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PERFORMANCE EVALUATION OF GEOFIBRE SHEETS ON CBR VALUE OF SOIL

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Abstract
Natural fibers, materials, or plants were used in the early days of geotextile production to improve the condition of roads built on unstable soil. Geofibres have just lately been put to use and tested in modern construction. A highly developed product that must meet a variety of criteria, geofibres have become increasingly popular in recent years. Suitable machinery is needed to produce custom industrial materials. Using geofibres in construction has been a huge success for over three decades. Stronger construction can be achieved by separating sub-grade from sub-base. An example of geosynthetics being utilized to reinforce clayey soil is presented in this publication. Clayey soils were used to prepare laboratory California bearing ratio (CBR) test samples. Thermally bonded nonwoven geofibre-reinforced reinforced soils demonstrate an increase in bearing ratio in these experiments.

1. INTRODUCTION

Frictional fills are hard to get by in many regions of the world, hence the usage of reinforced soil is limited in these places. Poor-quality on-site soils can be found in numerous circumstances. Imports of cohesion less soil may be reduced or perhaps removed altogether if these were demonstrated to be adequate for reinforced filling. Many people are unaware of the significant improvements in a cohesive soil's physical qualities that may be achieved by using appropriate drainage geosynthetic materials into the design of a building project. The mechanisms of action of geosynthetics materials used to strengthen cohesive soils are also unknown. Currently, India boasts one of the world's largest road networks, totaling over thirty-three hundred thousand kilometres.

However, as traffic volume and shaft loads increase, many of the current roadways are physically unsound. A coating of suitable granular material will increase the bearing capacity to support the anticipated traffic load at areas with acceptable sub-grade bearing capacity/CBR pricing. However, shear failure and severe rutting are common at areas with cosmic background radiation of less than 2 hundredths. Even though these techniques have a high intrinsic value as far as virgin material is concerned, emerging countries like Asia are more likely to put them to use. Natural fibre products have a lot of potential for rural building over soft clay in this setting.

Geofibres were one of the earliest textiles ever made. Ancient Egyptian sites have been excavated where mats made of grass and linen were found to be used. Geofibres were used to stabilise highways and their margins during the reign of the Pharaohs.

2. LITERATURE REVIEW

Tanvi Singh (2020) As a reinforcement for the subgrade soil, geosynthetics layers are being used (which is calculated in terms of CBR). Experiments are now being conducted to investigate the effect of CBR on strength. Subgrade soil was reinforced with single and double layers of woven and nonwoven geotextile fabric at depths of M/3, M/2, and 2/3M from the top of a CBR specimen, where Mis is the height of the CBR specimen, to evaluate how well it held up. The CBR value was predicted using ANN and M5P, and the results show that ANN outperforms M5P on the current set of data.

R.Madeswaran (2019) Roads in India are fundamentally unable to handle the present level of traffic, despite the country's extensive network. The use of geosynthetics is both compatible with and

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successful for improving soil qualities when done in conjunction with other methods. Geotextiles (woven and non-woven) are being tested as a soft subgrade and unbound gravel in an unpaved flexible pavement system.

S. Vijayasimhan Sivapriya (2019) In a heavily used road, automobiles generate a great deal of vertical stress, hence geosynthetic material can be utilised to boost the bearing capacity of the subgrade. Multiple geosynthetic materials were employed in the CBR mould as a subgrade reinforcement element in the current work, such as geo-grid, geo-textile, and geo-membrane, in order to better understand how diverse geosynthetic layering effects the subgrade. Results demonstrate that the bearing improved with increasing layers of geosynthetic material, and this improvement varied depending on the kind of geosynthetic material. Geogrid has the best CBR of the three geosynthetic materials.

