhancing and improving underground drainage. However, one of the most common applications is road construction, especially temporary roads such as construction roads, access roads, and logging roads. Geosynthetics are man- made products. It is in the form of a flexible sheet and is made from synthetic polymer materials and natural materials.

Geosynthetics are mainly classified into six major products: geotextiles, geomembrane, geogrid, geo-cell, geo-net and geo-composites. These geosynthetic products are widely used in geotechnical engineering as separators, filters, drains, stiffeners, hydraulic barriers, protectors and erosion control systems. Extensive land movements and disruptive land movements affect many projects around the world, primarily transportation.

The soil movement is due to expansion and contraction behavior as a function of humidity levels in different weather conditions. To counter this movement, geomembrane sheets are placed horizontally over the road, acting as a barrier against moisture and as a separation between the ground and subsoil. Geomembrane has a high success rate in improving the quality of roads and trails around the world.

Geomembranes combined with other geosynthetic materials (geocells, geogrids, or geotextiles) are commonly used for embankment stability and soil reinforcement in building roads and railways in hills and valleys against erosion.

1. **Geo-textile Components and Classification:** For detailed descriptions of non-woven and knitted geotextile manufacturing processes, consult literature and manufacturers' manuals can be referred. Nonwoven geotextiles are widely used for filtration, separation and drainage functions, and are also used to form moisture barriers. Abroad, the use of non-woven geotextiles has increased significantly for practical purposes. The spunbonded process involves spinning yarns on a moving web to form a carpet, which is then installed using various methods.

    - **Punching:** Punch bonding is a process where barbed needles are pushed through flat fiber fabric layers to mechanically intertwine fibbers, creating a mattress. Composite geotextiles are materials that combine multiple manufacturing techniques, such as needled nonwoven mats, to facilitate manufacturing or achieve desired properties.

      Durability of Geo-Textiles Sunlight damages polymers' physical properties, reduced by carbon black addition, but not eliminated, resulting in brittle material at cold temperatures. Chemicals in groundwater reacts with polymers. The selection of geo-textiles and their varieties should consider factors such as potential harm to polyester and low pH water for optimal performance.

2. **Geo-textile Functions and Applications:** Geo-textiles possess various properties, applications, and functions based on their physical, mechanical, hydraulic, degradation, and endurance properties.

3. **Filtration:** Geotextile openings prevent soil particle movement and function as particle size filters, passing water, moisture, and gases without significant hydrostatic pressure increase and their permeability properties can be used based on their use. Permeability refers to the ease with which soil can infiltrate.

4. **Drainage:** Geotextiles, with their three-dimensional structure, facilitate water flow and facilitate lateral flow by dissipating groundwater capillary rise. They also serve as drainage conduits, such as core and cover drains, for liquid or gas circulation.

5. **Reinforcement:** Geotextile introduction enhances total system strength through three mechanisms, primarily through the introduction of a geotextile into soil. It is a type of membrane that supports wheel loads. The lateral stress is caused by the interfacial friction between the geotextile and the soil/aggregate. The support surface's potential failure plane is forced to transform into an alternate surface with increased shear strength.

FILTRATION

DRAINAGE

REINFORCEMENT

II. LITERATURE REVIEW

Milad Saghebfar et al (2016) the study evaluates geogrids, revealing that these geo-synthetics improve pavement performance, predict the GE factor, and improve durability, thereby reducing operating costs.

Ravindra Kumar et al (2020) studied that Geotextile uses in pavement construction are examined in this research, which includes a literature Research and review. A recent study suggests geogrids are a better choice for flexible pavement reinforcement than geotextiles, and airport pavement design should continue, with geotextiles not used for general aviation airport subgrade support until lab and field testings are completed.

Suyog Gore et al (2019) studied that the road's service and function will be disrupted if the road is not maintained regularly, owing to financial considerations. Geotextiles are used in pavements to prolong service life, reduce maintenance, and reduce system thickness. Weaved geotextiles between soft subgrade and base course improve flexible pavement performance, outperforming non-woven geotextiles due to higher puncture resistance.

Dini M et al (2018) studied findings from an experimental survey on vertical stress measurements have been reported in this study. The study used four geotextile placements, including vertical and horizontal. Vehicle pressure on simulated pavement layers are also measured. The lowest pressure was found in the horizontal treatment, with significant differences.

Ayush Mittal and Shalinee Shukla (2018) studied the performance of flexible pavement is largely dependent on the subgrade soil, which acts as the basis for the pavement. Geo synthetic material is increasingly popular due to cost- and time-saving advantages, environmental friendliness, and consistency across soils. This study used non-woven geotextile and biaxial geo grid, approved by the Indian Roads Congress, and conducted compaction, soaking, and UCS tests.

III. CONCLUSION

It is concluded from the current study that soils reinforced with geotextile fibers can offer higher performance in terms of load-bearing capacity, higher stress distribution and lower deformation compared to unreinforced soils.

It is also speculated that fiber geotextiles provide effective subsoil amendment and effective protection of soil structure.

Therefore, it is proposed to construct test tracks using fiber geotextiles (woven and non- woven) with completely different geometries adapted to different soil conditions and evaluate their performance.

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