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SOIL REINFORCED WITH NONWOVEN GEOTEXTILE SHEETS IMPROVED CBR VALUE

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ABSTRACT
Introduction: Building materials technology has allowed substantial advances in structural engineering to take place in the past. Using wood, building stone, concrete, and lately, prestressed reinforced concrete, it became feasible to create an even larger and more complex structure.
Aim of the study: the main aim of the study is to Soil Reinforced with Nonwoven Geotextile Sheets Improved CBR Value.
Material and method: Tests at NITTTR Bhopal have employed the campus soil as a subgrade for the experiments. CH soil is utilized in this project (Clay of high plasticity).
Conclusion: In the laboratory, studies on the California bearing ratio (CBR) led to the following conclusions: Incorporating NW geotextiles into soils enhances CBR and, as a result, soil strength.
Keywords: Geosynthetics, Geotextiles, California bearing ratio, Reinforced soil etc.

1. INTRODUCTION

1.1 OVERVIEW

Geotextiles are synthetic textiles that are both porous and permeable. Polymers such as polyester and polypropylene are commonly used. soil stability and drainage improvement are achieved by utilizing geotextiles. With a wide spectrum of polymers and production processes, geotextiles can be used in a wide range of civil construction applications. It is also possible to use a wide range of geotextiles and synthetic materials in the design of geotechnical or environmental engineering projects. Only in ancient times was structural engineering able to make significant progress due to improvements in construction material technology occurring simultaneously. Building a large and complex structure became conceivable as technology advanced from wood to building stone to reinforced concrete to prestressed reinforced concrete throughout the years. With the progress of steel, it is now possible to build longer bridges and taller skyscrapers than ever before.

1.1 GEOTEXTILE EFFECT ON CBR STRENGTH OF SOFT SUBGRADE UNPAVED ROAD

The accessibility of a country's street transport framework offices is inextricably linked to its monetary improvement. Rustic streets connecting agricultural communities are critical in improving the country's economy, especially in a developing country. It is recognized that unpaved streets are preferable in low-traffic areas, but when unpaved streets are built on a fragile subgrade and the provincial street's periodic care is limited due to cost considerations, the administration may be disrupted and the street's capacity may be impacted. In such situations, geotextiles can be used to improve not only the appearance of the unpaved roadway by extending its life, but also to reduce the upkeep cost and the thickness of the street by employing various approaches.

2. LITERATURE REVIEW

Singh, Thakur & Naveen, Dr. BP & Tegar, Jagannath (2021) [1] In order to improve soil strength and permeability, geosynthetics are man-made materials that are used to fortify soils. Geosynthetics have been utilized to strengthen clayey soils, and this study examines its application as a tensional material. California bearing ratio (CBR) samples were prepared in the lab using clayey soils. To carry out the necessary testing, a clayey soil sample included both unreinforced and reinforced nonwoven

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geotextiles (NW) and superior needle-punched nonwoven geotextiles (SNW), each with their own unique properties (NW 8, 10, 21, 30 and SNW 14, 25, 62, 75). Thermally bonded nonwoven geotextiles increase the bearing capacity of reinforced soil, according to these experiments.

R. Issac, A. Bharathu, and Dr. Ramadevi (2021) [2] Even though this is common knowledge, not all soils are suitable for use as a high-quality pavement material. When such soils cannot be changed, many modification strategies should be used to improve their subgrade performance. Providing reinforcement to improve subgrade soil is one of the most extensively used methods presently. Today, a variety of soil reinforcement techniques are used, the most common of which being coir geotextile because it is a natural geotextile, it must be treated in order to improve its durability woven coir geotextile is employed as soil reinforcement in this study to improve the subgrade soil. Coir geotextile is put at various depths into a CBR mould to determine its effect on CBR value.

Madhu Negi and Sanjay Singh (2020) the effect of geo-textile as a tensional material utilized for subgrade reinforcement has been studied through an experimental programme on both unreinforced and reinforced soils with geotextile layer, the standard laboratory California bearing ratio (CBR) test was conducted under both soaked and unsoaked conditions (s). In this investigation, two types of subgrade soil were used: sandy and clayey soil with wet CBR values of 19.6 and 1.7 percent, respectively, and two types of geotextiles. In seven distinct occasions, geotextile reinforcements were used in samples. The effects of geotextile reinforcement on soil carrying capacity as measured by CBR value were explored. The results demonstrate that putting the geotextile layer increases the CBR value in the majority of situations (s). In the case of weak soil, such as clayey soil, geotextile reinforcement has been found to be the most effective. It was also discovered that woven geotextile outperformed nonwoven geotextile in every circumstance.

G. Rao, Evangeline Sheela, and Sayida M K. (2020) [4] Civil/geotechnical engineering practitioners around the world are constantly searching for new materials to use. Coir geotextiles, one of these emerging materials, is the subject of this study. Coir geotextiles, particularly those used in low-volume roadways, have undergone significant technological breakthroughs over the past few decades. There have been numerous investigations on the possibilities of coir geotextiles, and this document summarizes the results of those investigations.

