

SOIL STABILIZATION USING GEOSYNTHETIC MATERIAL (BAMBOO FIBRES)

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ABSTRACT: - Soil stabilization is the process which involves enhancing the physical properties of the soil in order to improve its strength, durability etc. by blending or mixing with additives. The different types of method used for soil stabilization are: Soil stabilization with cement, Soil stabilization with lime, Soil stabilization using bitumen, Chemical stabilization, and a new emerging technology of stabilization by Geo textiles and Geo synthetic fibers. In this study, we are making use of bamboo fibers as geo synthetic material for stabilization of soil. With the use of bamboo fibers to the soil the CBR values will improve, and thickness of pavement layer also gets reduced. Bamboo fibers are such a geosynthetic material which is easily available, and ecofriendly, and also cost effective. Bamboo fiber can substantially improve the properties of Black cotton soil. The advantages of this project are that to add bamboo fiber in soil stabilization is economically cheap as well as a superior concrete can be made.

INTRODUCTION: - A developing country with such a huge geographical area and population, such as India, requires extensive infrastructure. In India, land is being used for a variety of structures like houses, bridges, trains, and airports. Encountering land having soft soil for construction leads to an attention towards adopting ground improvement techniques such as soil stabilization. Soil stabilization is the process which involves enhancing the physical properties of the soil in order to improve its strength, durability etc. By blending or mixing it with additives. The different types of methods used for soil stabilization are: Soil stabilization using cement, Soil stabilization using lime, Soil stabilization using bitumen, Chemical stabilization and a new emerging technology of stabilization that is stabilization of soil by using Geo textiles and Geosynthetic fibers. Geosynthetic are synthetic products made from various types of polymers which may be either Woven or Non-Woven. These are used to enhance the characteristics of soil and have provided a practical way of constructing civil engineering structures economically. In this study, we are making use of bamboo fibers as geo synthetic material for stabilization of soil. With the introduction of bamboo fibers to the soil the CBR values may improve, and thickness of pavement layer also may get reduced. It may also reduce the intensity of stress on sub grade. Bamboo fibers is such a geosynthetic material which is easily available, eco- friendly, and also cost effective. With the application of soil stabilization technique in construction process the overall cost may get reduced when compared to the ordinary method of construction.

1.2 Needs and Advantages of soil stabilization

Soil properties vary a great deal and construction of structures depends a lot on the bearing capacity of the soil, hence, we need to stabilize the soil to improve the load bearing capacity. The gradation of the soil is also a very important property to keep in mind while working with soils. The soils may be well-graded which is desirable as it has a smaller number of voids or uniformly graded which though sounds stable but has more voids.

Advantages of soil stabilizations are as follows

- If weak soil strata are discovered during the construction phase, it is common practice to replace the weak soil with another excellent quality soil. With the use of soil stabilization techniques, the qualities of locally accessible soil (soil on site) may be improved and it can be utilized successfully as a sub grade material without having to be replaced. The cost of preparing the sub grade by replacing the weak soil with a good quality soil is higher than that of preparing the sub grade by stabilizing the locally available soil using different stabilization techniques.
- Stabilization can efficiently enhance the soil's strength-giving properties to the adequate point. It improves the strength of the soil, thus, increasing the soil bearing capacity.
- Increasing the bearing capacity of the soil, instead of using a deep foundation or raft foundation, is more cost and energy efficient. It is also used to provide more stability to the soil in slopes or other such places.
- Soil stabilization is sometimes used to reduce soil erosion or dust generation, which is especially useful in dry and arid conditions.
- Stabilization is also done for soil water-proofing; this prevents water from entering into the soil and hence helps the soil from losing its strength.
- It helps in reducing the soil volume change due to change in temperature or moisture content. However, the soil stabilization has disadvantage like increase in cost of construction and difficulty in mixing the fibers with soil.

Objective:

- To find an alternative solution for Soil Stabilization.
- To reduce Artificial Fiber and produce eco- friendly Natural Fiber.
- To provide high strength Soil than ordinary Black Cotton Soil.

- To develop an eco-friendly product at low cost.
- Optimization of Bamboo Fiber in valuable product.

LITERATURE REVIEW:

