

An Experimental Study on Stabilization of Expansive Soils with Ground Granulated Blast Furnace Slag (GGBS)

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Abstract

In developing countries like India, due to the remarkable development in road infrastructure, Soil stabilization has become the major issue in construction activity. Stabilization is not only a method of altering or modifying of one or more soil properties to improve the engineering characteristics and performance of a soil, but also processing available materials for the production of low-cost design and construction. Expansive soils are known for their low plasticity and low shear strength. These soils present significant geotechnical and structural engineering challenges all over the world, with costs associated with expansive behavior estimated to run in to several billions annually. Expansive soils are the soils that experience significant volume change associated with changes in water content which means they are volumetrically unstable due to seasonal moisture variation. Their strength decreases and compressibility increases tremendously on wetting. By keeping the above problem in view, the cohesive natured clayey soil was chosen and checked for compaction properties along with other general soil characteristics by varying the content of ground granulated blast furnace slag, which is waste by-product released during the processing of iron and steel metals. From the present study, it deduced that there is a significant decrease in compressibility characteristics of the clay with the increase in ggbs content. Ultimately, the composite soil which is stabilized with ggbs content proves to be good construction material for complex civil engineering structures

such as embankment, earthen dams and runways. The usage of ggbs for soil stabilization is not only economical, but also beneficial to the environment by putting an industrial waste to good use.

Keywords: *Soil Stabilization, Expansive Soil, Ground Granulated Blast Furnace Slag (GGBS), Strength Properties.*

I. INTRODUCTION

1.1 General

A land based structure of any type is only as strong as its foundation. For that reason, soil is a critical element influencing the success of a construction project. Soil is either a part of the foundation or one of the raw materials used in the construction process. Therefore, understanding the engineering properties of soil is crucial to obtain strength and economic permanence. Most recently, soil stabilization has once again become a popular trend as global demand for raw materials, fuel and infrastructure has increased.

Soil stabilization is the process of maximizing the suitability of soil for a given construction purpose. Soil stabilizers can be used to treat the upper several inches of soil or aggregate surfaces of low-volume roads when the strength or other properties of the in-situ soil do not meet the desired or required levels for anticipated traffic.

Soil can be either modified or stabilized by many methods, including chemical, mechanical, thermal, and electrical.

Modification is generally short term and includes benefits such as improvement in workability (expediting construction and saving time and money). Stabilization generally results in a longer term strength gain. Since expansive soils have a tendency to change their volume to a large extent, they cause heavy distress to engineering constructions. The lightweight structures are severely affected due to high swelling pressure exerted by these soils. Such type of large scale distress, due to expansive shrinking nature of expansive soil, can be prevented by either obstructing the soil movement and reducing the swelling pressure of soil or making the structure sufficiently resistant to damage from soil movement. Although mechanical compaction, dewatering and earth reinforcement have been found to

improve the strength of the soils, other methods like stabilization using admixtures are more advantageous.

The different admixtures available are lime, cement, fly ash, blast furnace slag, etc. The present stabilization, now-a-days, is gaining more importance because of its abundant availability and environmental concerns related to its production.

1.2 Scope and Importance of the Study

The experimental study is concerned with the selection of approximate type of soil to achieve a very high degree of compaction and to expose the compaction properties of clay. The clayey soils are difficult to compact in the initial stage of compaction, but as the moisture content increases the compaction becomes quite easy. The results of the study can provide thoughts for applying clay soil in various applications of soil stabilization process.

The study involves the usage of Ground granulated Blast Furnace Slag (GGBS) for the stabilization of clay soil, which is well mixed in different proportions as 5%, 10%, 15%, 20% and 25%. From the mixture, the effectiveness of the stabilizer will be

determined by conducting CBR, Unconfined Compression and Proctor Tests.

Soils that can be found every day in construction area have different characteristics and gives major effects to the construction. The soils that are not safe for construction should be treated to achieve the specification. An appropriate treatment method for the soil should be selected by considering the type, cost and duration of the construction. The usage of GGBS as stabilizer is an increasing significant approach to treat the problematic soils.

2. LITERATURE REVIEW

2.1 Brief History

The necessity of improving the engineering properties of soil has been considered as old as construction has existed. Many of the ancient Chinese, Romans and Incas buildings and road ways which exist till today utilized different techniques of soil stabilization. The use of lime as a building material dates back 5,000 years when lime and clay were mixed and compacted to form bricks used in the construction of the pyramids of Shensi in Tibet. About 2,000 years ago the Romans used lime to improve the quality of their roads. The

Romans also made mixtures of lime and volcanic ash called "pozzolana" in which the principles of today's cement can be seen. John Smeaton built the Eddy stone lighthouse in 1756 using a mixture of blue lime and pozzolanic clay without being aware that he had discovered the basic principle of cement manufacture. This enabled Joseph Aspdin to patent the process, which he called "Portland cement" in 1824.

The modern era of soil stabilization began in the United States during 1960's and 1970's when shortages of aggregates and petroleum resources forced engineers to consider alternatives of road construction instead of soil replacement. Since 1930, tests have been carried out in the United States with lime stabilization but success was achieved only ten years thereafter. The use of cement stabilization is over 65 years old with methods and materials proven and well established. Non-traditional stabilization products have been in development since the 1960's with many research papers and projects written on the subject. However, despite the multitude of information available the acceptance of these stabilization products is to be proven through time.

