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Study on Soil Stabilization by Using Fly Ash and Ground Granulated Blast Furnace Slag (GGBS)

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Abstract: ***Soil stabilization has become the more issue in construction activity. In this study we focus on improvement of soil by using Fly ash and ground granulated blast furnace slag (GGBS). In many villages there was demolition of houses due to flood situation and landslide so stabilization of soil is very important factor in this area.***

In these studies we use local Fly ash and Ground granulated blast furnace slag (GGBS) for stabilization of soil. Soil are generally stabilized to increase their strength and durability or to prevent soil erosion. The properties of soil vary a great deal at different places or in certain cases even at one place the success of soil stabilization depends on soil testing. Various methods are there to stabilize soil and the method should be verified in the lab with the soil material before applying it on the field. The various percentages of Fly ash and GGBS were mixed with soil sample to conduct soil test. Using fly ash reduces the plasticity index which has potential impact on engineering properties also GGBS has cementations property which acts as binding material for the soil. On addition of 15% Fly ash and 5% GGBS increase the strength of soil (according to IS2720:1985) it's recommended for better result.

Keywords: Stabilization of soil, Fly ash, GGBS, Black cotton soil, Soil test.

I. INTRODUCTION

Soil stabilization is defined as chemical or physical treatments which increase or maintain the stability of soil or improve its engineering properties. Soil stabilization is a procedure where in the engineering properties of the soil are altered and enhanced to increase its stability for construction purpose. Soils are generally stabilized to increase their strength and durability or to prevent soil erosion. The properties of soil vary a great deal at different places or in certain cases even at one place the success of soil stabilization depends on soil testing.

Now for soil stabilization we are use Fly ash and GGBS because shear strength and bearing capacity of soil can be increased.

Table 1: Tests

SrNo	Property	As per IS
1	Specific gravity	2.60 – 2.68
2	Liquid limit	60 - 85
3	Plastic limit	20 - 35
4	Maximum dry density	1.96g\cc
5	Optimum moisture content	12.5%
6	Free swell index	25 -50%

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II. PREVIOUS RESEARCH WORK

A. Stabilization Of Expansive Soil Using Fly Ash

In this nearly 51.8 million hector of land area in India covered with expansive soil. One of the most important aspects in construction is soil stabilization. In the present study, using fly ash obtained from sea sterlite, Jharsuguda, stabilization of black cotton soil obtain from Nagpur is attempted. With various proportions i.e. 10%, 20%, 30%, 40% & 50%, expansive soil is stabilized in that fly ash possess no plastic property.

B. Stabilization Of Soft Soil With Granulated Blast Furnace Slag And Fly Ash

This paper evacuates the potential of GBS with fly ash to stabilize a soft soil. This soil is classified as CI-MI as per ISCS. Different amount of GBS i.e. 3%, 6%, 9% with different amount of fly ash i.e. 3%,6%,9%,12% were used to stabilized the soil. The performance of GBS with fly ash modified soils was evaluating using compaction and CBR test.

C. Stabilization Of Black Cotton Soil Using Ground Granulated Blast Furnace Slag And Plastic Fibres

Plastic fibers are waste product from industries so GGBS and ppf are used. The aim of this research is to know the consequence of GGBS and PPF. From this outcome it was observed that maximum percentage of GGBS and PPF are 15% and 1% respectively when compared with all other combination tried in this investigation.

