## A review paper on subgrade stabilization of road pavement by Geotextile

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## ABSTRACT

Subgrade soil stabilization is the process of improving soil properties to develop its shear strength, durability, and fill the interparticle space, etc. Geotextile reinforcement is better than other methods. Geotextiles are synthetic and non-biodegradable. They are more flexible than metal strips and therefore compatible with the deformability of the floor. In addition to shear resistance, 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. Thanks to its multifunctional features such as drainage, filtration, reinforcement, etc. This article reviews the work of various researchers on soil stabilization and the use of geosynthetic materials to improve soil strength.

Key words: Geotextile, geosynthetics, soil, soil stabilization

## 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, geocell, geonet and geocomposite. 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.

These soils exhibit specific 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.

**Geo-textile Components and Classification**

Literature and manufacturers' manuals should be consulted for more detailed descriptions of woven and knitted geotextile manufacturing processes that continue to develop. 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 fibers are usually randomly oriented in the geotextile plane, but a preferred orientation can be given. In the spunbond process, the yarns are spun and placed directly on a moving web to form a carpet, which is then installed using one of the following methods: are explained below.

Punching: Punch bonding involves pushing multiple barbed needles through one or more layers of flat fiber fabric and into the plane of the geotextile. This process mechanically intertwines the fibers to form a mattress. Combined Assembly: Sometimes a combination of assembly techniques is used to facilitate manufacturing or to achieve desired properties.Composite geotextiles are materials that combine two or more manufacturing techniques. The most common composite geotextiles are nonwoven mats that are needled on one or both sides of the woven layer.

**Durability of Geo-Textiles**

Exposure to sunlight degrades the physical properties of polymers. The rate of degradation is reduced by the addition of carbon black but not eliminated. Polymer material becomes brittle cold temperature. Chemicals in groundwater are Reacts with polymers. In the presence of water, all polymers acquire water over time. High pH water. It can be harmful to polyester, and low pH water can be harmful to polyamide. All of The factors discussed must be taken into account while selecting the geo-textiles and its varieties for the best performance.

**Geo-textile Functions and Applications**

Geo-textiles have different properties, applications and functions depending upon their physical properties, mechanical properties, hydraulic properties, degradation properties and endurance properties etc. Some of them are listed below.

**Filtration**: Geotextile openings should be such that they prevent movement of soil particles. It also performs the function of a traditional particle size filter. The geotextile and granular filter must pass water, moisture and gases without a significant increase in hydrostatic pressure. Example: A gutter covered with geotextile along the edge of a road. The ease with which water, moisture and air can infiltrate or infiltrate the soil is known as permeability.

1. **Drainage**: This is the capacity of thick non-woven geotextiles whose three-dimensional structure allows water to flow through the plane of the geotextile. It also shows the transmission function of the geotextile. Here, the geotextile facilitates lateral flow by dissipating the kinetic energy of capillary rise of groundwater. Geotextiles acting as drainage act as conduits for the circulation of liquids or gases in the plane of the geotextile. Some examples are geotextiles used as core drains and cover drains.
2. **Reinforcement**: It is the synergistic improvement in total system strength created by the introduction of a geotextile into a soil and developed primarily by the following three mechanisms: 1. A type of membrane that supports wheel loads. 2. Lateral stress by interfacial friction between geotextile and soil/aggregate. 3. Forcing the potential failure plane of the support surface to develop into an alternate surface with greater shear strength.



FILTRATION DRAINAGE



REINFORCEMENT

### **LITERATURE REVIEW**

The structural benefits of Hossein Ali Mohammadi (2021) geogrids were evaluated by measuring the resilient modulus, deflection and permanent deformation of the pavement base. The results of this study show that the use of geosynthetic reinforcements can improve pavement performance in several ways. The GE factor of geogrid reinforcement for flexible pavements has been predicted using a novel formulation. This paper, which increases geogrid comprehension, and a well-developed technique for using GE variables during pavement design are the outputs of this study. Implementation is anticipated to bring about the following advantages: enhanced durability, decreased thickness of gravel or asphalt, and lower operating expenses.

**Ravindra Kumar (2020)** studied that Geotextile uses in pavement construction are examined in this research, which includes a literature search and review. Geogrids seem to be a better choice for flexible pavement reinforcement than geotextiles, according to the findings of a recent study. For now, airport pavement design processes should continue to be employed, and if geotextiles are incorporated in the construction, no structural support should be assigned to them. Geotextiles should not be used for general aviation airport subgrade support until the laboratory grid study and field grid testing have been completed, according to this recommendation.

**Thaker Grishma (2019)** make use of Geotextiles in the building of pavement is becoming more common since the technique has shown to be effective. This is known as the separation/stabilization application, and it involves placing geotextiles under both paved and unpaved roads. Separation, Stabilization, Reinforcement, and Filtration are just a few of the advantages of using geotextiles on paved and unpaved roads. For both economic and environmental reasons, geotextiles may be used instead of or in addition to natural aggregate building materials. A variety of stressors were examined in the current research, including those common to highway building.

**Suyog Gore (2019)** studied that the road's service and function will be disrupted if the road is not maintained regularly, owing to financial considerations. With these limitations, geotextiles will be employed in pavements to lengthen pavement service life, which needs less repair and maintenance and also decreases the overall thickness of pavement systems. Weaved geotextiles between the soft subgrade and base course are used in this article to improve the performance of flexible pavements. Woven geotextiles outperform non-woven geotextiles in terms of performance due to their higher puncture resistance under impact loading. Settlement fractures produced by soft subgrade may be avoided by inserting a geotextile layer between soft subgrade and base course.

**Dini M. (2018)** studied findings from an experimental survey on vertical stress measurements reported in this study. In this investigation, four different treatments were employed, including a vertical and horizontal geotextile structure with 5 5 and 10 10 cm dimensions, a horizontal geotextile, and a treatment without geotextile. The pressure exerted by vehicles on the simulated pavement layer is measured by sensors placed in various holes and connected via cables to data logging and recording equipment. This treatment had the lowest pressure on the lower layers when compared to the other treatments, and the difference between its value and the other treatments was significant.

**Ayush Mittal (2018)** studied the performance of flexible pavement is largely dependent on the subgrade soil, which acts as the basis for the pavement. Due to its cost- and time-saving Advantages, the usage of geo synthetic material is becoming more popular. It is also less environmentally sensitive and is consistent over a broad variety of soils. Non-woven geotextile and biaxial geo grid were used in different combinations in this investigation. Materials approved by Indian Roads Congress were used in the development of the geotextile and geo grid. Compaction, soaking CBR, and unconfined compressive strength (UCS) tests were carried out by following relevant sections of the Indian standard code (IS: 2720).

## 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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