

A Experimental Study of Stabilization of Expansive Soil by using Fly Ash and Rice Husk Straw Ash

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Abstract— In India, Black cotton soil covers over one-fifth of the entire land area. These are mostly found in and around the Deccan plateau. Black cotton soil is an expansive soil which proves problematic for the engineering work. Black cotton soil has low bearing capacity, high compressibility and swelling and shrinkage properties. To overcome on these engineering problems soil stabilization is the best solution. In our research we used the concept of chemical stabilization. We used fly ash and rice husk straw ash in different proportion with black cotton soil. The present paper briefly describes the experimental investigation carried out by adding fly ash and rice husk straw ash to black cotton soil for improving its engineering properties.

I. INTRODUCTION

Soil is defined as sediments or other accumulation of mineral particles produced by the physical or chemical disintegration of rocks plus the air, water, organic matter and other substances that may be included. Soil is typically a non homogeneous, porous, earthen material whose engineering behavior is influenced by changes on moisture content and density. Black Cotton soil is clayey soil grayish to blackish in color.

Black cotton soil is an expansive soil which proves problematic for the engineering work. Black cotton soil has low bearing capacity, high compressibility and swelling and shrinkage properties. In India black cotton soil covers a large geographical area. In other hand india produces huge waste like fly ash from industries and rice husk straw ash from agriculture field. Black cotton soils are made of varying proportions of clay minerals Like Montomorillonite, kaolinite, chemicals like iron oxide, illite, organic matter like humes and calcium Carbonates. Montomorillonite has properties of swelling and shrinkage after addition or removal of water. These properties are creating problems like compaction, consolidation, cracks, etc. That's why it is necessary to stabilize the black cotton soil.

Soil stabilization is the process by which a admixing agent is added to natural soil deposit to improve the engineering properties of soils by mechanical or chemical means or both. Stabilization can be done by many ways like mechanical stabilization, chemical stabilization, cement stabilization, physical stabilization, etc. chemical stabilization is the process of stabilization by adding the admixture like cement, fly ash, baggass ash, groundnut shell, rice husk straw ash, etc. chemical stabilization is the cheap method of soil stabilization. Admixture like fly ash, baggass ash, rice husk ash has cementing and fibrous properties which are helpful in soil stabilization. By using chemical stabilization we can reduce the desposal problems of waste material.

II. Objectives of study

Present study has following objectives:

- To compare and find optimum percentage of stabilizer to be added in soil for stabilization of black cotton soil.
- To minimize the problem of waste disposal by using agricultural waste and industrial waste in soil stabilization.

- To evaluate the Engineering Properties of black cotton soil for different proportions.

III. Materials

1. Fly ash :-

Fly ash is a industrial waste produced by burning of pulverized coal in electric generation power plants. industries. Fly ash is in fine powder form. Fly ash is a pozzolan, a substance containing aluminous and siliceous materials. Material in fly ash like aluminous and siliceous are forms a cement when the required amount of water is added. Fly ash is environmentally friendly material. Fly ash is used for generation of bricks, tiles and hollow blocks.

2. Rice husk straw ash :-

Rice husk straw ash is a byproduct from rice mills. If 1000kg of rice paddy are milled then about 22% of rice husk (220kgs) is obtained and after burning this husk we will get about 25% of ash (55kgs). India is second largest country

3. Cement :-

Cement is binding material. Cement used is a Portland cement. Proportion of cement is 5% with respect to the soil.

IV. Black Cotton Soil

The expansive soils commonly known as black cotton soils. Black cotton soil covers Large areas in central and southern parts of India. These soils occupy nearly about 72 million hectares or about 20% of geographical area of our Country (India). These soils are found major amount in Deccan plateau region like.- Maharashtra, Gujarat, Andhra Pradesh, Western Madhya Pradesh, , Northern Karnataka and Tamil Nadu,...etc.

Black Cotton soils Typically behave different under different climatic conditions, and this create the construction of roads and buildings problematic, expensive, and difficult. Construction on black cotton soil suffers from early failures. Construction on Black cotton soil is very expansive and difficult which gives the problems to the engineering works.

Black cotton soil has swelling and shrinkage properties and due to this there is excessive variation in volume and stability with variation on water content. Black cotton soil has low bearing capacity, high compressibility, shrinkage and swelling properties.

V. Material proportion:-

Proportion made of soil with fly ash & rise husk ash in increasing order like 3%, 6%, 9% & 12% respective with

the weight of soil. Constant percentage of cement is 5% added in soil.

VI. Tests

1. **Atterberg Limit test** :- In this test the soil is sieved through the 425micron IS sieve. Take material which passed through the sieve and put in to oven for 2 hours before the test. Then conduct tests for varying proportion of fly ash and rice husk ash with soil. Atterberg test gives the plastic limit and liquid limits.
2. **Standard proctor test** :- Standard proctor test is conduct for calculating the moisture content and maximum dry density of soil. Perform test on soil only and take readings and then perform tests for various proportion of fly ash and rice husk ash with soil. And then compare results.
3. **Unconfined Compression Test:-** Specimen made of dimension of 50mm diameter and 100mm height. Various proportion of fly ash & rise husk ash added in soil & above mixed sample moulded in given mould. Above specimen tested on unconfined compression machine. Compare of soil sample, soil with fly ash & soil sample with rise husk ash.
4. **Differential swell test** :- Differential swell index findout by comparison of swelling between two measuring cylinders of containing water & kerosin respectively. 10grms of sample passing through 425 micron IS sieve & mixed sample of soil & fly ash, soil & rise husk ash for various proportion taken.

VII. Conclusion

- The soil admixed with FA, BA, RHA and RSA samples were cured up to 28 days before testing. Various tests like shrinkage limit, CBR and UCS were conducted. The following conclusions have been drawn from these laboratory tests.
- It is evident that the addition of fly ash increases the CBR value of the saturated soil. This is true irrespective of the strength of soil.
- It was observed that for soil with moisture content of 25% & 30%, the CBR value increases with the increasing fly ash till after which remains constant. Thus optimum fly ash content can be recommended as 6%.
- It was observed that maximum strength on unconfined compressive test obtained at 6% of fly

ash, rice husk ash. . Thus optimum fly ash, rice husk ash content can be recommended as 6%.

- Based on the present study, all stabilizers viz. FA and RHA attains its optimal strength. The results are based only on laboratory investigations and hence it is further recommended that the viability and long-term performance in field, of this material should be determined in actual highway construction projects.

VIII. Future Scope

- In rural village, the development of road network is of vital importance in socioeconomic development. It is very difficult to lay the pavement in the rural village having black cotton soil as subgrade strata.
- Fly ash & rice husk ash are industrial & agricultural wastes, optimum usage of this material in subgrade soil stabilization will bring down the construction cost of pavement. In this study an attempt is made to stabilize black cotton soil with addition of the fly ash & rice husk ash in varying proportions. The strength parameter like CBR , UCS, Standard Proctor tests are determined to know suitability of material.
- Soil treatment is used to make embankments, capping layer, base course of transportation structures like roads.
- Treatment for soil stabilization also increase performance in resting, in particular, mechanical & climatic stresses & increase the service life of structures.

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