Naragani V-V Gopala Rao (2019) The use of geotextiles for pavement construction has been widely publicised. Geotextile reinforcement's impact on pavement design has yet to be studied in well-instrumented, full-scale studies. Some key technical issues in desert highway construction have been satisfactorily addressed through numerous indoor and outdoor experiments, such as dry compaction on sand base and the design parameters of subgrade and pavement structure combinations, as well as stability analysis of sand base reinforced with geotextiles. The use of geotextiles to stabilise poor subgrades in secondary roads has been widely acknowledged over the past 30 years. Geotextiles in pavements have been shown to improve traffic flow in two different ways.

M B, Vikram. (2018). Improved bearing capacity can be achieved by the use of geotextiles in soil reinforcement. Soil reinforcement has been accomplished using the geotextile as a tensional material in this study. The load-penetration behaviour of geotextile-reinforced granular soils was studied in a laboratory CBR experiment. Selection and testing of granular soil samples with various gradings are carried out without the use of reinforcement. So by inserting geotextile at particular depth within the sample heights in one and two layers, impacts of geotextile number and grading on reinforced granular soils and geotextile performance are examined. According to the results of these studies, the bearing ratio of geotextile-reinforced granular soils rises.

Dhavashankaran D (2018) In a flexible pavement system, the effectiveness of geofabric as an asphalt layer. The research was conducted in a lab setting. The experimental investigation included the construction and testing of a geofabric mesh pavement in the laboratory. Road construction using Geo-Fabrics. Fabric textiles are finding new uses in road building and other branches of civil engineering as newer laying techniques are being adopted. Pavement is one of the most essential materials of transportation infrastructure. Construction of asphalt concrete pavement, including the geo-fabric, requires significant quantities of bitumen and natural aggregates. Flexible pavement systems can benefit from the usage of geo fabric, according to the findings of this study.

K. Sai Krishna (2017) Geofibres will be used to strengthen the subgrade in this project. About 33 million kilometres of road exist in India today, making it one of the world's greatest road networks. The fast increase in traffic volume and axle loads is causing many existing roads to become physically unsuitable. Adding a layer of appropriate granular material to a site with acceptable subgrade bearing capacity/CBR value can increase the bearing capacity to accommodate the anticipated traffic load. Shear failure and severe rutting are common difficulties at locations with CBR under 2%. Because of the high expense of both the techniques and the virgin material required, developing countries like India have yet to make extensive use of these technologies. Natural fibre materials have the potential to be used in rural road building over soft clay in this context. In terms of coir fibre production, India

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is by far the most populous country. Non-woven items and blankets may now be made by needle punching or adhesive bonding the fibres. The use of geofibre in place of more typical road construction methods has shown to be more affordable. Natural geofibre like coir, on the other hand, degrades without causing harm to the environment.

3. METHODOLOGY

All of the tests were carried out in accordance with the established protocol. The testing in this study were carried out with the California bearing ratio (CBR). CBR testing on reinforced soil systems were the focus of the research. Reinforcement in the form of thermally-bonded nonwoven geofibres is ideal for use in reinforced soil systems.

3.1 Preparation of Specimen

To conduct the experiment, we used the same set-up as a normal CBR lab test. In addition to a 150 mm inner diameter and 175 mm height cylindrical mold, the plunger is also 50 mm in diameter and cylindrical in shape. The remoulded sample is compressed in a CBR mould with a moisture content that matches the OMC for the CBR test. Static compaction was used to compact the soil sample.

3.2 Testing

In a load frame with an electronic equipment, specimens were evaluated for loads and penetrations with LED displays. At a pace of 1.25mm/minute, a conventional plunger with a diameter of 50mm was inserted into the earth.

4. RESULT & DISCUSSION

4.1 CALIFORNIA BEARING RATIO TEST ON POLYPROPYLENE GEOTEXTILES REINFORCED SOIL

According to the data collected, the loads that corresponded to penetrations of 1.0mm, 1.5mm, 2.0mm, 2.5mm, 3.0mm, 4.0mm, 5.0mm, 7.5mm, 10mm and 12.5mm were reported. The CBR value was determined by comparing the ratio of the test load to the standard load and expressing it as a percentage. Figure 1 to 3 show the load versus penetration curve of fine sandy soil reinforced with one, two and three layers of polypropylene geofibres respectively. Table 1 presents the CBR value of fine sandy soil reinforced with one, two and three layers of polypropylene geofibres for 2.5mm and 5mm penetration.

