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Stabilization of Black Cotton Soil using Lime and G.G.B.S (Ground Granulated Blast Furnace Slag) As A Admixtures

D. Srinadh, P. Praneeth, D.Manideep reddy, K.Shyam Chamberlin, N.Sandeep Kumar

Abstract: ***Soil Stabilization is one of the modern techniques for modification of soil which are using in our daily life in construction. Due to increase in population land is also getting scarce so we need to build in the available area. So this technique we use is called Soil stabilization or modification of soil. As we know that some of the soils are not useful for construction. As a result while constructing pavements like national highways (NH) we should definitely build the pavement on soils like black cotton soil by improving its strength because the original nature of the soil will have poor bearing capacity and less strength. So by adding admixtures from Industrial wastes such as Ground granulated blast furnace slag(GGBS) which is the waste of iron ore i.e., in powder form and Lime which will increase the bearing strength of the soil, So that it will also increase the pavement design over long period of time which is the ultimate goal for the design of the pavement or any other construction purpose. So by adding these admixture using the industrial waste which is available in a low cost so that we can easily improve the strength of the soil because of the availability of admixtures in economy. After adding the admixtures Soil should be tested by some basic tests of U.C.C (Unconfined Compressive Strength) and also California bearing test (CBR) and also some basic tests like MDD (Maximum Dry Density) & OMC (Optimum Moisture Content), Plasticity index and liquid limit etc.., should be carried out in order to test the improved strength of the soil.***

Keywords : Lime , GGBS, Black cotton soil, UCC,MDD&OMC & CBR Teat.

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***** Correspondence Author
D. Srinadh*, Undergraduate Students**,** Civil Engineering Department, KLEF, Vaddeswaram, Andhra Pradesh, India
P. Praneeth, Undergraduate Students**,** Civil Engineering Department, KLEF, Vaddeswaram, Andhra Pradesh, India
D.Manideep reddy, Undergraduate Students, Civil Engineering Department, KLEF, Vaddeswaram, Andhra Pradesh, India
K.Shyam Chamberlin, Assistant Professor, Department of Civil Engineering, KLEF, Vaddeswaram, Andhra Pradesh, India
N.Sandeep Kumar, Assistant Professor, Department of Civil Engineering, KLEF, Vaddeswaram, Andhra Pradesh, India

I. INTRODUCTION

Availability of black cotton soil: Black cotton soil is mostly available in state like ANDHRA PRADESH, TAMIL NADU and KERALA and developing cities like AMARAVATHI capital of Andhra Pradesh are covered with black cotton soil. According to INDIAN GEOTECHNIAL 20% of the land in India is covered with black cotton soil

PROBLEMS WITH BLACK COTTON SOIL

These black cotton soils contain more moisture and when it is exposed rainy water the swelling characteristics is more. There is a chance to collapse So this black cotton soil in not suitable for construction in civil engineering appliances.

OBJECTIVES- INCLUDES

1. To determine the properties of black cotton soil and admixtures like LIME and GGBS
2. To determine the plasticity ,compaction and swelling characteristics of black cotton soil-lime at various %of lime.
3. To determine the plasticity, compaction and swelling characteristics of black cotton soil-GGBS at various %of GGBS.

COMPONENTS OF STABILIZATION:

Till now we have dome some experiment on highly expanded soil (black cotton soil). This highly expanded soils are not used for any construction purpose in civil engineering appliances so we have done some research on soil stabilization to use that expand soil in construction purpose. By stabilizing the highly expanded soil we have add some admixtures like G.G.B.S and LIME it help the soil to stabilize and give a strength to the black cotton soil.

STABILIZING MATERIALS:

The stabilizing materials like
1. G.G.B.S (or) G.G.F.S
2. LIME

LIME:

It is a calcium and several inorganic mineral. These are used in many industries in large amount like cement industry, construction etc.,

G.G.B.S:

G.G.B.S means ground granulated blast furnace slag it is a waste product of industrial waste.