2.2 Significance of Soil Stabilization In The Indian Context

In India, expansive soils are occupying nearly 23% of the total area is considered as a problematic soil which is available up to a depth of 3.7 meters on an average. The soil has various problems like less stability, less shear strength and large expansion & shrinkage in volume with changing seasons. These demerits obstruct construction like big infrastructure, road pavements, etc. on this soil. Innovative methods of soil stabilization are in great demand all over the world. There is growing concern over the cost of transporting large quantities of good soil from distant borrow areas for the construction of embankments and sub grades for roads. There is another concern regarding disposal of industrial wastes to avoid environmental problems.

There are several industrial wastes which are being produced in millions of tons as unwanted by-products in the manufacturing industries & thermal power plants every year in India as well as all over the world. Most of these wastes are left unutilized and are posing environmental hazard by polluting the soil, water and air. Some of these wastes like fly ash & blast furnace

slag have pozzolanic properties and are being used in the construction industry along with cement or lime as activators.

Very few researchers have done some work in the stabilization of clayey soils using blast furnace slag. In this study, experimental investigations are carried out to study the beneficial effects of stabilizing clay soil using ground granulated blast furnace slag mixed in different proportions.

2.3 Objectives of the Study

The basic objectives of our present study are as follows:

- Improving the bearing capacity of the soil on addition of GGBS.
- Variation of Strength of the soil at different water contents.
- Effect of GGBS on CBR value of the soil.

- Effect of GGBS on Compressive Strength of the soil.

3. MATERIALS

3.1 Blast Furnace Slag

It is non-metallic by-product derived from producing iron in a blast furnace. It mainly consists of silicates and alumina -silicates of calcium. Blast furnace slag have a long history of being utilized as industrial by-products, going back almost 100 years in the United States. BFS is composed of the non-metallic components removed from iron ore during processing in a blast furnace. It consists essentially of silicates and alumina-silicates of calcium and other bases. BFS have unique physical and chemical properties that make them particularly well suited to a variety of uses in construction and civil engineering projects.

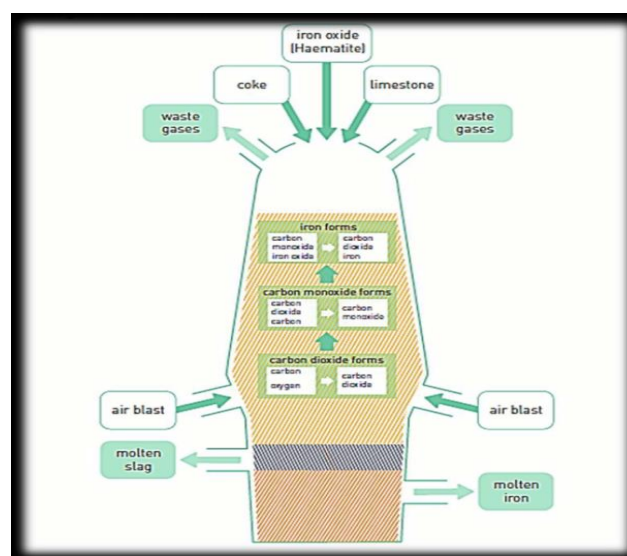


Figure-1: Flow Chart showing the formation of GGBS slag during the manufacturing process of Iron

3.2 Types of Blast Furnace Slags

The physical properties of slag can vary greatly depending on the processing done after the slag is removed from the furnace. Depending on cooling system adopted, slags are of three types, namely –

1) Air-cooled Slag

Hot slag after leaving the blast furnace may be slowly cooled in open air, resulting into crystallized slag which can be crushed and used as aggregate.

2) Granulated (Merit 5000) or Pelletized Slag

Sudden cooling with water or air of hot slag may result into formation of vitrified slag. The granulated blast furnace slag or Merit 5000 (commonly known in Sweden) is a result of use of water during quenching process, while, the

use of air in the process of quenching may result into formation of pelletized slag.

3) Expanded slag

Under certain conditions, steam produced during cooling of hot slag may give rise to expanded slag.

4) Light Weight Slag

Controlled cooling of a slag as a thin layer in a pit, followed by crushing and screening.

GGBS which is procured from Vizag Steel Plant has been used for our present work. It is obtained by quenching molten iron slag from a blast furnace. It is a granular product. It is dried and ground into a fine powder before it is used for the experimental studies.

3.3 Properties of GGBS

The physical and chemical properties of GGBS are shown below (see Table 1 & 2).

Table-1: Physical Properties of GGBS

Property/Parameter	Value
Colour	Grey
Size (mm)	0.003
pH Value	8.4
Atterberg's Limit	26 Non -Plastic

a) Liquid Limit (%)	
b) Plastic Limit (%)	
Specific Gravity	2.81
Compaction Characteristics	
a)Max. Dry Density (g/cc)	1.38
b)Optimum Moisture Content [OMC] (%)	20

Table-2: Chemical Properties of GGBS

Constituent	Percentage (%)
SiO ₂	4.0
MO	3.6
CaO	39.2
Al ₂ O ₃	13.5
Fe ₂ O ₃	1.8
S ₂ O ₃	1.7
MnO	0.2

3.4 ENVIRONMENTAL BENEFITS

An independent nationally renowned chemical laboratory and risk assessment team has conducted a human and ecological risk assessment of BFS. The risk assessment scientists analyzed samples from a representative cross-section of the slag industry in accordance with the EPA's risk assessment guidelines. The results of this study reinforced that BFS conforms to the EPA's stringent requirements and does not pose a threat to human or plant life. As in most applications, when

materials are used in environmentally sensitive areas they should be tested to assess environmental impact. It should be noted that BFS and SFS have a long history of environmentally safe application, and that the use of slag has very positive environmental benefits. The use of slag in cement manufacturing significantly decreases carbon dioxide emissions, and reduces the energy needed to Calcite limestone. The use of slag as aggregate reduces the need for virgin materials and the energy use and emissions produced

during the mining, processing and transportation of those materials.

