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SOIL STABILIZATION USING BAMBOO GRID

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Abstract - *An inventive and environmentally friendly method of stabilizing the soil beneath square footings in construction is the use of bamboo grids. By embedding bamboo strips in a grid pattern, the technique improves load distribution and soil stability. Bamboo is an environmentally friendly material that is perfect for this use because of its high tensile strength and quick renewability. The soil, which came from BIT's Agri Ground, was identified as SC (sand with clayey particles), and 12% was determined to be the ideal moisture content. Bamboo grids improved bearing capacity and decreased settlement by increasing CBR values by 14%. Additionally, a 40% increase in shear strength prevented soil from slipping under stress. Bamboo grids provide a sustainable alternative to traditional techniques that call on costly synthetic materials or hazardous chemicals substitute. To ensure their long-term durability, proper design, care, and maintenance are necessary. This method contributes to ecological advantages and sustainable building by fusing traditional materials with contemporary engineering.*

***Key Words**: **Bamboo Grids, Soil Stabilization, Sustainability, Eco-friendly, Load Distribution, Shear Strength, CBR Values**.*

1.INTRODUCTION

In order to improve soil qualities, increase load-bearing capacity, decrease settlement, and stop erosion, soil stabilization is crucial in civil engineering. Although they can be useful, traditional techniques like mechanical compaction, chemical additives, or geosynthetics are frequently expensive and environmentally problematic. Bamboo has become a natural soil stabilizing element and a sustainable substitute. Bamboo is perfect for strengthening soil because of its quick growth cycle, remarkable tensile strength, and lightweight design. By distributing loads across the soil, its grids—which are composed of interwoven bamboo poles or strips—lessen stress concentrations that can cause structural failure. Because of its inherent flexibility, bamboo can adjust to changes in the soil and maintain stability over time. Additionally, because it is porous, it improves drainage and lowers the risk of erosion and waterlogging. One major benefit of bamboo is its sustainability; it uses fewer resources than to wood. It works well with a variety of soil types since it also increases soil cohesiveness and shear strength. Bamboo grids can be used for a variety of purposes, including improving agriculture, building roads, and creating embankments. By generating work in rural places, the material also boosts local economies. Bamboo's ability to sequester carbon is consistent with international climate initiatives. Even though issues like durability and insect resistance still exist, more study will increase its efficacy in stabilizing soil, providing a resilient infrastructure solution that is both economical and environmentally benign.

1.1 SOIL COLLECTION AND PREPARATION:

The laterite soil is collected from the BIT college near Agriculture department and dry it in oven for 24 hours and after dry it the soil test was done. The soil to be stabilized should be compacted to a consistent depth, free from large debris, and properly graded. Conduct soil testing to assess the soil's properties, such as, specific gravity, particle size distribution, direct shear, proctor, cbr test

1.2 COLLECTION OF BAMBOO GRIDS

Choose mature bamboo with a diameter of 4-6 cm and ensure it is free from cracks or defects. Bamboo species like Bambusa vulgaris or Phyllostachys edulis are often used due to their strength and flexibility. The design of the bamboo grids will involve spacing of grids, thickness, and configuration a square pattern.

1.3 GRID SPACING

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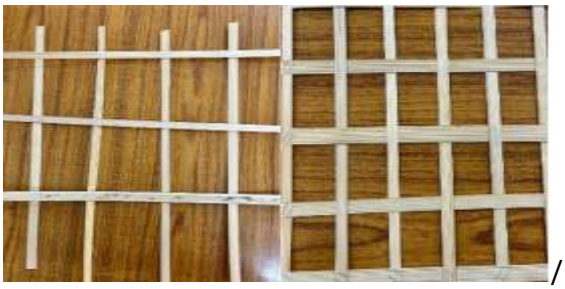
Bamboo Strip Dimensions: The bamboo width ranges from 1 to 3 cm, depending on the soil type and necessary strength. Higher load-bearing needs may call for the adoption of wider strips. Thickness ranges from 0.5 to 1 cm. It is more difficult to work with thicker strips offer more strength and longevity. But the strips' lengths might vary greatly, they should typically cover the whole width of the CBR mould or reinforcement test area during the test conducted with bamboo grid.



BAMBOO GRID

Bamboo Grid Spacing and Arrangement: In a bamboo strips the grid spacing we provided is 4 cm to 4 cm by referring the geo grid spacing. Better reinforcement is provided by closer spacing. The bamboo grids include strips that are perpendicular to one another and are placed in square or rectangular shapes. For this soil stabilization we choose a bamboo strip shape as square shape and it is stronger and equally distribute the load to the soil during the grid is used. Tensile strength is improved in both horizontal directions by this crosshatch design.