It is extracted when the iron ore is heated up more than 80 million tons of industrial waster is released every year . The G.G.B.S contain (30% - 50%) of CaO , (28% - 38%) of SiO2, (8% - 24%) OF Al2O and (1% - 18%) of MgO.

PROPERTIES:

Black cotton soil contain clay particles so it doesn't have the bearing capacity.

It depend upon the climatic conditions in rainy season the soil will more expanded and sticky nature so this soil in not suitable for construction purpose

PROPERTIES OF G.G.B.S AND LIME:

G.G.B.S (Ground Granulated Blast Furnace Slag) it is a by-product of pig iron. This G.G.B.S is used in concrete as a binding agent. It contain chemicals like CaO,SiO2,MgO etc., Lime is one of the construction material. Lime has two category i) non-hydraulic ii) hydraulic lime. The non hydraulic lime is float on the water and the hydraulic will settle down at the bottom surface of water. The burning temperature is 900 degrees and this process in nothing but calcinations.

This lime has i) building breathing property ii) comfortable environment iii) ecological benefits iv) good workability v) high durability vi) finishing of the building vii) self healing property

II. METHODOLOGY-

1. For the soil sample by adding percentages like 10%, 20%,30% of GGBS and 2% and 4% for lime for BC soil
2. Tests are conducted on soil sample to know the properties
3. By adding GGBS and lime in soil we can stabilize the black cotton soil

SWELLING INDEX:

Swelling index is also known as free swell index. It is a experimental to determine the swelling characteristics of the soil.

SHRINKAGE LIMIT:

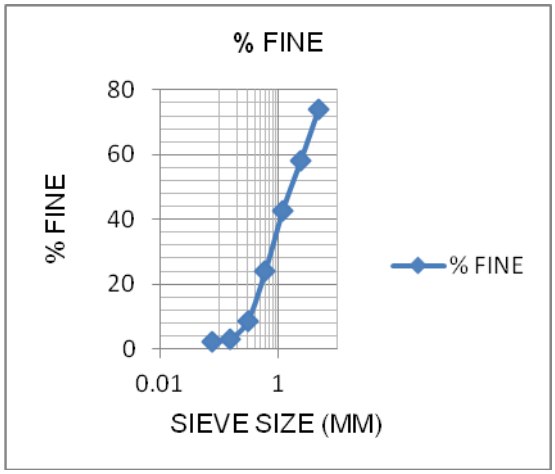
The ATTERBERG LIMIT is also known as SHRINKAGE LIMIT. It is nothing but the reducing the volume of the soil.

III. RESULTS AND DISCUSSION:

SIEVE ANALYSIS:

We have taken 920g of oven dried soil sample and placed in the set of sieves (4.75mm, 2.36mm, 1.18mm, 600 µ, 300 µ, 150 µ, 75, pan) and place it in a sieve shaker for 5min and taken the weight retained in each sieve

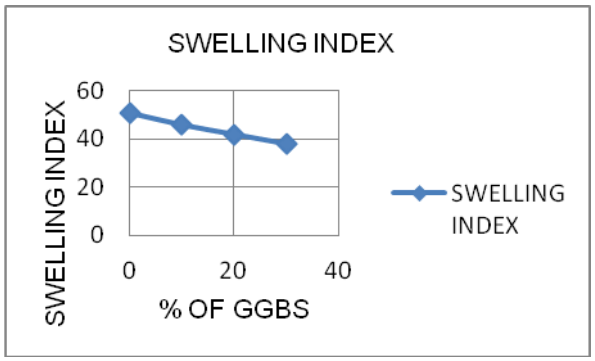
S.no	Sieve(mm)	Wt retained	% weight retained	Cum %	% fine
1	4.75	0.240	26.08	26.8	73.92
2	2.36	0.387	15.59	42.06	57.94
3	1.18	0.528	15.32	57.30	42.7
4	600	0.699	18.58	75.97	24.03
5	300	0.842	15.54	91.52	8.48
6	150	0.891	5.32	96.84	3.16
7	75	0.899	0.86	97.71	2.29
8	PAN	0.916	1.84	99.56	0.44