4. EXPERIMENTAL STUDY

4.1 Sample Collection

For this study, the soil sample was obtained from in-situ soil and the stabilizer – ground granulated blast furnace slag (GGBS) was obtained from Vizag Steel Plant, Visakhapatnam.



Figure-2: Soil Sample



Figure-3: GGBS Sample

4.2 Mixing Ratios

Following steps are carried out while mixing the slag to the soil:

- 1) All the soil samples are compacted at their respective maximum dry density (MDD) and optimum moisture content (OMC), corresponding to the standard proctor compaction tests.
- 2) Content of ggbs in the soil is herein decided by the following equation.

$$\rho f = \frac{Wf}{W}$$

Where, ρf = Ratio of slag

Wf = Weight of the slag

W = Weight of the air-dried soil



Figure-4: Mixing of soil and GGBS Sample

The values adopted in the present study for the percentage of slag are 0%, 5%, 10%, 15%, 20% and 25% and are as follows:

- A) 0% GGBS + 100% SOIL
- B) 5% GGBS + 95 % SOIL

- C) 10% GGBS + 90% SOIL
- D) 15% GGBS + 85% SOIL
- E) 20% GGBS + 80% SOIL
- F) 25% GGBS + 75% SOIL
- G) 25% GGBS + 75% SOIL

3) In the preparation of samples, if the slag is not used then, the air-dried soil was mixed with an amount of water that depends on the OMC of the soil.

4) If the slag was used, the adopted content of mixed into the air-dried soil in small increments by hand, ggbs was first mixed into the air-dried soil in small increments by hand, making sure that the slag gets mixed uniformly, so that a fairly homogenous mixture is obtained, and then the required water was added.

5.0 RESULTS AND DISCUSSION

5.1 Specific Gravity

Table-3: Specific Gravity of the Soil

Sample Number	1	2	3
Mass of Empty Bottle, M1(gm)	658	658	658
Mass of Bottle + Dry Soil, M2(gm)	1379	1375	138
Mass of Bottle + Dry Soil + Water, M3(gm)	1928	1929	1926
Mass of Bottle + Water, M4(gm)	1500	1500	1500
Specific Gravity	2.46	2.48	2.43
Average Specific Gravity	2.46		

5.1.1 Liquid Limit

Table-4: Liquid Limit of the Soil

Test No.	1	2	3
No. of blows	14	23	26
Mass of Can with lid (g)	36	36	36
Mass of can with lid + Wet Soil (g)	55	45	55
Mass of can with lid + Dry Soil (g)	50	43	51
Mass of Water (g)	5	2	4
Mass of Dry Soil (g)	4	7	15
Moisture Content (%)	35.7	28.5	26.6

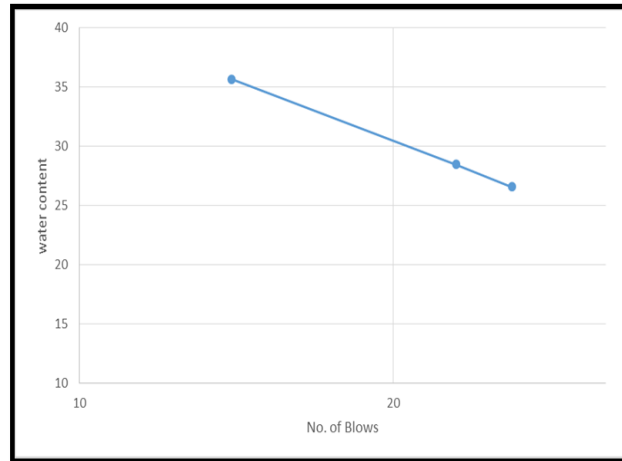


Figure-5: Liquid Limit Graph

Liquid Limit corresponding to 25 blows = 27.1 %.

Table-5: Plastic Limit of the Soil

Test No.	1	2	3
Mass of Can with lid (g)	36	36	36
Mass of can with lid + Wet Soil (g)	44	46	47
Mass of can with lid + Dry Soil (g)	43	44	46
Mass of Water (g)	1	2	1
Mass of Dry Soil (g)	7	8	10
Moisture Content (%)	14.2	25	10
Average Plastic Limit (%)	16.4		

5.1.3 Plastic Limit

$$I_p = WL - WP = 27.1 - 16.4 = 10.7 \%$$

As per ISCS, the soil sample comes under “CL: Lean Clay”.

