ISSN 2348 – 8034
Impact Factor- 4.022

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

COMPARATIVE STUDY ON EFFECT OF BURNT BRICK DUST AND WOVEN GEOTEXTILE MATERIAL ON BLACK COTTON SOIL

Amulya Gudla[*1] & Nukaraju Bharathi[2]
[*1&2]Department of Civil Engineering Kakatiya Institute of Technology and Sciences
Warangal, India

ABSTRACT

The expansive soil is also known as Black Cotton Soil or clayey soil. Black Cotton soil occupies about 3% of the world land area. High percentage of Montmorillonite renders high degree of expansiveness. Expansive soils also shrink when they dry out. The fissures that are developed may sometimes extent to serve limit like ½" wide and 12"deep.Through these fissures help water to penetrate which shoots the soil again to shrink and swell. When the soil swells it exerts pressure on structure upon. So, this behavior of the soil results in structural damages especially in lightweight structures. In this project as Ground Improvement Technique burnt brick dust and a woven geo textile material is introduced to decrease the swell pressure in Black Cotton Soil. Tests are conducted on Black cotton soil, Black Cotton soil and 50% replacement of Brick dust and Black Cotton soil with placement of geo textile at a depth of H/2 from top. . A comparative study is also conducted among Swelling pressure, Permeability, Atterberg limits and consolidation properties of natural soil, Soil with 50% replacement of Brick dust and Placement of an woven geotextile at a height of H/2 from bottom of the sample

Keywords: Black Cotton soil; Brick dust; Shrink; Swell pressure; Woven geo textile

I. INTRODUCTION

Expansive soil is commonly known as black cotton soil because of their color and suitability for growing cotton. It starts swell or shrink excessively due to change in moisture content. When an engineering structure is associated with black cotton soil, it experiences either settlement or heave depending on the stress level and the soil swelling pressure. Black cotton soil contains high percentage of montmorillonite which renders high degree of expansiveness. The behavior of black cotton soil is uncertain when subjected to moisture content. One of the challenges faced by civil engineers is the design of foundation for sites for expansive Soils. Most economical and effective method for stabilizing expansive soils is using admixtures. Soil stabilization is a process to treat a soil to maintain, alter or improve the performance of soil. In this study, the potential of burnt brick dust as stabilizing additive to expansive soil is evaluated. This evaluation involves the determination of the swelling pressure, Atterberg's limits, Permeability and Consolidation on expansive soil in its natural state as well as when mixed with 50% OF BRICK DUST (**Sachin N. Bhavsar 2014**). An Woven geotextile is also introduced at a depth of H/2 from the top of the sample to evaluate the swelling pressure, Permeablity, Atterberg Limits and Consolidation properties. **Sachin N. Bhavsar , Hiral B. Joshi2014** studied on the effect of burnt brick dust on engineering properties of Expansive Soil. **Ingle et.al.** Studied and presented brief information on geosynthetics products and their standards. The study Concluded that the impact of geo synthetics material (in terms of reduction of the base course thickness) is up to 40% as Compared to unreinforced section**. Salma Tawfiq and Zalihe Nalbantoglu** studied the Swell-shrink behavior of expansive clays

II. EXPERIMENTAL STUDY

A. Materials Collected

Black Cotton soil is collected from Parkal region of Warangal

district. Burnt Brick dust is collected from local region of Warangal district. Woven Geotextile is collected from PHIGA INFRATECH Pvt Ltd, Kukatpally, Hyderabad-500085, and Telangana, India.

B. Properties of Black Cotton Soil

TESTS	VALUES
Liquid limit (%)	65
Plastic Limit (%)	26.39
Shrinkage limit (%)	12.24
Plasticity Index (%)	38.61
MDD (g/cc)	1.71
OMC (%)	18.08
DFS (%)	60
Specific gravity	2.5

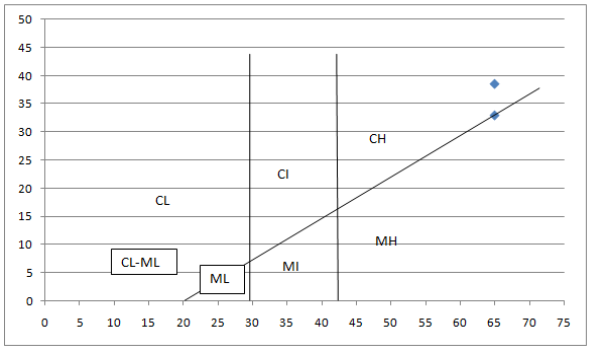

Fig 1: Plasticity Chat of Black Cotton Soil

C. Properties of Brick Dust

TESTS	VALUES
Grain size distribution	Well grade sand
Specific Gravity	2.26

III. PROPERTIES OF BLACK COTTON SOIL BY REPLACING IT WITH 30%, 40%, 50% and 60% BRICK DUST

A Comparative study is performed to find out the optimum percentage of brick dust, is to be mixed by replacing Black Cotton Soil. From the table mentioned below, 50% replacement of black cotton soil with brick dust acquired good result.