SWELLING INDEX

We have taken 10g of BC soil and added different percentage of GGBS (10%, 20%, 30%) and lime (2%, 4%)

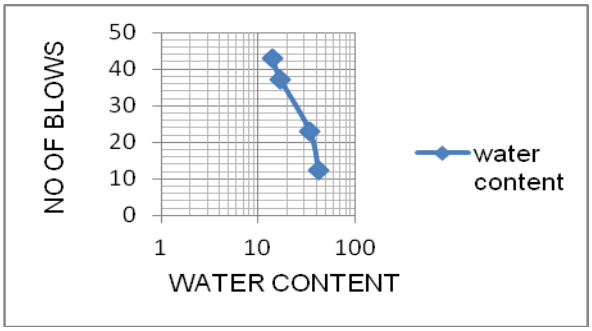
GGBS %	SWELLING INDEX	DEGREE OF EXPANSION
0% GGBS	51%	VERY HIGH
10%GGBS	46%	HIGH
20%GGBS	42%	HIGH
30%GGBS	38%	MODERATE



CASAGRANDE METHOD:

No of blows	**42**
Weight of cointainer (w0)	**17.3**
Wet soil(w1)	**39.2**
Dry soil(w2)	**36.8**
(w1-w2)	**2.4**
(w2-w0)	**19.5**
Water content	
result	**12.3**

NO OF BLOWS	WATER CONTENT
42	**12.3**
34	**23.1**
17	**37.2**
14	**43.1**

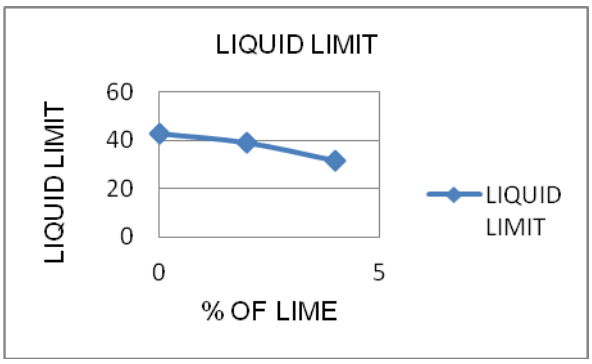


Plastic limit

Wt of cointainer	21.8
Wet soil(w1)	30.2
Dry soil(w2)	27.9
(w1-w2)	2.3
(w2-w0)	6.1
W1-w2/w2-w0*100	37.70

Wt of cointainer	17.3
Wet soil(w1)	30.2
Dry soil(w2)	27.6
(w1-w2)	2.6
(w2-w0)	10.3
W1-w2/w2-w0*100	25.2

Test speciman	Liquid limit	Plastic limit	Plasticity limit
Bc soil	43	32.2	10.9
10%GGBS	41	24.5	13.3
20%GGBS	39.4	26.0	15.4
30%GGBS	37.3	23.3	16.5



SNO	OBSERVATION AND CALCULATION	DETERMINATION
1	Empty maa (m1)	6.336
2	Mould+compacted soil	10.35
3	M=m2-m1	4.018
4	Inner diameter	152
5	Hight of the mould	127
6	Volume of mould	23.03
7	Bulk density	1.744
8	Cup number	123
9	Empty cup	130
10	Mass of empty cup	119
11	Water content%	8.4%
12	Dry density	1.60%

Bc soil +10% GGBS

Water content(%)	Dry density
13.4	1.53
14.1	1.62
15.3	1.58

Bc soil +20% GGBS

Water content	Dry density
13.7	1.61
14.3	1.68
16.2	1.66

Bc soil +30% ggbs

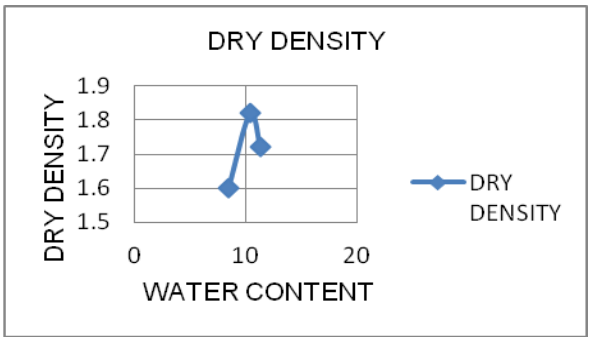
Water content	Dry density
14.2	1.68
15.6	1.77
16.9	1.73