5.2 Particle Size Distribution

Table-6: Sieve Analysis of the Soil

Sieve Size (mm)	Mass of Sieve (g)	Mass of Sieve + Soil (g)	Soil Retained (g)	Percent Retained (%)	Cumulative Percent Retained (%)	Percent Finer (%)
4.75	392	392	0	0	0	100
2.00	418	490	72	7.2	7.2	92.8
1.00	389	440	51	5.1	12.3	87.7
600 μ	377	400	23	2.3	14.6	85.4
425 μ	402	449	47	4.7	19.3	80.7

300 μ	355	453	98	9.8	29.1	70.9
150 μ	371	518	147	14.7	43.8	56.2
75 μ	312	577	265	26.5	70.3	29.7
Pan	422	719	297	29.7	100	0

Mass of soil sample taken = 1 Kg.

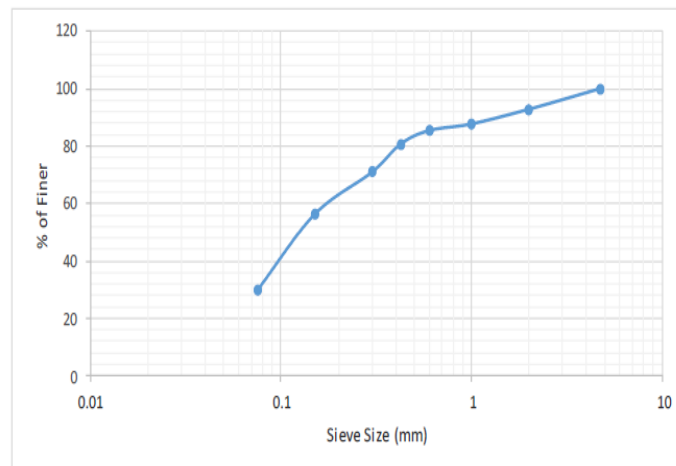


Figure-6: Sieve Analysis Graph

From the Graph –

% of Gravel = 0

% of Sand = 7.2

% of Silt = 63.1

% of Clay = 29.7

5.3 STANDARD PROCTOR TEST

a) For normal soil

Mass of Soil Sample taken = 2.5 Kg.

Table-7: Standard Proctor Test for the Soil

Content	% Of Water				
	5%	10 %	15%	20%	25%
Empty Wt. of Mould, a (g)	7500	7500	7500	7500	7500
Wt. of Mould + Compacted Soil, b (g)	9998	10060	10210	10310	10287
Wt. of Compacted Soil, b-a (g)	2498	2560	2710	2810	2787
Wt. of Cup, W1 (g)	36	36	36	36	36
Wt. of Cup + Wet Soil, W2 (g)	43	44	54	52	51

Wt. of Cup + Dry Soil, W3 (g)	42	43	51	49	48
Wt. of Soil, W3-W1 (g)	6	7	15	13	12
Mass of Water, W2-W3 (g)	1	1	3	3	3
Water Content, $W = \frac{w2-w1}{w3-w1} \times 100$	16.7	14.3	20	23	25
Bulk Density, $\gamma = \frac{b-a}{V}$ (g/cc)	1.82	1.86	1.97	2.00	2.03
Dry Density, $\gamma = \frac{\gamma}{1+W}$	1.57	1.63	1.64	1.66	1.62

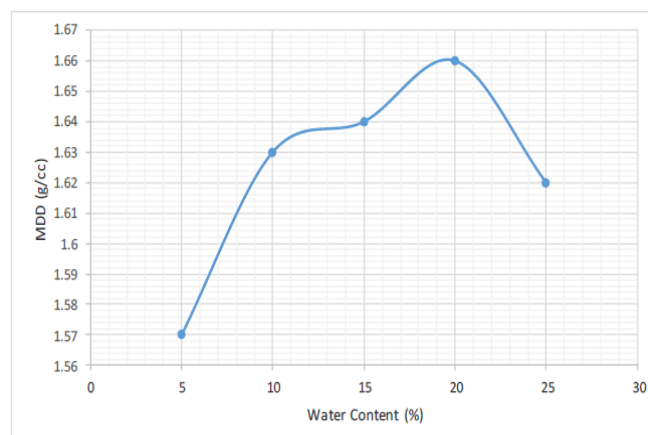


Figure-18: Proctor Test for Normal Soil

From the Graph –

- Optimum Moisture Content = 20%
- Maximum Dry Density = 1.66 g/cc

C) 5% GGBS

Table-13: Standard Proctor Test for soil with 5% GGBS

Content	% Of Water				
	5%	10 %	15%	20%	25%
Empty Wt. of Mould, a (g)	7500	7500	7500	7500	7500
Wt. of Mould + Compacted Soil, b (g)	10013	10081	10251	10356	10301
Wt. of Compacted Soil, b-a (g)	2513	2581	2751	2856	2801
Wt. of Cup, W1 (g)	36	36	36	36	36
Wt. of Cup + Wet Soil, W2 (g)	43	64	56	58	51
Wt. of Cup + Dry Soil, W3 (g)	42	61	53	51	48
Wt. of Soil, W3-W1 (g)	6	25	17	15	12
Mass of Water, W2-W3 (g)	1	3	3	4	3
Water Content, $W = \frac{w2-w1}{w3-w1} \times 100$	16.7	12	17.6	26.7	25

Bulk Density, $\gamma = \frac{b-a}{V}$ (g/cc)	1.83	1.88	2.00	2.1	2.04
Dry Density, $\gamma = \frac{\gamma}{1+W}$	1.58	1.67	1.70	1.72	1.63