Ghosh, Mahuya & Rao, G. & Sarma, Uma (2020) The results show that using any form of experimental jute geotextiles improves the stress-strain behavior of the models and the cumulative percent strain value with the number of loading cycles when compared to control models. Despite jute's biodegradation, including a jute geotextile improved the models' performance by at least 10 times under cyclic loads. The experimental jute geotextiles were used over subgrade for a real-world road project, and the results are still pending.

Sheela Evangeline, Sayida M K Girish, (2019) India boasts one of the world's largest road networks, with a total length of around 56 lakh kilometers. Excessive rutting is a prevalent problem at sites with insufficient CBR. Ground renovation measures such as the use of coir geotextile are a suitable alternative for overcoming this. Coir geotextiles are made from coir fibers, which are produced from the husk of a coconut, and have a higher lignin concentration than other natural fibres, making them more durable. Pavement reinforcement with coir geotextiles is both cost-effective and environmentally benign. Roads built on all soil types saw a decrease in bituminous Macadam overlay, an improvement in in-situ CBR values ranging from 22 percent to 178 percent when the usual deflection was reduced. Additionally, the fields CBR and DCPI were linked.

3. OBJECTIVES OF THE STUDY

- To investigate the role of geotextiles in road construction and the various varieties of geotextiles
- To study Materials and Geotextiles for Unpaved Roads Types of Geotextiles.

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4. EXPERIMENTAL STUDIES

Tests at NITTTR Bhopal have employed the campus soil as a subgrade for the experiments. CH soil is utilised in this project (Clay of high plasticity). In the laboratory, soil was tested for several index characteristics and compaction parameters, which are listed in Table 1. Figures 1 and 2 show images of the NW and SNW materials that were utilised in the CBR testing. Tables 2 and 3 list the nonwoven geotextile properties of thermally bonded (NW) and needle-punched (SNW), respectively, according to GEO NATPET manufacturers.

4.1 Sample preparation

The American Society for Testing and Materials (ASTM) created a standard technique for conducting all of the tests (ASTM 2006). The CBR (California bearing ratio) was employed in this investigation. Based on ASTM D 1883, these tests were carried out. The ASTM D 698 compaction test was also carried out on the material. CBR tests were conducted on reinforced soil systems as part of the experimental research. The mould was used for eight different experiments. In three equal lifts, the 175 mm-high mould was filled with the typical proctor density soil (Fig.). Tables 4 list the nonwoven geotextile properties of thermally bonded (NW) and needle-punched (SNW), respectively, according to GEO NATPET manufacturers. Refined soil system shown in Figure 4 is made in the 150-mm diameter mould. Figure 5 depicts the CBR test setup schematically.

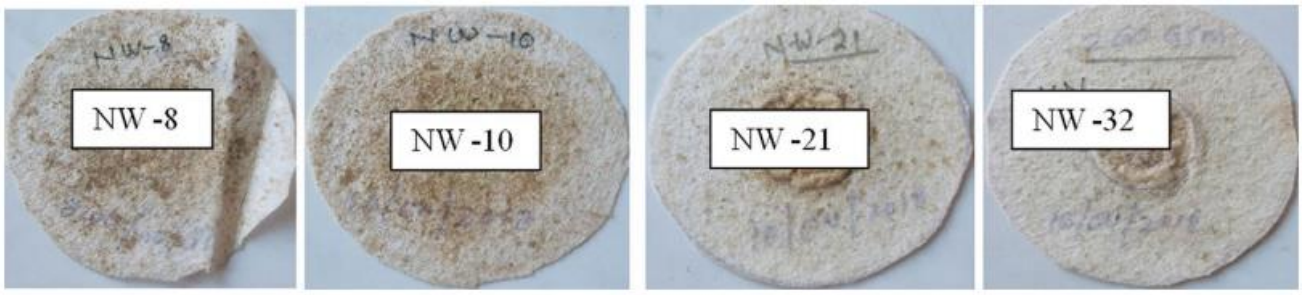

Fig. 1 thermally bonded nonwoven geotextiles

Fig. 2 Superior needle-punched nonwoven geotextiles

5. RESULTS AND DISCUSSION

Soil and two kinds of nonwoven geotextiles, NW and SNW, are employed in the current work to investigate the properties of clay. Tests on geotextile-free soil specimens with and without CBR measurements are conducted. Figure 3 depicts the NW soil's load-penetration sensitivity. Soil gains in CBR value by incorporating NW. The CBR value of soil rises significantly at NW-30 as the NW thickness is increased. Geotextile's content of NW-21 was also determined to be optimal, since it was observed that preparing similar soil samples for CBR testing beyond NW-21 was not possible. Similarly, adding SNW increases soil CBR value (Fig. 4). The CBR value of soil improves somewhat as SNW thickness increases, and SNW-62 was determined to have the optimal amount of geotextile material. In addition, the polypropylene threads in SNW geotextiles offer it exceptional strength, allowing it to withstand the strains of construction and installation. SNW geotextiles are UV and naturally degradable resistant, making them a cost-effective long-term solution.