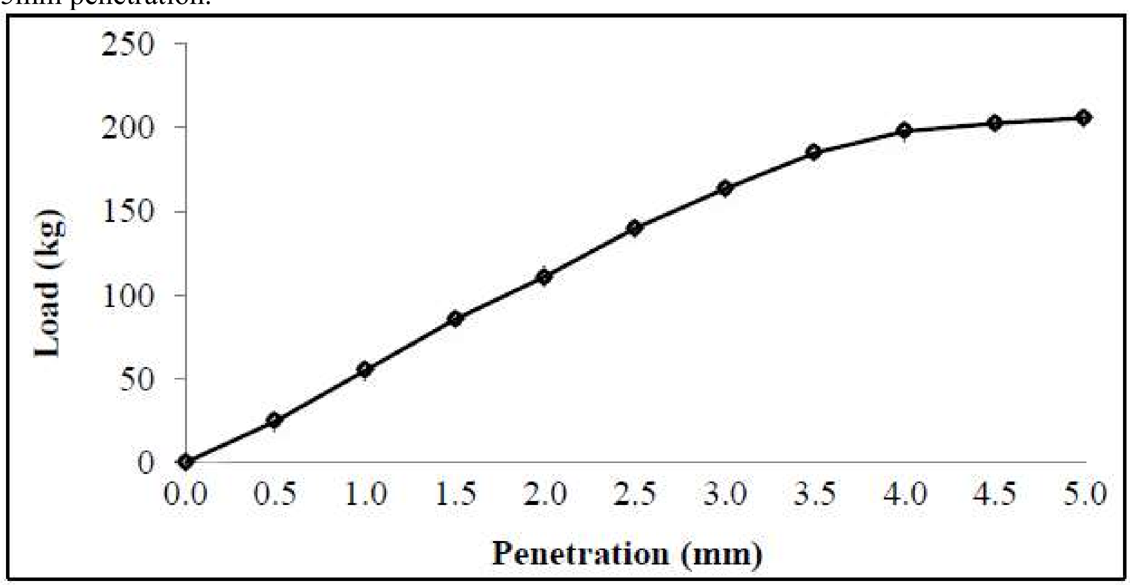

Figure 1: Load Vs Penetration Curve of Polypropylene in One Layer

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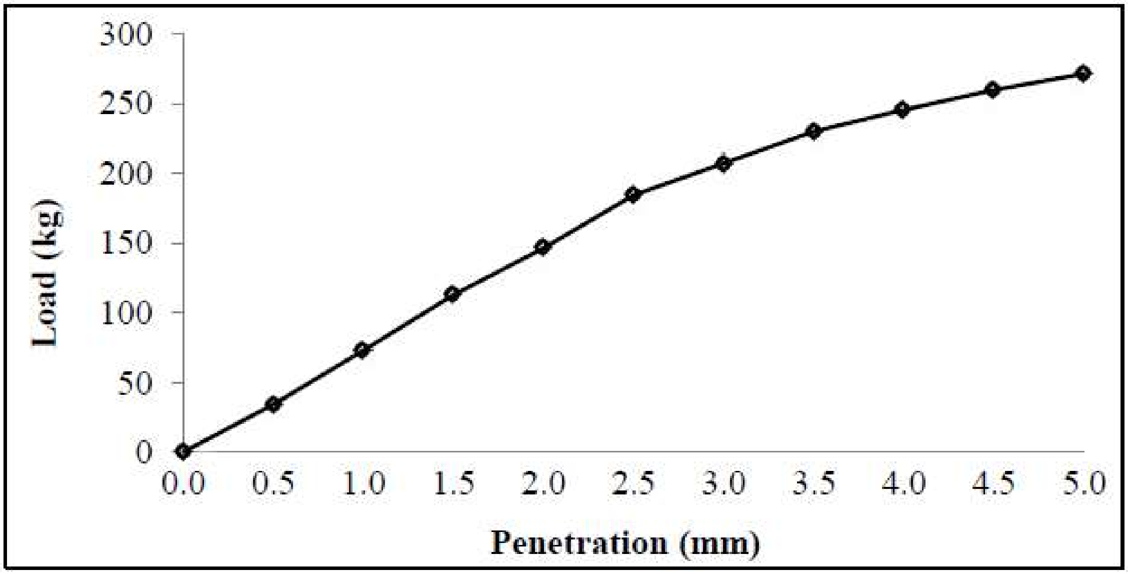