D. Stabilization Of Soft Soil Using Ggbs And Lime Pengawala Mohil1

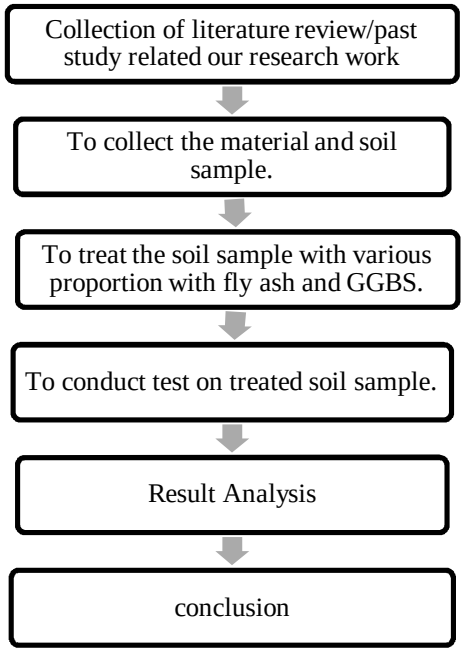
The present study aims for use of modified bitumen by using waste polyethylene terephthalate for road construction. Using this to improve the property of the bitumen and it can easily economically available and can be used. For India there in variation in temperature as well as load con vary so it can be more durable.

E. Comparative Study On Stabilization Of Soil With Ggbs And Fly Ash

In this present study different amount of fly ash and GGBS are added respectively i.e. 5,10,15, and 20% by dry weight of soil are used to study stabilization of soil. This can be evaluating by performing physical test on soil. From this test it was found that optimum value of fly ash is 15%band GGBS is 20% for stabilization of given soil based on CBR value determined.

III. METHODOLOGY

In this project, the following methods are to be used as,



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Table 2: Mix proportions

% of Fly Ash	% of GGBS	Liquid limit (%)	Plastic limit (%)	Plasticity Index (%)
5%	2.5	40	32.1	7.9
	5	41	30.54	10.46
	7.5	55	38.46	16.54
	10	40	30.2	9.8
10%	2.5	38.7	45.11	6.41
	5	52.1	33.23	18.87
	7.5	47.5	39.19	8.31
	10	40	53.33	13.33
15%	2.5	30	29.54	0.47
	5	27.5	25.51	1.99
	7.5	44	43.22	0.78
	10	60	52.1	7.9

IV. RESULT AND DISCUSSION

A. *Atterbergs Limits*

1) *Liquid Limits:* It is defined as minimum water content at which is in liuid state and has a small shearing. Take about 120 gm. of air-dried soil from thoroughly mixed portion of material passing 425 micron I.S sieve is to be obtained. Distilled water is mixed to the soil thus obtained in a mixing disc to form uniform paste. A portion of the paste is placed in the cup of Liquid Limit device and spread into portion with few strokes of spatula. Determine water content also determine the liquid limit corresponding to 25 blows. The number of blows required to cause the groove close for about 1 cm shall be recorded.