GRID PLACEMENT

2. BAMBOO GRIDS ARE PALCED IN VARIOUS DEPTH(CBR TEST)

1. Single Layer Placement: A single bamboo grid layer is placed at a specific depth, usually between 25% to 50% of the total depth from the top surface of the soil in the CBR mould. This position is effective in reinforcing the soil in the primary shear zone, where maximum stress occurs during the penetration of the piston.

2. Multiple Layer Placement: Multiple bamboo grid layers are placed at equal intervals throughout the depth of the soil sample. This configuration distributes reinforcement throughout the soil sample, providing improved load distribution and enhancing the overall stability of the soil.

3. Near the Surface (Top 25-30%): The bamboo grid can be placed close to the top surface, typically within the top 25-30% of the total depth. This placement helps in directly reinforcing the upper layer, which often bears the majority of the load in pavement applications.

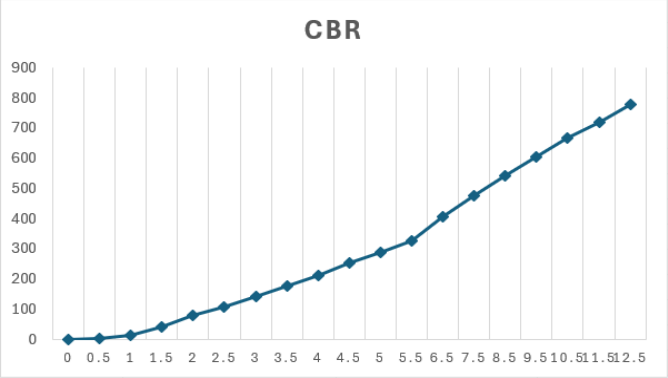
Table -1: CBR (CALIFORNIA BEARING RATIO)

S.NO	PENETRATION (mm)	CBR	1 st LAYER BAMBOO GRID	2 nd LAYER BAMBOO GRID	3 rd LAYER BAMBOO GRID
1	0	0.00	0.00	0.00	0.00
2	0.5	35.67	51.66	2.46	24.60
3	1	63.96	70.11	13.53	49.20
4	1.5	82.41	89.79	43.05	67.65
5	2	104.55	115.62	78.72	82.41
6	2.5	124.23	143.91	109.47	95.94
7	3	147.60	172.20	142.68	114.31
8	3.5	174.66	200.49	178.35	133.61
9	4	202.95	226.32	212.79	152.52
10	4.5	231.24	253.38	252.79	174.66
11	5	257.07	280.44	289.05	199.26
12	5.5	286.59	308.73	328.41	222.63
13	6.5	350.55	362.85	405.90	268.14
14	7.5	410.82	413.28	476.01	314.88
15	8.5	464.94	471.09	543.66	360.39
16	9.5	519.06	515.37	606.39	398.52
17	10.5	570.72	560.88	666.66	431.73
18	11.5	618.69	594.09	722.01	479.70
19	12.5	669.12	654.36	779.82	517.83

SAMPLE NUMBER	CBR AT 2.5 mm penetration(%)	CBR AT 5 mm penetration(%)	final CBR value (%)
1 st layer bamboo grid	10.50	13.64	13.64
2 nd layer bamboo grid	7.99	14.06	14.06
3 rd layer bamboo grid	7.00	9.69	9.69

The result to be found in a CBR for laterite soil is 14.06%. Normal CBR Reading: 12.50% ,2layer bamboo grid: 14.06%. By comparing the soil compaction in laterite soil by

providing two layers of bamboo grids gives better results than normal CBR test. 12.50 < 14.06 % In this result we understand that using bamboo the bearing capacity will increase.



GRAPH

Grid Size for Laboratory Tests (e.g., CBR Mold): CBR mould diameter is approximately 15 cm diameter, so bamboo grids are cut to fit within this size. One or more bamboo grids may be placed within the mould at different depths, depending on test objectives.

3. CONCLUSIONS

The use of bamboo grids for soil stabilization is an innovative and sustainable approach that combines cost-effectiveness with environmental benefits. By testing the soil with the bamboo grid will increase the bearing strength and reduce the settlement of the soil. So we test bamboo grid in CBR (California bearing ratio) testing machine and finally we get better results by using a 2 layers of bamboo grid as 14% increase. It is a renewable and biodegradable resource, provides an eco-friendly alternative to synthetic materials commonly used in soil stabilization projects. Its high tensile strength and flexibility make it an effective reinforcement material for improving soil strength, reducing erosion, and enhancing load-bearing capacity.

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