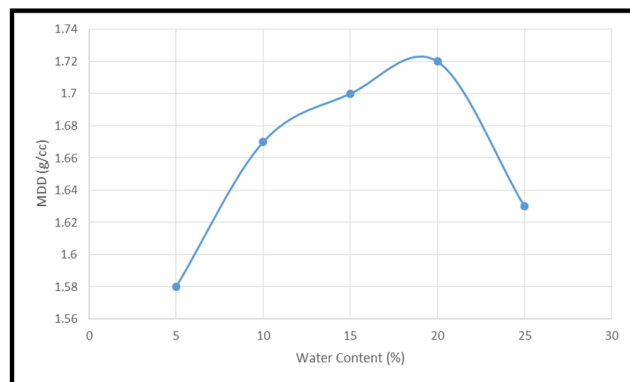


Figure-19: Proctor Test for Soil with 5% GGBS

From the Graph –

- Optimum Moisture Content = 19%
- Maximum Dry Density = 1.72 g/cc

c) 20% GGBS

Table-16: Standard Proctor Test for soil with 20% GGBS

Content	% Of Water				
	5%	10 %	15%	20%	25%
Empty Wt. of Mould, a (g)	7500	7500	7500	7500	7500
Wt. of Mould + Compacted Soil, b (g)	10013	10110	10349	10437	10340
Wt. of Compacted Soil, b-a (g)	2513	2610	10349	2937	2840
Wt. of Cup, W1 (g)	36	36	2849	36	36
Wt. of Cup + Wet Soil, W2 (g)	43	52	57	35	59
Wt. of Cup + Dry Soil, W3 (g)	42	50	53	52	55
Wt. of Soil, W3-W1 (g)	6	14	17	16	19
Mass of Water, W2-W3 (g)	1	2	4	3	4
Water Content, $W = \frac{w_2-w_1}{w_3-w_1} \times 100$	16.7	14.2	23.5	19	21
Bulk Density, $\gamma = \frac{\gamma}{1+W}$ (g/cc)	1.83	1.76	1.93	2.02	2.07
Dry Density, $\gamma = \frac{\gamma}{1+W}$	1.58	1.66	1.68	1.79	1.71

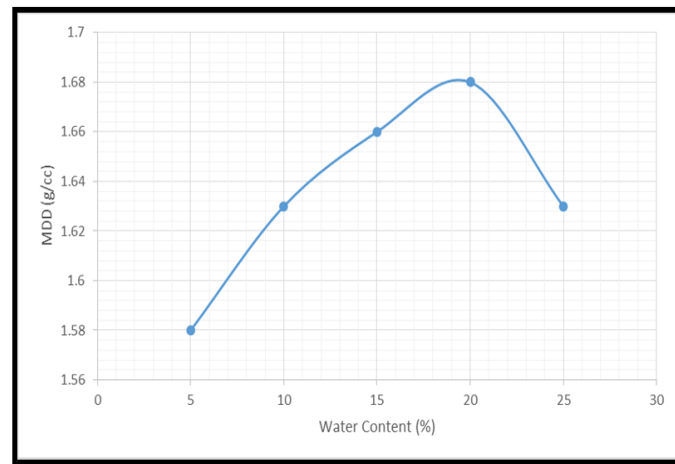


Figure-22: Proctor Test for Soil with 20% GGBS

From the Graph –

- Optimum Moisture Content = 20%
- Maximum Dry Density = 1.79 g/cc

f) 25% GGBS

Table-17: Standard Proctor Test for soil with 25% GGBS

Content	% of Water				
	5%	10 %	15%	20%	25%
Empty Wt. of Mould, a (g)	7500	7500	7500	7500	7500
Wt. of Mould + Compacted Soil, b (g)	10013	10010	10232	10375	10301
Wt. of Compacted Soil, b-a (g)	2513	2510	2732	2875	2801
Wt. of Cup, W1 (g)	36	36	36	36	36
Wt. of Cup + Wet Soil, W2 (g)	43	64	48	46	51
Wt. of Cup + Dry Soil, W3 (g)	42	61	46	44	48
Wt. of Soil, W3-W1 (g)	6	25	10	8	12
Mass of Water, W2-W3 (g)	1	3	2	2	3
Water Content, $W = \frac{w_2 - w_1}{w_3 - w_1} \times 100$	16.7	12	20	25	25
Bulk Density, $\gamma = \frac{\gamma}{1+W}$ (g/cc)	1.83	1.83	1.99	2.10	2.04
Dry Density, $\gamma = \frac{\gamma}{1+W}$	1.58	1.63	1.66	1.68	1.63

