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Black Cotton Soil Stabilization with Fly Ash and Coconut Fiber

Lecturer Ritu Mewade
Civil Engineering Department, Government Polytechnic College Khirsadoh
District - Chhindwara ,Madhya Pradesh

Abstract- Soil plays a significant role in civil engineering works. The local soil's poor engineering qualities might make building challenging. The black cotton soil is a large soil that may be found in many parts of India, but is most widely dispersed in South India. Black cotton soils cause extensive damage to infrastructure, buildings, and roadways. The black cotton soil varies with the seasonal fluctuations of the climate in that location. The soil absorbs water and swells during the rainy season, whereas the soil shrinks during the summer months. Because of these shifts, superstructures such as buildings and pavements, as well as foundations, suffered serious damage. Fly ash is a byproduct of coal that is derived from thermal power plants. Fly ash and coconut fiber are used to stabilize black cotton soil. In this project, we are stabilizing the black, and the use of coconut fiber is extremely high, and displacing these materials is a huge issue owing to their non-disposable properties.

Keywords- Black Cotton Soil, Shrinkages, Disposable, Pavements, lasers, Soil Stabilization, Fly ash ,coconut fiber.

I. INTRODUCTION

In recent decades, urbanization has demand building of civil engineering projects on unstable soil due to land constraints. Black cotton soil lacks engineering qualities, such as shear strength and bearing capacity. In India, black soil is prevalent in Andhra Pradesh, Karnataka, Maharastra, Gujarat, Rajasthan, Uttar Pradesh, Madhya Pradesh, and Tamil Nadu, accounting for around 30% of land area. Stabilizing such soils is necessary prior to beginning construction. Stabilization involves adding binders or stabilizers to soft soils to improve their strength and stiffness. Stabilization requires additional investments, which raises overall construction costs. Using waste products or byproducts can save costs and provide a trash disposal option. This study examines the use of fly ash and coconut fibers as soil additions in black cotton.

II. LITERATURE REVIEW

Pannde, et al. (2011) Fly ash is the ash formed during the burning of pulverized coal in coal-fired electric and steam generating plants. In their investigation, they added fly ash (class-F) up to 100% to black cotton soil at a 10% increment and discovered that the California bearing ratio (CBR) values of black cotton soil increased up to 20% with the addition of fly ash, but fell after that. It again grew and reached its optimum value when the percentage of fly ash was 70%.

(Hejazi et al., 2012).The mature coconut's outer layer of fibrous material, known as the coconut husk, is the fruit's reject. Lignin, tannin, cellulose, pectin, and other water-soluble materials make up the majority of the fibers, which are typically 50–350 mm long. Most coconut trees are grown in tropical areas of the world, and their contents are used in

both food and non-food items, supporting people's livelihoods everywhere.

Objectives of the Study

- To study the combined effects of fly ash and coconut fiber on properties of black cotton soil.
- To find the optimum percentage of ash and coconut fiber combined as stabilizing agents.
- To find the increase in geotechnical properties after addition of ash and coconut fiber.

III. MATERIALS AND METHOD

Materials

Figure 1: Fly Ash

Figure 2: Coconut Fiber

Mix Proportions

Fly ash, which is said to make the soil stronger, is added in four different percentages: 5%, 10%, 15%, and 20% of the soil's bulk. The ratio of fly ash mass to soil sample mass expressed as a percentage is known as percentage by mass.

Experimental Procedure

- .Clean and dry the pycnometer
- Wash the bottle with water and allow it to drain.
- Wash it with alcohol and drain it to remove water.
- Weigh the empty bottle with stopper (W1)
- 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 (W2). Put 200ml of distilled water in the bottle to allow the soil to soak completely. Leave it forabout 2 hours.
- Again, fill the bottle completely with distilled water. Now determine the weight of the bottle with stopper and the contents (W3).
- Now empty the bottle and clean it thoroughly. Fill the bottle with only distilled water and weigh it let it be (W4).
- Repeat the same process for 2 to 3 times, to take the average reading of it.

IV. RESULT AND DISCUSSION

Table 1: Specific Gravity of Black Cotton Soil

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

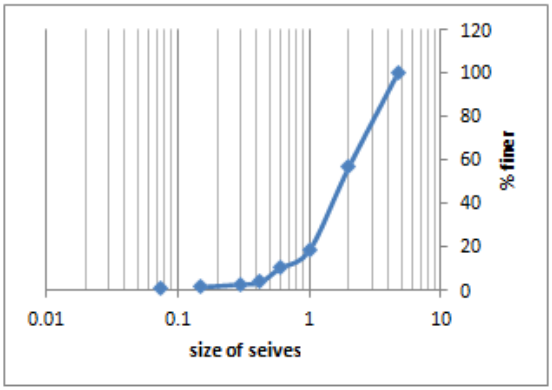

Figure 3: Particle Size Distribution of Black Cotton Soil

V. CONCLUSION

In the current study, different proportions of fly ash and coconut coir are combined with black cotton

soil, which is extremely compressible by nature. Fly ash and coconut fiber, in varying amounts, were used to partially replace the black cotton soil. The test results are examined to determine the best mix of various components for the soil's maximum bearing capability.

- Adding fly ash and coconut coir fiber (CCF) to black cotton soil enhances the soil's engineering qualities.
- As the percentage of fly ash and coconut coir fiber increases, the percentage of fly ash and coconut coir fiber that is finer decreases the liquid limit. Because both additions absorb more water, the liquid limit drops.

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