Table 1 Properties of different combinations of Black Cotton Soil and Brick Dust

TESTS	30%BD	40%BD	50% BD	60%BD
Liquid Limit (%)	44.2	43	**29.3**	47
Plastic Limit (%)	25	24.5	**11.43**	Non-plastic
Shrinkage limit (%)	9.4	7.8	**7.3**	45.25
Plasticity Index (%)	19.2	18.5	**17.83**	47
MDD (g/cc)	1.81	1.88	**1.94**	1.38
OMC (%)	15.55	14.3	**11.69**	6.6
DFS (%)	10	5	**0**	8.33

IV. PROPERTIES OF GEOTEXTILES

Woven geo textile is tested for the following properties

Table 2 Properties of Selected Woven Geotextile

Tests	VALUES
Thickness	0.636mm
Apparent opening size	0.18mm
Mass per unit area	0.02g/cm^2
Permeability	4.61x10^{-9}mm/sec

V. RESULTS AND DISCUSSIONS

The following tests are conducted to determine the effect engineering properties of Burnt brick dust ad geo synthetic material over Black cotton soil.

A. Swell pressure test

The swell pressure test is conducted over Black cotton soil, Black Cotton Soil with 50% replacement of brick dust and Black Cotton soil with placement of geotextile at a height of h/2 from the bottom and are compared for optimum value.

Table 3 Comparison of swell pressure test results

TESTS	BLACK COTTON SOIL	REPLACING WITH 50% BRICK DUST	PLACING WOVEN GEOTEXTILE WITH AT H/2
Swell pressure(N/mm^2)	255	120	105

B. Falling H ead Permeability Test

Three samples of Black Cotton soil, Black Cotton soil with 50% replacement of Brick dust and Black Cotton soil with woven Geotextile at h/2 from the bottom are subjected to permeability test. The following table indicates the comparison of the result of permeability test.

Table 4 Comparison of permeability test results

TESTS	BLACK COTTON SOIL	REPLACING WITH 50% BRICK DUST	PLACING WOVEN GEOTEXTILE WITH AT H/2
Falling head permeability(mm/sec)	1.31×10^{-5}	2.19×10^{-4}	7.06×10^{-3}

C. Modified Proctor Test

The compaction parameters namely Optimum Moisture Content and Maximum Dry Density are determined by performing Modified Proctor test over of Black Cotton soil, Black Cotton soil with 50% replacement of Brick dust and Black Cotton soil with woven Geotextile at height of h/2 from the bottom. The results are tabulated and compared with each case below.

Table 5 Comparison of Compaction parameters

TESTS	BLACK COTTON SOIL	REPLACING WITH 50% BRICK DUST	PLACING WOVEN GEOTEXTILE WITH AT H/2
Optimum Moisture content	14.8	11.69	10.2
Maximum Dry density	2.26	1.94	2.3

D. Shrinkage Limit

This Atterberg limit is performed to know the amount of water at which it reaches to constant volume upon change in water content. The following table shows the variations of Shrinkage limit for different combinations of black cotton soil.

Table 6 Comparison of shrinkage limit

TESTS	BLACK COTTON SOIL	REPLACING WITH 50% BRICK DUST	PLACING WOVEN GEOTEXTILE WITH AT H/2
Shrinkage limit	12.24	7.3	18.86

VI. CONCLUSIONS

- From the figure1 shown above, the soil sample collected (Black Cotton Soil) is a High Compressible Clay.
- From table 5 the swell pressure of black cotton soil is reduced 38% by replacing 50% brick dust and by placing woven geo textile at h/2 the swell pressure is reduced 13% compared to brick dust.

- From table 6 the falling head permeability of black cotton soil is increased 94% by replacing 50% brick dust and by placing woven geo textile at h/2 the falling head permeability is increased 96% compared to brick dust.
- From table 7 OMC of black cotton soil is reduced 21% by replacing 50% brick dust and by placing woven geo textile at h/2 the OMC is reduced 13% compared to brick dust.
- From table 8 MDD of black cotton soil is reduced 14% by replacing 50% brick dust and by placing woven geo textile at h/2 the MDD is reduced 15% compared to brick dust.
- The shrinkage limit of black cotton soil is reduced 40% by replacing 50% brick dust and by placing woven geo textile at h/2 the shrinkage limit is increased 61% compared to brick dust.
- From the above results it is stated that woven geo textile acquired good results compared to brick dust

REFERENCES

1. *Salma Tawfiq and Zalihe Nalbantoglu — Swell-shrink behavior of expansive clays‖ 2nd International Conference on New Developments in Soil Mechanics and Geotechnical Engineering, 28-30 May 2009*
2. *Sachin N. Bhavsar , Hiral B. Joshi , Priyanka k. Shrof, Ankit J. Patel -Effect of burnt brick dust on engineering properties on expansive soil. International Journal of Research in Engineering and Technology eISSN: 2319-1163 pISSN: 2321-7308.*
3. *G.S. Ingle and S.S. Bhosale, "Geo synthetic Reinforced Flexible Pavement: Gateway of the sustainable pavement", Indian Highways, vol.41 no. 6, pp. 6-15, 2013...*