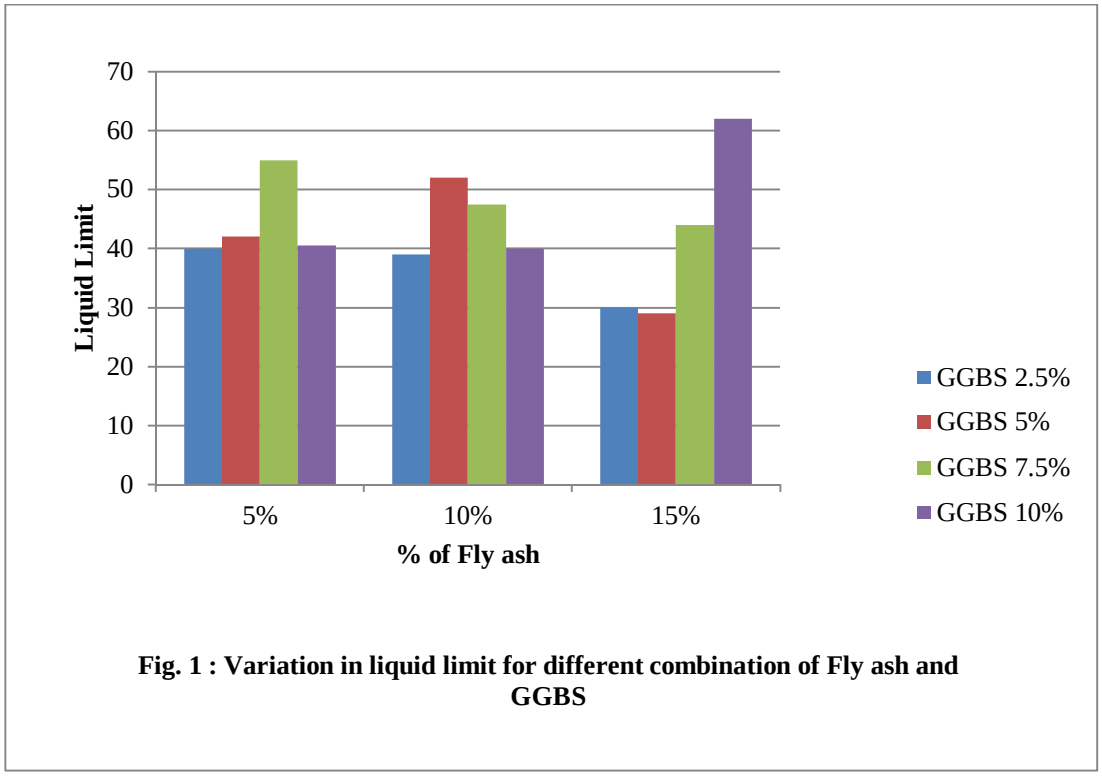


Fig. 1 : Variation in liquid limit for different combination of Fly ash and GGBS

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2) *Plastic Limit Test:* It is defined as the water content of soil which is in between plastic and semi-solid state of consistency of soil. Take about 20gm of thoroughly mixed portion of the material passing through 425micron IS sieve. Mix it thoroughly with distilled water in the evaporating dish till the soil mass becomes plastic enough to be easily molded with fingers. Take about 10gms of this plastic soil mass and roll it between fingers and glass plate with just sufficient pressure to roll the mass into a threaded of uniform diameter throughout its length. Continue rolling till you get a threaded of 3 mm diameter. Collect the pieces of the crumbled thread in air tight container for moisture content determination. Repeat the test to at least 3 times and take the average of the results calculated to the nearest whole number