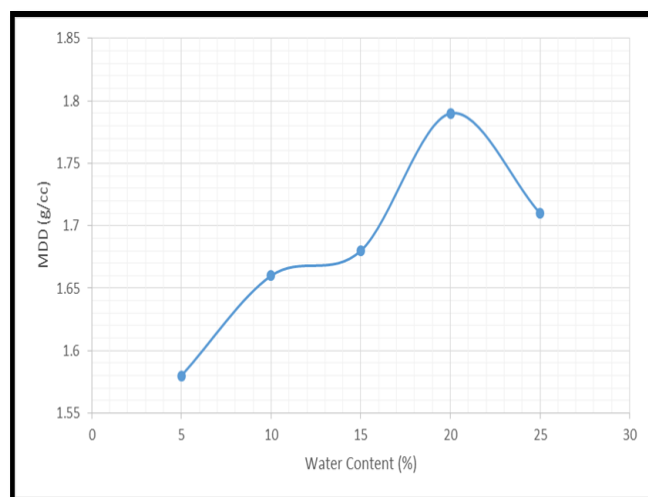


Figure-23: Proctor Test for Soil with 25% GGBS

From the Graph –

- Optimum Moisture Content = 20%
- Maximum Dry Density = 1.79 g/cc

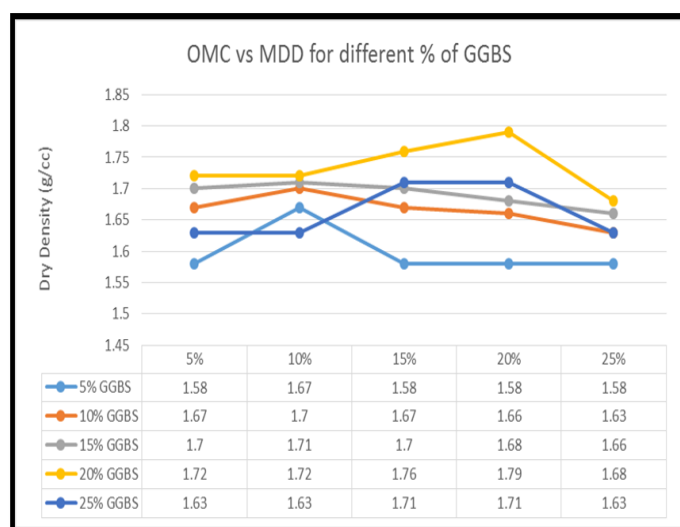


Figure-24: OMC vs. MDD for different % of GGBS

5.4 CBR Test

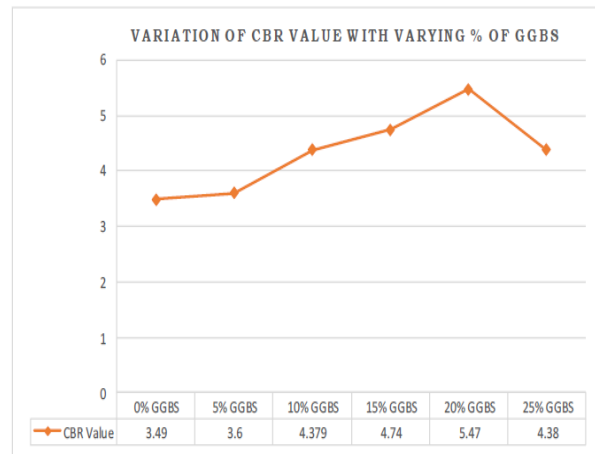


Figure-25: Variation of CBR Value with varying % of GGBS

5.5 UNCONFINED COMPRESSION TEST

g) For Normal Soil

Corrected Area = 14.22 mm²

Table-18: UCS for Normal Soil

Dial Gauge Reading	Strain	Proving Dial Reading	Stress (MPa)
0.5	0.0033	35	0.0207
1.0	0.0067	62	0.0349
1.5	0.0100	79	0.0462
2.0	0.0133	91	0.053
2.5	0.0167	98	0.0567
3.0	0.0200	93	0.0536
3.5	0.0233	85	0.0487

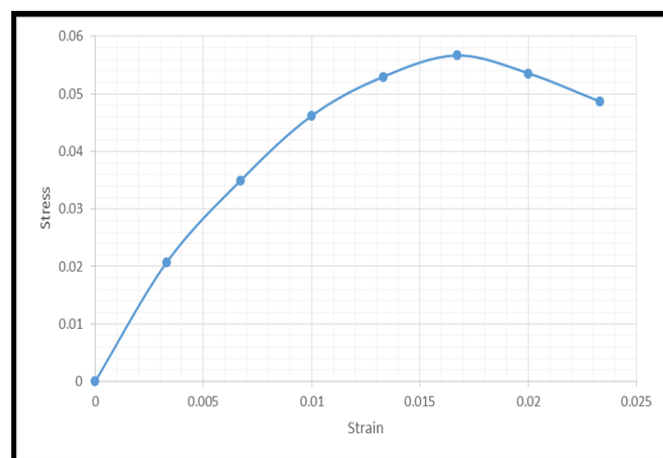


Figure-26: UCS Test for Normal Soil

As obtained from graph –

➤ UCS = 0.0562 MPa

h) 5% GGBS

Corrected Area = 13.79 mm²

Table-19: UCS for soil with 5% GGBS

Dial Gauge Reading	Strain	Proving Dial Reading	Stress (MPa)
0.5	0.0033	48	0.0284
1.0	0.0067	65	0.0382
1.5	0.0100	93	0.0544
2.0	0.0133	102	0.0594
2.5	0.0167	109	0.0631
3.0	0.0200	105	0.0605
3.5	0.0233	96	0.0551

