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SOIL STABILIZATION OF BLACK COTTON SOIL BY USING FLYASH AND COCONUT FIBER

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Abstract - The soil is very important in the civil engineering constructions. The poor engineering properties of the local soil may cause difficulties in a construction. The black cotton soil is an expansive soil, which can be seen in various locations of India, and also extensively distributed mostly in South India. The black cotton soils are the major source of great damage to infrastructure, buildings and roads also. The black cotton soil changes according to the seasonal variations of the climate in that area. When it is rainy season, the soil absorbs the water and swell, and when it comes to summer season the soil will be affected to shrinkage. Due to these changes the super structures like buildings and pavements, foundations got severely damaged. The fly ash is a by-product of the coal and is obtained from thermal power stations. Soil stabilization of black cotton soil by using fly ash and coconut fiber. In this project we are stabilizing the black and the usage of coconut fiber is very high and the displacing of these materials is the major problem due to its non disposable characteristics.

Key Words: Shrinkages, Disposable, Pavements, lasers, Stabilizations.

1.INTRODUCTION

Black Cotton Soil is a cohesive soil. It is generally light to dark grey and black in color. It possesses the characteristics of swelling during the rainy season and shrinking during summer season. In both situations, it poses difficulties. Swelling caused in Black Cotton Soil during the rainy season, the structure has uplift pressure and generates heave in the foundations, plinth beams, ground floors of the buildings and canals, roads surfaces, etc and on shrinkage in the summer season, cracks created in walls, slabs, plinth protection, floors, etc. These soils are highly compressible and have extremely low bearing capacity. It is greatly tough to work with such soils. Lightly loaded structures are also suspectable to damage as a result of the volume changes in the soil. The black cotton soils shows difficulties in the constructions but these are the most suitable soils when it comes to agriculture. Cotton, paddy, sugar cane, black gram and corn grows in this kind of soil in central and southern parts of India. It is a type of soils that are rich in minerals and nutrients.

2. ROLE OF SOIL IN CONSTRUCTION

Soils are used as construction materials in the civil engineering structures and are founded in (or) on the surface of the earth. Geotechnical properties of soils influence the stability of civil engineering structures. Soil is very important for building a modern infrastructure. Soil is directly used tomake building materials, such as cement and brick, as well as indirectly used to grow the plants used to make building materials such as wood boards etc. The soil is used in various purposes in civil engineering works such as load bearing structures, filling component, retaining walls, and many more, without soil we cannot do a construction work. These properties of soils are highly important in any constructional work and those are permeability, bearing strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, composition are depth to the water table, depth to bedrock, and soil slopes.

3. LITERATURE REVIEW

Fly ash: Fly ash is the ash produced by combustion of pulverized coal in coal-fired electric and steam generating plants. Pandian et al. (2001) in their study, added fly ash (class- F) up to 100% to black cotton soil at an increment of 10% and found that California bearing ratio (CBR) values of black cotton soil increased up to 20% addition of fly ash beyond it, CBR decreased. It again increased and attained an optimum value when the percentage of fly ash was 70%.

Coconut fiber: The outer covering of fibrous material of a matured coconut, termed coconut husk, is the reject of coconut fruit. The fibers are normally 50–350 mm long and consist mainly of lignin, tannin, cellulose, pectin and other water-soluble substances (Hejazi et al., 2012). Coconut palms are mainly cultivated in the tropical regions of the world and the product from the palm is applied in food and non-food products, which sustains the livelihood of people all over the globe.

Fig-1: Fly Ash

Fig-2: Coconut Fiber

Coir or coconut fiber belongs to the group of hard structural fibers. It is an important commercial product obtained from the husk of coconut. Coconut fiber is extracted from the outer shell of a coconut. The common name, scientific name and plant family of coconut fiber is coir, Cocos nucifera and Aceraceae (Palm), respectively. Real time image pertaining to the study area.

