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Impact of Granulated Blast Furnace Slag on Index Properties of Expansive Soil

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ABSTRACT

Black cotton soil is an expansive soil. These are prone to large volume changes as the water content keeps on changing. Black cotton soil has low bearing capacity and high shrinkage and swelling property. These soils content the mineral montmorillonite. The expansive soil is feeble and has to improve for the construction projects. To stabilize the soil by using waste material can enhance the index properties of an unstable soil .By maintaining the proportion waste ingredient waste for an economic replacement of lavish additives such as chemical additives, using Granulated Blast Furnace Slag (GBFS) can be valuable. Granulated Blast Furnace Slag (GBFS) contain Cao (30-50 %), SiO2 (28-38%), Al203 (8-24%) and Mg0 (1-18%) which are acceptable for the advancement of an expansive soil. Tests are conducted for the index properties to increase the properties of soil.

Keywords: Ground Granulated Blast Furnance Slag (GGBS), montmorillonite, index properties, soil Property, Waste utilization

I. INTRODUCTION

In this quaternary time, growing population has been a great problem for making resources available.Due to which cities or town are expanding their areas where the land comprises low soil quality. Construction work cannot be carried out in such type of land. Therefore it becomes necessary to to improve the quality of soil. As per civil engineering aspect, method to improve soil is termed as **STABILISATION**. In technical terms, the process of improving soil properties by various methods with a view that the improved soil can sustain the load of whole structure is **SOIL STABILISATION**. Stabilization can be further classified into two categories i.e. Chemical and Mechanical stabilization. Now a days our society is focusing on eco friendly materials so that to reuse the waste material .therefore aim of this project is to stabilize the soil by using waste material that is Ground Granulated Blast Furnance Slag (GGBS).GGBS is obtained by cooling molten iron slag from a blast furnance in water or steam, to manufacture a granular product that is then dried and ground into a fine powder.

II. GROUND GRANULATED BLAST FURNANCE SLAG (GGBS)

Ground Granulated Blast Furnace Slag (GGBS) is a waste product from the blast furnaces used to make iron. These functions at a temperature of about 1500 degrees centigrade and are discontented with a carefully controlled mixture of iron ore, coke and limestone.

As a result iron ore is reduced to iron and the remaining materials from a slag that floats on top of the iron. This slag is tapped off at a regular interval as a molten liquid and if it is to be used for the manufacture of GGBS it has to be rapidly cooled in large volumes of water. The cooling optimizes the cementitious properties and produces granules similar to coarse sand. This "granulated" slag is then dried and ground to a fine powder

III. CHEMICAL COMPOSITION

CHEMICAL NAME	COMPOSITION
1.Calcium Oxide (Cao)	(30-50%),
2.Silicon Dioxide (SiO_2)	(28-38%),
3.Aluminium oxide (Al_2O3)	(8-24%),
4.Magnessium oxide(MgO)	(1-18%).

IV. OBJECTIVE OF THE PROJECT

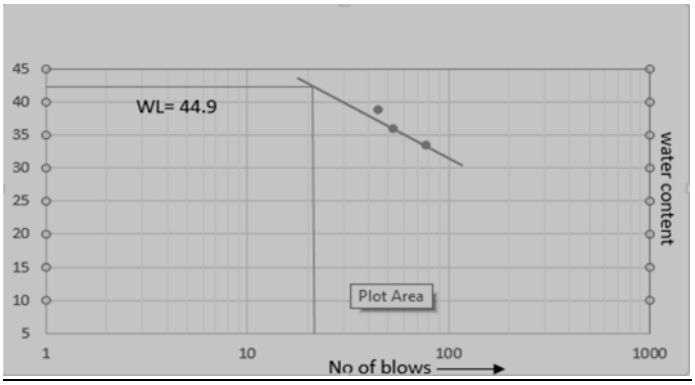
A. To determine the engineering behavior and geotechnical properties of soil with Ground Granulated Blast Furnace Slag (GGBS)
B. To increase the index properties of soil
C. To reuse the waste material Ground Granulated Blast Furnace Slag (GGBS).

V. METHODOLOGY

The methodology carried out to achieve the objective of this Project is imparted as follows. Various experiments have to be done to determine index properties of soil. And the changes after addition of additives are also resolved.

VI. RESULTS OF UNTREATED SOIL

Sr. No	Experiment Names	Results
1	Water content of soil	40%
2	Specific gravity of soil	2.1
3	Dry density of soil	15.23
4	Liquid Limit of soil	44.9%
5	Plastic Limit of soil	14.51%
6	Plasticity Index	30.39%



Graph 1. of Liquid Limit of soil

PI = 30.39 > 17

THEREFORE IT IS CONCLUDED THAT:

1. Soil is highly plastic, highly cohesive soil.
2. Soil is not good for construction as well as foundation material.
3. Strength of soil has to be increased.
4. Ground Granulated Blast Furnace Slag (GGBS) was added with soil at proportion of 5%, 10% and 15% and the results are detailed below:

VII. V.RESULTS OF CONSISTENCY LIMITS FOR TREATED SOIL

RATIO OF ADDITIVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICIY INDEX
5%	44	19.84	24.16
10%	40.9	27.7	13.2
15%	37.3	31.74	5.56

VIII. CONCLUSION

A. Original soil was highly plastic, highly cohesive therefore additive Ground Granulated Blast Furnace Slag (GGBS) was added to soil.
B. By adding Ground Granulated Blast Furnace Slag (GGBS) GGBS the value of plasticity index of treated soil get reduced than the value of plasticity index of original soil, hence soil is modified.
C. Index properties of soil increased.
D. Modified soil can be used for construction as well as foundation material.

IX. REFERENCES

[1]. Increase bearing capacity of soil by using plastic (soft drinks) bottles by lama saini, abhishek gupta, imtiyaz ali. (2016)
[2]. Strength development of soft soil stabilized with waste paper sludge by V. Surya Teja Sindhuja, G Sai Krishna. (2016)
[3]. Soil stabilization by using different traditional and non traditional additives by Abhinav Rawat, Anupam Mital (April 2015).
[4]. Study of soil cement stabilization for pavement base course and sub grade by Bsit Riyaz, Muneeb Hital, Mujtaba Mir, Muneeb Bshir (2015).
[5]. Abu siddique and Bipradas rajbongshi, ""Mechanical properties of a cement stabilized coastal soil for use in road construction", Journal of civil engineering The institution of Engineers" Vol. CE
[6]. Anil Misra, Debabrata Biswas and Sushant Upadhyaya (13 December 2004), "Physio-mechanical behavior of self-cementing class C flyash-clay mixtures,"
[7]. Akshaya kumar sabat, radhikesh p. nanda (2011), "effect of marble dust on strength and durability of rice husk ash stabilized expansive soil" international journal of civil and structural engineering volume 1,
[8]. Dr. Robert M. Brooks (2009)," Soil stabilization with flyash and rice husk ash", International Journal of Research and Reviews in Applied Sciences, Volume 1, Issue 3.
[9]. Kumara G.H.A.J.J. and Tani K. (2011), "Use of improved clay by paper sludge ash in slope stability of
[10]. dredged river embankments", annual research journal of SLSAJ vol.