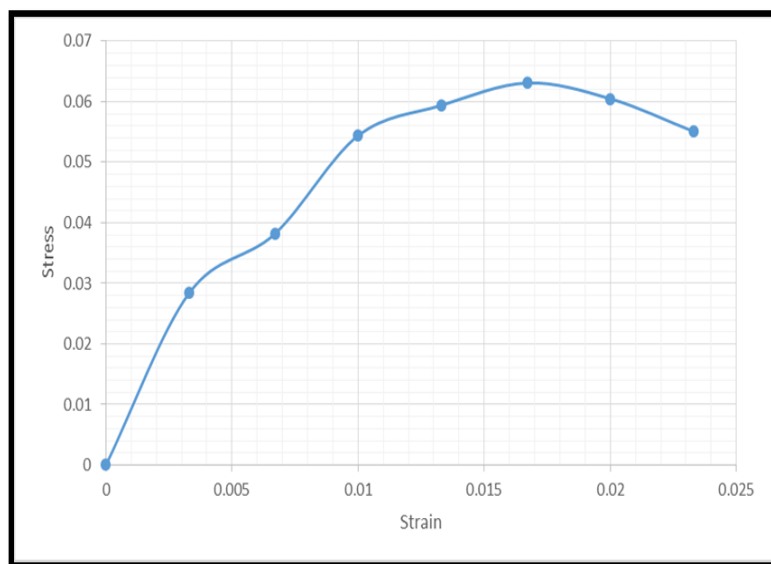


Figure-27: UCS Test for soil with 5% GGBS

As obtained from graph –

UCS = 0.0631 MPa

I) 10% GGBS

Corrected Area = 10.43 cm²

Table-20: UCS for soil with 10% GGBS

Dial Gauge Reading	Strain	Proving Dial Reading	Stress (MPa)
0.5	0.0033	47	0.0277
1.0	0.0067	71	0.0417
1.5	0.0100	94	0.0550
2.0	0.0133	105	0.0612
2.5	0.0167	110	0.0639
3.0	0.0200	103	0.0593
3.5	0.0233	92	0.0527

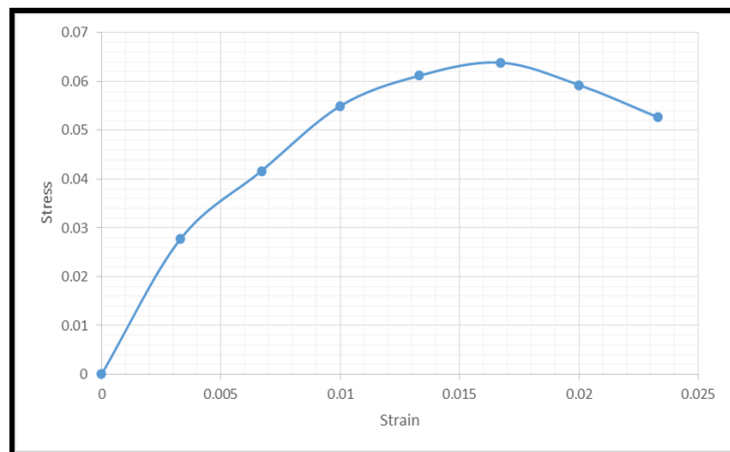


Figure-28: UCS Test for soil with 10% GGBS

As obtained from graph –

UCS = 0.0637 MPa

J) 15% GGBS

Corrected Area = 12.2 cm²

Table-21: UCS for soil with 15% GGBS

Dial Gauge Reading	Strain	Proving Dial Reading	Stress (MPa)
0.5	0.0033	51	0.0302
1.0	0.0067	69	0.0406
1.5	0.0100	94	0.0550
2.0	0.0133	105	0.0612
2.5	0.0167	111	0.0643
3.0	0.0200	106	0.0611
3.5	0.0233	93	0.0533

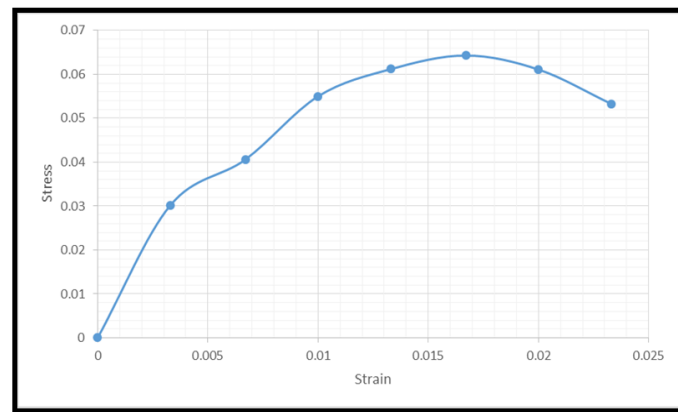


Figure-29: UCS Test for soil with 15% GGBS

As obtained from graph –

UCS = 0.0643 MPa

k) 20% GGBS

Corrected Area = 10.8 cm²

Table-22: UCS for soil with 20% GGBS

Dial Gauge Reading	Strain	Proving Dial Reading	Stress (MPa)
0.5	0.0033	69	0.0408
1.0	0.0067	108	0.0635
1.5	0.0100	145	0.0849
2.0	0.0133	158	0.0919
2.5	0.0167	166	0.0961
3.0	0.0200	161	0.0927
3.5	0.0233	152	0.0871