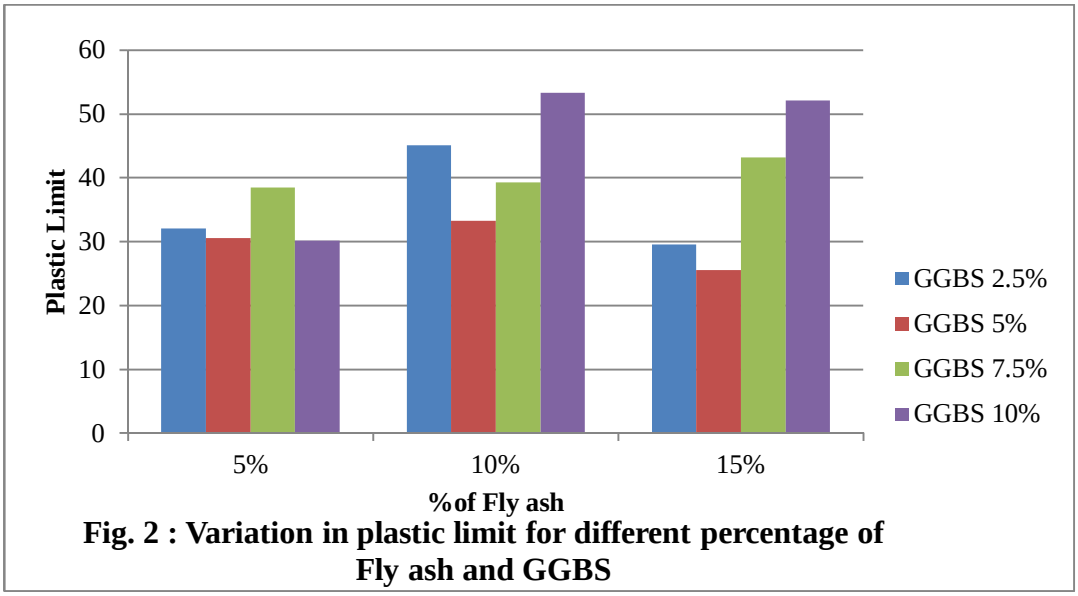


Fig. 2 : Variation in plastic limit for different percentage of Fly ash and GGBS

3) *Standard Proctor Test:* This method covers the determination of the relationship between the moisture content and density of soils compacted in a mold of a given size with a 2.5 kg rammer dropped from a height of 30 cm. Take a representative oven-dried sample, approximately 5 kg in the given pan. Weigh the proctor mould without base plate and collar. Fix the collar and base plate. The 8% of water is added to the soil and it was mixed thoroughly to ensure the uniform distribution of moisture. Place the soil in the Proctor mould and compact it in 3 layers giving 25 blows per layer with the 2.5 kg rammer falling through. Add water in sufficient amounts to increase the moisture content of the soil sample by one or two percentage points and repeat the above procedure for each increment of water added. Continue this series of determination until there is either a decrease or no change in the wet unit weight of the compacted soil.