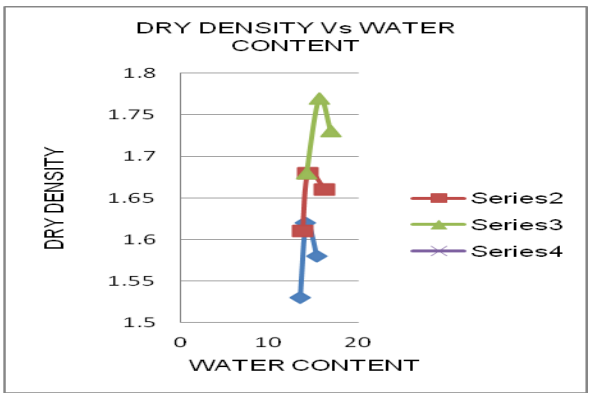
Bc soil +2% lime

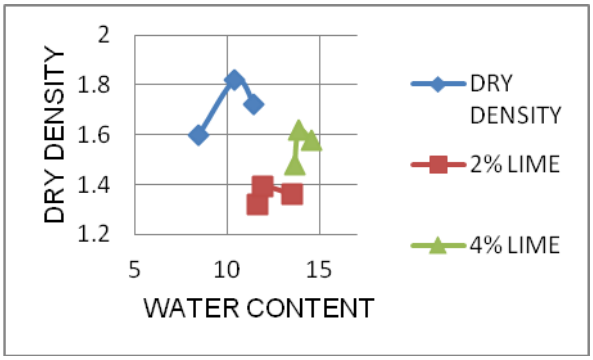
Water content	Dry density
11.6	1.32
11.9	1.39
13.5	1.36

Bc soil +4% lime

Water cotent	Dry density
13.6	1.48
13.8	1.62
14.5	1.58







IV. CONCLUSION:

These are the following conclusions of conducted experiment The results of the tests shows the OMC and MDD for GGBS and lime is individually mixed with B.C soil by using standard proctor test. It obtained that 14.2% water content and 1.68% dry density for 30% of GGBS and 4% lime for 13.6% water content and 1.48% dry density. In this study lime gives less dry density while compared with GGBS. From our study lime gives higher liquid limit and which is better for using GGBS than lime. From our study lime gives higher plastic limit and which is better for using GGBS than lime

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AUTHORS FROFILE

D.Srinadh, B.Tech in civil engineering Koneru lakshmah Education Foundation (Deemed to be University) ,green fields , vaddeswram ,AP .Research on gio technical engineering and his research is based on the stabilization of soil using admixtures

D.Manideep reddy, B.Tech in civil engineering Koneru lakshmaiah Education Foundation (Deemed to be University) ,green fields , vaddeswram ,AP .Research on gio technical engineering and his research is based on the stabilization of soil using admixtures

P.Praneeth, B.Tech in civil engineering Koneru lakshmah Education Foundation (Deemed to be University) ,green fields , vaddeswram ,AP .Research on gio technical engineering and his research is based on the stabilization of soil using admixtures

K. Shyam Chambrelin, Associate professor at Koneru Lakshmaiah Education Foundation (Deemed to be University) in civil engineering department completed B.Tech and Master of technology in geotechnical engineering at JNTU, Pursuing PhD at ANU Guntur, Lifetime Member of Indian geotechnical society and Indian Society for Technical Education. (ISTE) published 13 papers in journal SCOUPS, IJR. and researched in geosynthetic materials.