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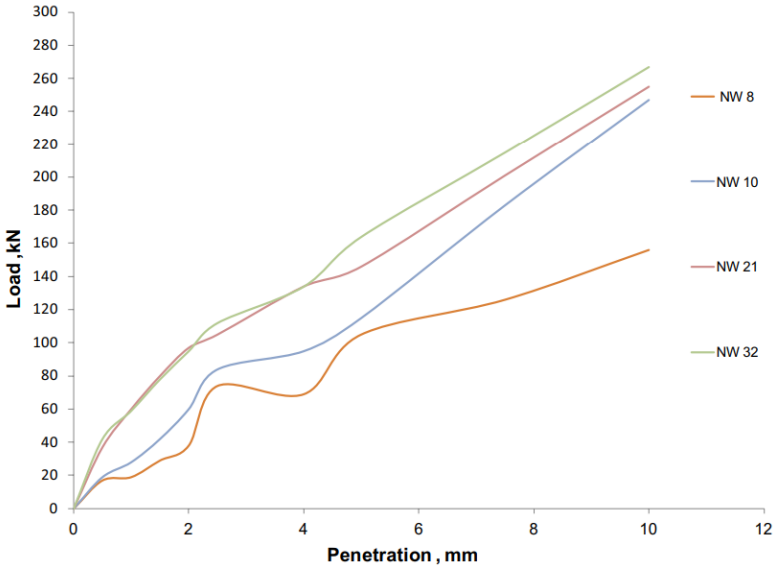

Fig. 3 Load-penetration response of the NW Soil

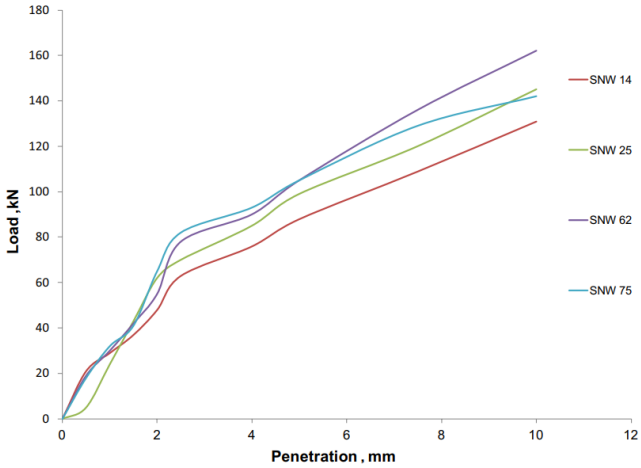

Fig. 4 Load-penetration response of the SNW soil

Strength mobilisation of reinforcing geotextile's material is clearly shown in Fig. 8 by the fact that it is strongly dependent on the specific CBR range of soil samples. Because of their high tensile strength, the NW geotextiles were successful in strengthening the soil, and their results are on par with those of the other reinforcements. Geotextiles such as NW performed as well as SNW and unreinforced soil. SNW geotextiles also serve as a separator and filter, allowing fluids to flow freely while blocking soil particles from passing through. Separation, filtration and protection applications may benefit from the use of cost-effective geotextiles from SNW geotextile. NW and SNW geotextiles, on the other hand, are practical instruments that civil engineers may use to tackle any sort of geotechnical issue.

Table 4 shows that the mobilisation of reinforcing geotextile material strongly relies on the range of CBR of the soil sample. The higher the CBR of the NW soil sample, the more efficient the strength mobilisation effects of geotextile material. NW-30 soil has a significant rise in CBR value when the NW thickness is increased.

Table 4: Geotextiles with unreinforced soil: a summary of the testing findings

Parameters	Unsoaked CBR, %	qu, (kPa)
"Unreinforced soil"	"19"	"13.3"
"SNW 14"	"16"	"11.2"
"SNW 25"	"18.2"	"12.7"

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"SNW 62"	"20"	"14.0"
"SNW 75"	"21"	"14.7"
"NW 8"	"19"	"13.3"
"NW 10"	"21.5"	"15.1"
"NW 21"	"27"	"18.9"
"NW 30"	"29"	"20.3"

6. CONCLUSIONS

In the laboratory, CBR experiments were performed and the following findings were derived.

1. Adding NW geotextiles to soils increases CBR, which in turn increases the soil's overall strength. Geotextile-reinforced soils in different earthen constructions should perform better than unreinforced ones and boost the soil's capacity for load bearing.
2. In particular at higher CBR values, the Black equation considerably overestimates the final bearing capacity.
3. The results of this investigation show that adding NW and SNW geotextile sheets to soil improves its load bearing capacity and reduces the amount of rapid settling.
4. If you're looking for an inexpensive way to separate, filter, and protect your property, geotextiles are an excellent option.
5.

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