Figure 2: Load Vs Penetration Curve of Polypropylene in Two Layers

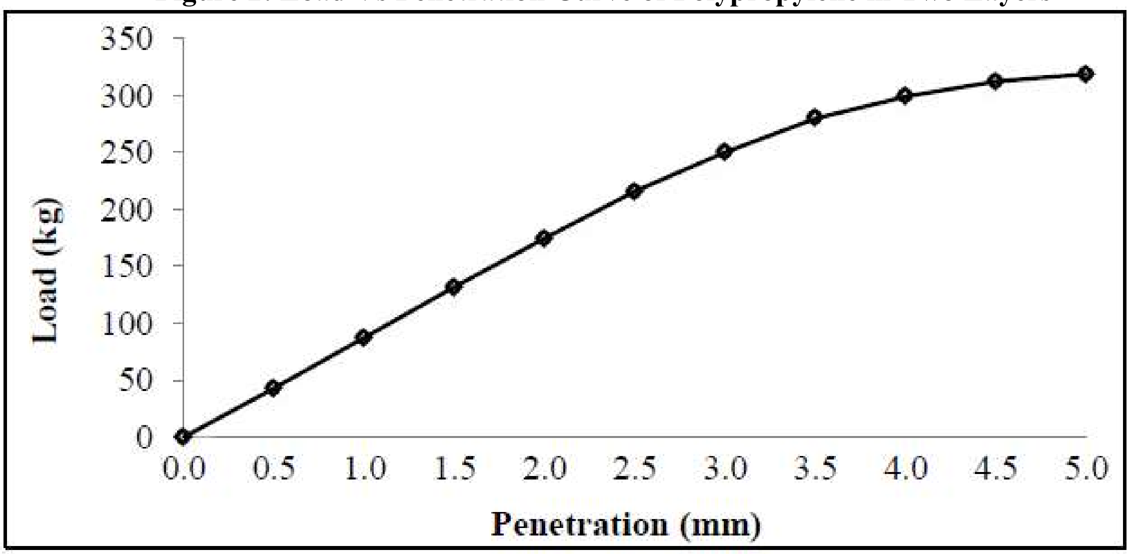

Figure 3: Load Vs Penetration Curve of Polypropylene in Three Layers

Table 1: CBR Value of Polypropylene Geofibre Reinforced Fine Sandy Soil

Number of	**CBR(%) Value**	
Geofibre Layers	**2.5 mm Penetration**	**5 mm Penetration**
Initial	6.57	6.32
One layer	10.21	10.01
Two layer	13.46	13.20
Three layer	15.78	15.52

Table 1 summarizes the CBR values of polypropylene geofibre reinforced fine sandy soil in percentage for different situations, where the initial CBR refers to the percentage CBR obtained for fine sandy soil alone without any geofibre in place. Figure 4 shows the CBR value of fine sandy soil, unreinforced and reinforced with polypropylene geofibre in one, two and three layers. The CBR value of the fine sandy soil reinforced with polypropylene geofibre shows that CBR values corresponds to