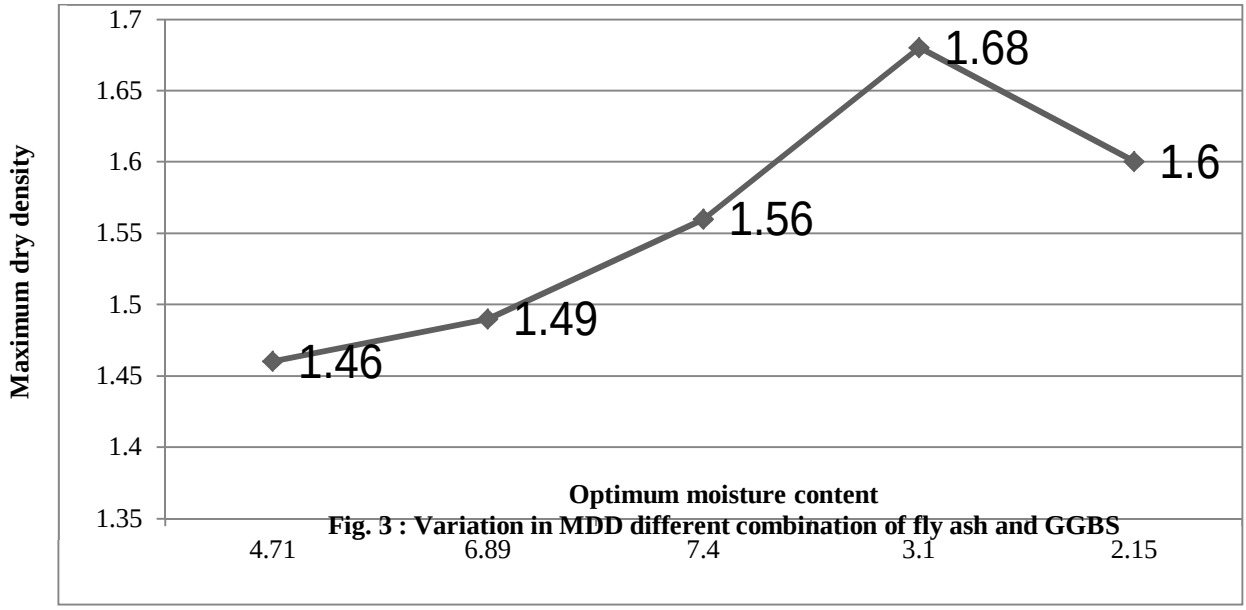


Fig. 3 : Variation in MDD different combination of fly ash and GGBS

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V. CONCLUSION

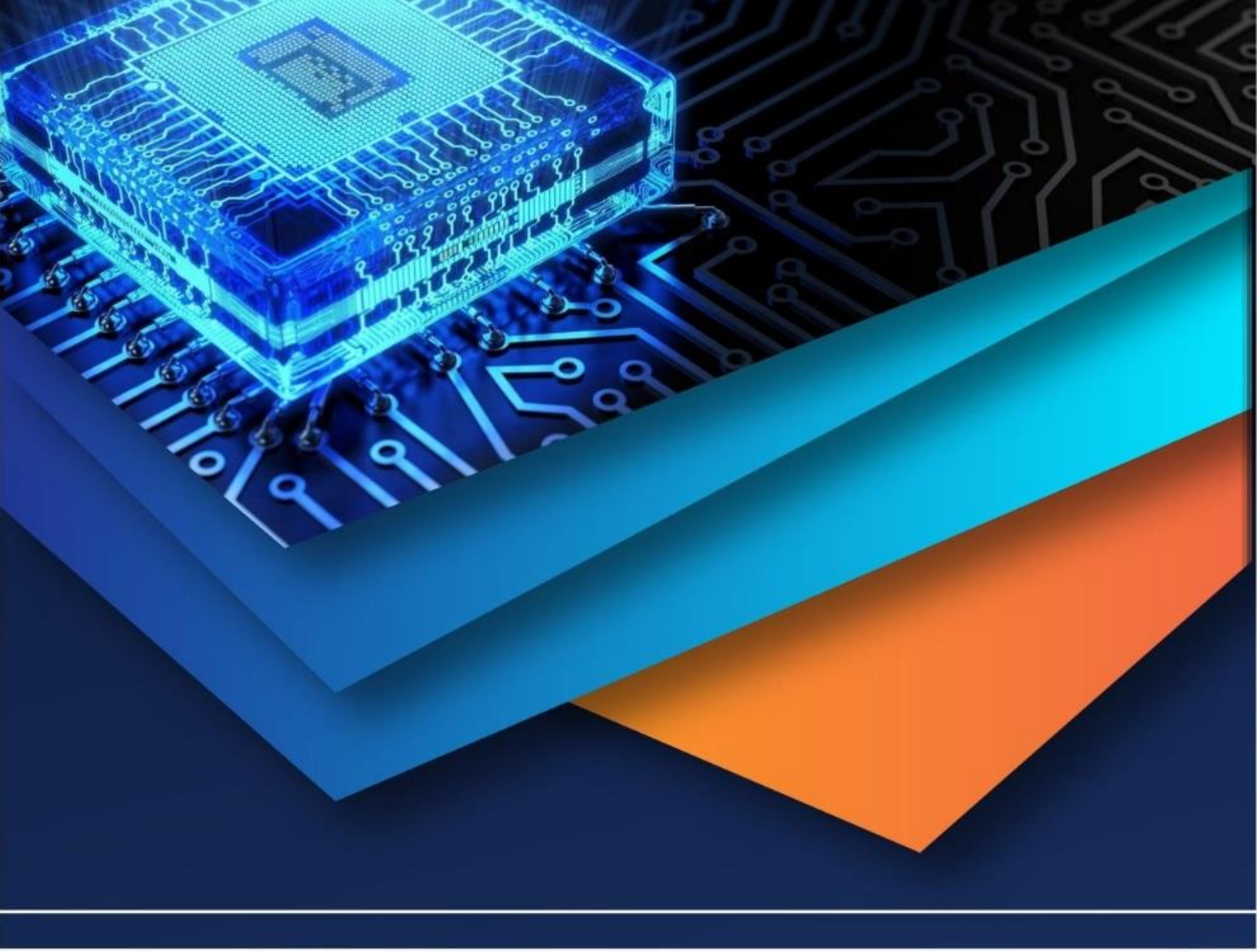
Based upon the result of experiment investigation the following conclusions are drawn.

A. The optimum dose of combination of fly ash and GGBS for stabilizing soil is found to be 15% fly ash and 5%GGBS.
B. Liquid limit of black cotton soil is decrease with addition of 15%fly ash and 5%GGBS.
C. With the addition of fly ash and GGBS MDD increase and OMC start decreasing.
D. It is concluded that use of 15% fly ash and 5%GGBS by weight of soil is recommended for better result.

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