

# "Experimental Investigation for Stabilization of Black Cotton Soil By using waste material - Brick Dust "

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**Abstract** - *With the increasing population and the reduction of available land, more and more construction of building and other civil engineering structures have to be carried out on weak or soft soil. Owing to such soil of poor shear strength and high swelling and shrinkage, a great diversity of ground improvement techniques such as soil stabilization employed to improve mechanical behavior of soil, thereby enhancing the reliability of construction. In this Study try to resolve the above problems by replacing the soil with stabilizing agents in different combination. The process includes study of water content, Atterberg's limit test, swelling index, UCS test. From the above mentioned test it has been observed great decrement in swelling shrinkage of soil. Brick is traditional or modular brick obtained from brick plant, the strength of bricks depends on nature of soil used for making and the method adopted for molding and burning of bricks. Brick dust is a waste material obtained in Brick manufacturing plant & its disposal is very important issue concerned with air pollution. This study emphasized the disposal of Brick dust with its effective use in Soil Stabilization.*

**Key Words:** *Soil Stabilization , Ground improvement technique, Brick dust , Waste Disposal, Black cotton soil*

## 1. INTRODUCTION

Soil stabilization means alteration of the soils properties to meet the specified engineering requirements. Methods for the stabilization are compaction and use of admixtures. Lime, Cement was commonly used as stabilizer for altering the properties of soils. From the recent studies it is observed that, solid waste materials such as Brick dust, are used for this intended purpose. Disposal of these waste materials is essential as these are causing hazardous effects on the environment. With the same intention literature review was undertaken on utilization of Brick dust same is presented here.

### 1.1 Necessity of soil stabilization

In Maharashtra and particularly Vidarbha region top layers comprises of black cotton soils deposits are observed everywhere which is basically a clayey soil comprises of montmo- rillonite clay mineral as its major constituent. These soils are black in color thus the name black cotton soil suggested, are found suitable for agricultural purposes but are problematic in nature to the civil engineering projects. Effect of volumetric changes in the form of swelling and shrinkage under the water influence pose numerous problems to the structures built on it such as cracks, undulations, uneven surfacing, settlement of different nature and magnitudes, etc. These soils is having less bearing capacity, less shearing resistance and are generally not suitable / ideal as a foundation soil for construction purposes.

To make black cotton soils suitable as a good substratum for construction usage improvement in existing properties are necessary. Recent studies shows Brick dust with the same intention author have undertaken review of utilization of these waste materials as stabilizer and same is presented here. This may found to be an economical treatment method for soils as these materials are available locally and such solution will definitely found beneficial for the developing countries like India where economy is the prime concern for adopting any new method or technique. Additionally, safe disposal mechanism can be suggested for the waste being generated which will help in reducing the hazardous effect on the environment of the region.

### 1.2 Brick Dust

Brick dust with its component burnt brick powder is a waste powder generated from the burning of bricks with the soil covered by surroundings. Due to burning of soil bricks it hardened and at the time of removal the set up we get the powder form of brick. it has red color and fine in nature. it has great ability to reduce the swelling potential of black cotton soil. Brick due to burning of soil bricks it hardened and at the time of removal the set up we get the powder form of brick. It has red color and fine in nature. it has great ability to reduce the swelling potential of black cotton soil.



Fig-1 : Brick Dust Material

## 2. METHODOLOGY & EXPERIMENTAL STUDY

There are two different methods of soil stabilization (i) Additive (ii) Mechanical. The additive stabilization of soil is done by adding material brick dust. This technique is used in this type of stabilization is based on,

- The materials taken for mixing with the soil
- Test conducted on it
- The comparison between previous basic soil & with additives

As we are making soil stable with the additives technique

Following are the combination which we have taken

- Combination of Black cotton soil+ brick dust. In this combination, black cotton soil is mixed by weight with brick dust on percentage basis i.e. 10%, 20%, and 30%.
- 4.75 mm IS sieving BCS 4.75 mm IS sieving brick dust used for the preparation of sample. There are Four samples for experimental test.
- (1) Plain black cotton soil (0%) ,(2) 10% brick dust + 90% black cotton soil (10%BD), (3) 20 % brick dust + 80 % black cotton soil (20%BD) , (4) 30 % brick dust + 70 % black cotton soil (30%BD).
- These Four samples considers for the experimental test for day1, day7 and day28 performance.

**Test performed :-**

- Moisture content (IS 2720-Part II 1973)
- Swelling index (IS 2720- Part 40- 1977)
- Unconfined compressive strength test(IS 2720- Part X 1991)



Fig -2 Determination of Unconfined Compressive

Strength

**Results :-**

**Table -1:** Moisture content(%) Test Results

MC	0%	10%BD	20%BD	30%BD
1DAY	36.36	32.35	30.05	27.84
7DAY	28.57	26.76	23.62	20.96
28DAY	11.11	10.56	9.49	8.17

**Table -2 :** Swelling Index Test Results

FSI	0%	10%BD	20%BD	30%BD
1DAY	37.18	35.00	32.05	29.00
7DAY	36.62	34.17	31.30	28.14
28DAY	34.19	32.65	28.81	23.98

**Table-3:** Unconfined compressive strength(kN/m<sup>2</sup>) test Test Results

UCS	0%	10%BD	20%BD	30%BD
1DAY	183.73	191.37	207.50	225.00
7DAY	207.19	217.38	236.46	266.15
28DAY	210.25	239.89	267.19	297.76

## 3. CONCLUSIONS

1. On the basis of experimental test results, it is observed that the moisture content (MC) reduces after 7 days and 28 days results respectively. MC of 30% BD is reduces to 26.46%. Hence replacement of brick dust is more effective.

2. Free swelling index of black cotton soil decreases brick dust up to certain limit. Free swelling decreases by with 29.86% by 30%with BCS replacement of brick dust. Hence replacement of brick dust is more effective.

3.Results obtained from UCS test, compressive strength carrying capacity of samples with partial replacement is increased up to 29.39% for 30%BD sample Hence replacement of brick dust is more effective.

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