- **Sujitkawade** et al., were studied the effect of geogrid and lime on the properties of the soil. Their key objectives are to evaluate the properties of the soil prior and later the mixing up of lime and geogrid to it. The various tests they have conducted and were natural water content determination, Compaction test, Atterberg's limits, specific gravity, Compaction test, and Compressive Strength test. After the study and executing the entire above tests, they concluded that and they concluded that there was a significant increase in the compressive strength of the soil for optimum lime content of 15% which was found.
- **AyushMithal and Dr. Shalinu Shukla** were examined the effectuality of use of geotextiles as a reinforcement material (such as Mechanical property, Physical property, Hydraulic property, Durability property and Endurance property), Fibers of Geotextiles, (both natural and synthetic fibers), functions of Geotextiles, application of geotextiles Types of Geotextiles and impact of geotextiles on environment. They have finalized that, because of the versatile functions of geotextiles they should be used in many strategic civil engineering works. The usage of geotextiles not only reduces the cost of construction but also reduces maintenance cost.
- **Vegulla, Raghudeep** et al. were examined that the outcome of vitrified polish waste on the properties of the soil. Their subjective was to sum up the decrease in pavement thickness due to an increase in CBR after adding of polish waste. They have carried out the various tests like Atterberg's limits, Grain size distribution, Compaction tests and CBR tests on soil solely and with addition of vitrified polish waste. They summarized that with 10% add on of vitrified polish
- **E.A. Subaida, S. Chandrakaran, N. Sankar** et al presents the results of an experimental study conducted to investigate the beneficial use of woven coir Geotextiles as reinforcing material in a two-layer pavement section, are presented. Monotonic and frequent loads were practical on reinforced and unreinforced laboratory roadway segment through a rigid rounded plate. The effects of placement location and stiffness of geotextile on the presentation of reinforced sections were investigated using two base course thicknesses and two types of woven coir Geotextiles. The investigation consequences designate that the inclusion of coir Geotextiles improved the bearing capacity of thin sections. Placement of geotextile at the

interface of the sub grade and base course increased the load carrying capacity significantly at large deformations. Considerable development in bearing capacity was experimental when coir geotextile was located within the base route at all stage of deformations. The best possible placement position of coir geotextile was originated to be within the base course at a depth of one-third of the plate diameter below the surface.

- **Akolade, A.S And Olaniyan** et al presents Highway construction is one of the main engineering design and construction in civil engineering in many countries all over the world. Existing revise have exposed that civil engineer attractive in highway construction have quite a little challenge during road construction especially as it is related to the topography of the site, inadequate sub grade soil and high-water table, in spite of this challenges, the application of geogrids as a geotechnical property is imperative to improve the sub grade of soils with soaked condition. Soil samples were label (A, B& C) at haphazard. These samples were taken to the Laboratory for experiments to recognize and establish the Grain size analysis, Atterberg, compaction and California bearing ratio by introduction the geo-grids at unreliable depths and in single layer under soaked circumstances (48hrs) to determine the strength of the soil samples.
- **Charles Anum Adams, Nana Yaw Amofa, Richter Opoku –Boahen** et al presents Geogrid reinforcement is gaining acceptance as an effective way of improving on the properties of naturally occurring soils for road pavement construction. In lots of steamy countries, weak lateritic sub grades are common and often discarded after proof rolling during construction due to deprived strength. The precise objectives of this research were to 1) Determine the effect of strength of geogrid reinforcement material on the California Bearing Ratio of a sample of relatively poor lateritic sub grade material under soaked and unsoaked condition and 2) Establish the effect of geogrid reinforced sub grade on the design thickness of low volume paved roads. This was undertaking for two strengths of geogrid in both soaked and unsoaked circumstances. The California Bearing Ratios of the soil–geogrid sub grade was used to determine the pavement layer thicknesses for a low volume paved road using the Transport Research Laboratory Road Note 31 method of pavement design.
- **Charles A.Adams, YawAdubofourTuffour , Samuel Kwofie** et al presents The mechanism for strength development when unbound soils are reinforced with geogrid is not well understood. Research on geogrid reinforcement has tended to center mostly on humanizing the property of the geogrid with little attention to the pressure of soil properties on geogrid performance. This learning investigated the effects of plasticity index and gradation properties of lateritic soils on strength enhancement within a soil-geogrid-reinforced compound for a pavement. Three samples of soil with dissimilar plasticity and gradation were compacted and hardened in strength with and without geogrid reinforcement.

Reinforcement involved incorporating one and two layers of geogrid into the sample at diverse depths within the compacted sample height. The consequences indicated that as soil plasticity increased, the CBR decreased.

- **Abhijith R.P** et al presents an experimental study on the utilization of natural coir fibers on unpaved roads. Coir fibers provide a reinforcement action to the sub grade soil. Coir fiber is a natural material obtained from coconut husk which is commonly seen in India. Use of coir fibers improves the sub grade soil strength. Coir fibers of varying length from 0.5 to 3cm and varying percentage from 2 to 8 of total weight of soil were added with the soil and CBR test was conducted. The consequences completed that introduction Geotextiles at two third deepness from bottom position was seems to be more effective. The reinforcement action is necessary during initial stage and later reinforcement action is obtained by the consolidation of sub grade soil.

Methodology:

Materials Used: In this study we are using varies materials such as Bamboo fiber and Black Cotton Soil for stabilizing the soil.

Serial number	Bamboo fiber properties	Values
1.	Density	0.6–1.1
2.	Young's modulus (GPa)	11–17
3.	Tensile strength (MPa)	140–230
4.	Elongation (%)	16
5.	Uniformity index (%)	92.7
6.	Moisture (%)	6.5

Table7: The physical properties of Bamboo Fiber

Conclusion: After studying a number of journal papers and previous study reports, I came to the conclusion that Bamboo Fibers are widely used for stabilizing black cotton soil. The goal of my study is to find an alternative source of stabilizing materials that is also eco-friendly, and by using this material, the properties of black cotton soil are improved.

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