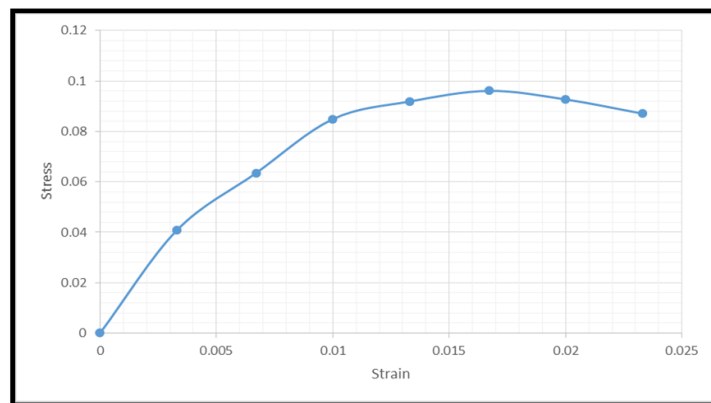


Figure-30: UCS Test for soil with 20% GGBS

As obtained from graph –

UCS = 0.0965 MPa

L) 25% GGBS

Corrected Area = 12.81 cm²

Table-23: UCS for soil with 25% GGBS

Dial Gauge Reading	Strain	Proving Dial Reading	Stress (MPa)
0.5	0.0033	65	0.0372
1.0	0.0067	105	0.0617
1.5	0.0100	130	0.076
2.0	0.0133	154	0.0897
2.5	0.0167	162	0.0938
3.0	0.0200	155	0.0893
3.5	0.0233	142	0.0814

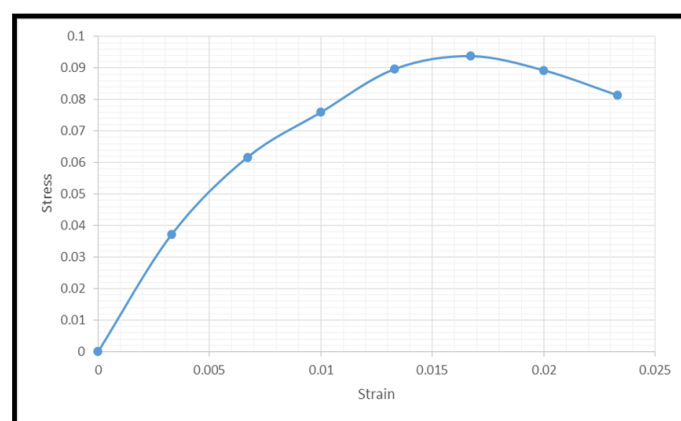


Figure-31: UCS Test for soil with 25% GGBS

As obtained from graph –

UCS = 0.0938 MPa

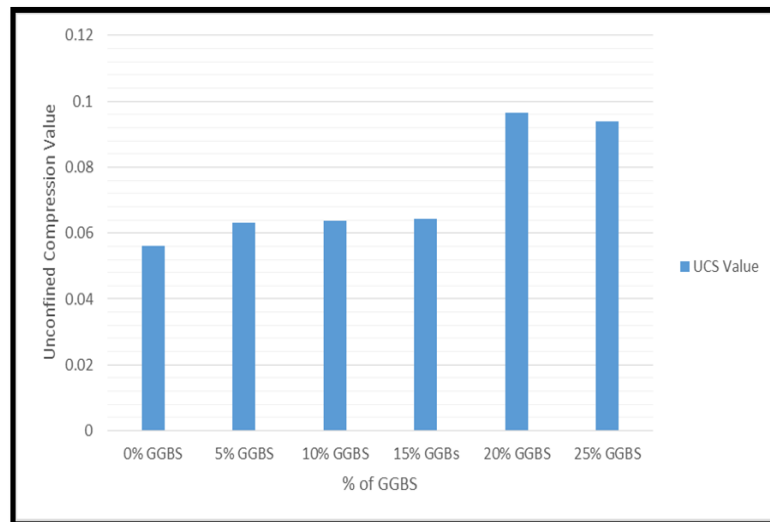


Figure-32: Variation of UCS Value with varying % of GGBS

CONCLUSIONS

On the basis of present experimental study, the following conclusions are drawn:

- It is observed that with the increase in water content, the dry density also increases up to 10% moisture content and with further increase in water content the dry density decreases gradually.
- The increase of the maximum dry unit weight with the increase of the percentage of GGBS is mainly due to the higher specific gravity of the fine GGBS compared with expansive soil and the immediate formation of cemented products by

hydration which increases the density of soil.

- It can also be observed that the optimum moisture content was decreased with further increase in GGBS content.
- The lowest dry density was observed to be about 1.58 g/cc for 95% soil and 5% GGBS mixture and highest dry density was about 1.79g/cc. for 80% soil and 20% GGBS mixture.
- It can also be observed that the CBR Value of the soil was increased gradually up to 20% GGBS content

and gets decreased with further increase in GGBS content.

- On comparing the results from UCS test of the soil sample, it is found that the values of unconfined compressive strength shows a net increment of 41.7% from 0.0562 MPa to 0.0965 MPa (illustrated in figure- 5.14).
- Overall it can be concluded that reinforced soil can be considered to be good ground improvement technique especially in engineering projects on expansive soils.

SCOPE FOR FUTURE RESEARCH

As the construction projects are increasing rapidly in infrastructural sector the tests on soils become vital. All soils are not having identical properties hence tests plays important role. Hence stabilization of soils having much important criteria before deciding the bearing capacity of soils. There are much methods for soil stabilization are available. But the best method opted should be such that it do not cause any environmental disturbances also prevent the problem of waste disposal. The study give guidance for future researchers to encounter the eco problems and disposal of solid wastes.

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