4. PHYSICAL PROPERITES OF COCONUT FIBER

- Length
- Density
- Breaking elongation
- Diameter
- Specific Gravity
- Diameter
- Specific Gravity
- Youngs Modulus
- Tenacity

Property	Value
Length (mm)	15 – 280
Density (g/ cc)	1.15 – l.4
Breaking elongation (%)	29.04
Diameter (mm)	0.1 -1.5
Specific gravity	1.15
Young's modulus (GN/m2)	4.5
Tenacity (g/tex)	10.0

Table- Physical Properties

5. METHOD OF MIXING

The fly ash which is expected to increase the strength of the soil is added to the soil in four different percentages that are 5%, 10%, 15%, 20% by mass of a soil. Percentage by mass represents the ratio of mass of fly ash to mass of soil sample taken as a percentage.

6. METHODOLOGY

PRELIMINARY LABORATORY TESTS:

Experimental investigation plays a major role in finite elemental analysis. It is important to verify and validate the accuracy of finite element models using test data.

SPECIFIC GRAVITY TEST:

Specific gravity 'G_s' is defined as the ratio of the density of material to the density of standard fluid or water. The knowledge of specific gravity is needed in calculation of soil properties like voidratio, degree of saturation etc.

7. PROCEDURE

1. Clean and dry the pycnometer
2. Wash the bottle with water and allow it to drain.
3. Wash it with alcohol and drain it to remove water.
4. Weigh the empty bottle with stopper (W_1)
5. Take about 100 to 200 gm of oven soil sample transfer it to the bottle. Find the weight of the bottle with stopper and soil (W_2). Put 200ml of distilled water in the bottle to allow the soil to soak completely. Leave it forabout 2 hours.
6. Again, fill the bottle completely with distilled

water. Now determine the weight of the bottle with stopper and the contents (W_3).

7. Now empty the bottle and clean it thoroughly. Fill the bottle with only distilled water and weigh it let it be ($W_{4)}$.
8. Repeat the same process for 2 to 3 times, to take the average reading of it.

8.RESULTS

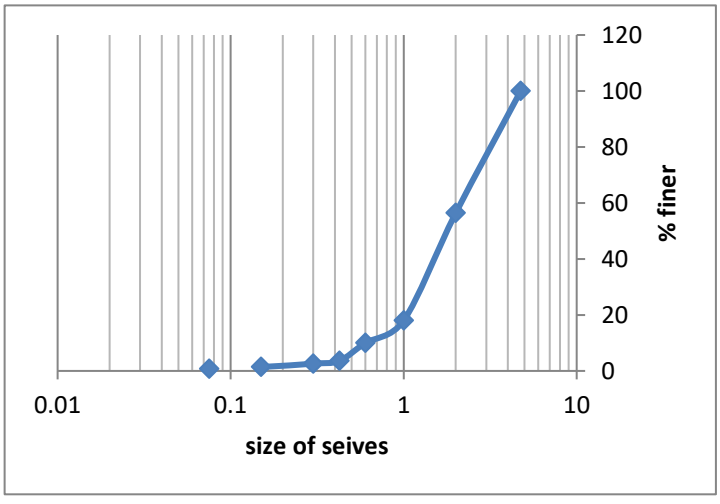
5.1 SPECIFIC GRAVITY TEST RESULTS

5.1 SPECIFIC GRAVITY OF BLACK COTTON SOIL

The main specific gravity values of black cotton soil are shown in Table:5.1.

S. No	Description	% OF FLY ASH
1.	W1	181gm
2.	W2	381gm
3.	W3	781gm
4.	W4	660gm
5.	G	2.531
6.	Avg. Values	2.562

TABLE 5.1 SPECIFIC GRAVITY OF BLACK COTTON SOIL



GRAPH 5.2: PARTICLE SIZE DISTRIBUTION OF BLACK COTTON SOIL

9. FUTURE SCOPE

- In order to increase the life of Coconut coir, treating the coir with Bitumen, copper-based chemicals, phenol and some other patented chemical compounds.
- Use of coconut coir in Concrete Structures to increase its strength.
- Installation methods of Coconut coir for various civil engineering applications.
- Flyash are used in the soil with different percentages.
- Different alternative materials are used as replacements of soil.
- Different soil stabilization parameters are used to attain better strength.

10. CONCLUSIONS

 Addition of Fly ash, Coconut coir fiber (CCF) in Black cotton soil improves the Engineering properties of soil.

 With the increase in percentage of fly ash, and coconut coir fiber, Liquid limit decreases because the percentage finer of fly ash and coconut coir fiber is more. Both additives have more absorption of water hence liquid limit decreases.

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