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2.5mm penetration is slightly higher than CBR values corresponds to 5mm penetration. It can be seen that by providing one additional layer of polypropylene geofibres, the increase in CBR value was around 50%. In polypropylene geofibre reinforced fine sandy soil, the increase of CBR value for one, two and three layer is 55.40%, 104.87% and 140.18% corresponds to unreinforced fine sandy soil for 2.5mm penetration. Percentage increase of CBR in three layer polypropylene geofibre reinforced case was found to be more when compared with one and two layers polypropylene geofibre reinforced fine sandy soil. It can be clearly seen from the results, CBR value increases with the addition of number of polypropylene geofibre layers.

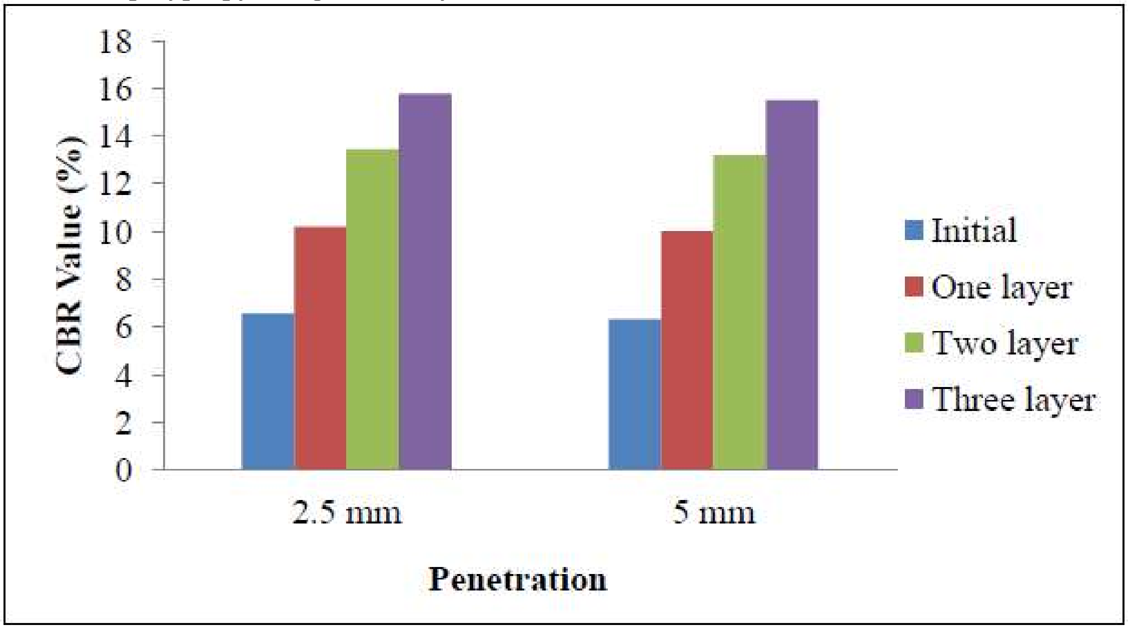

Figure 4: Comparison between Reinforced (Polypropylene) and Unreinforced

5. CONCLUSION

It is concluded that CBR tests are conducted with one, two and three layers of polypropylene geofibres..Adding an additional layer of polypropylene geofibre results in a CBR value increase of approximately 50%. In polypropylene geofibre reinforced fine sandy soil, the increase of CBR value for one, two and three layers is 55.40%, 104.87% and 140.18% corresponds to unreinforced fine sandy soil for 2.5mm penetration.

Geofibre-soil interface strength mainly based on the surface roughness of geofibres than the tensile strength of geofibres.. CBR value and interface friction of Polypropylene Geofibres is higher than other geofibres since the surface roughness of Polypropylene Geofibres is higher than other geofibres. CBR value depends on surface roughness of geofibres.. Similarly, CBR value and interface friction of carbon Geofibre is lower than other geofibres since the surface roughness of Carbon Geofibre is lower than other geofibres..

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