

IMPROVEMENT OF SOIL PROPERTIES USING ZYCOBOND+TERRASIL WITH GGBS

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Abstract- In today's day soil stabilisation is the major problem for civil engineers, either for construction of road and also for increasing the strength or stability of soil and reduces the construction cost. Ground granulated blast furnace slag (GGBS) material is used in the current work to stabilise soil (clay). The main objectives of this research were to investigate the effect of GGBS on the engineering property (optimum moisture content and maximum dry density, plastic limit, liquid limit, compaction, and California bearing ratio test) of the soil and determine the engineering properties of the stabilised. Granulated shaped blast furnace slag is most suitable for increasing the strength of the soil and for this we check the following property of soil. GGBS, ZYCOBOND, TERRASIL are added from 0% to 15% by dry weight of soil, first of all check the all soil property at 0 % (no GGBS, ZB, TS) and then compare after addition of GGBS, ZB, TS from 5% to 15%.

Index terms- GGBS, Soil, Terrasil, Zycobond, stabilization

I.INTRODUCTION

GENERAL: Good qualities of sub grade soils are preferable for durable road but not always available for highway construction. The highway engineer designing a road pavement may be faced by weak or unsuitable sub grade. In this case the following methods to overcome this problem can be considered. First improve in-situ materials by normal compaction methods and design for the modified properties. Second, import the suitable materials from the nearest convenient source and replace the site materials. Third, improve the properties of the existing materials by incorporating some other materials; this process is known as "soil stabilisation".

SOIL STABILISATION: Soil stabilisation in its general meaning considers every physical and chemical method employed to make a soil suitable for its required engineering purpose. In its specific meaning in road engineering, soil stabilisation is a process to improve the soil strength by using additives in order to use as a base or

sub base courses and carry the expected traffic and pavement loads.

AIM: To determine the physical and chemical behaviour of unsterilized black cotton soil and evaluate the strength and the effectiveness of the stabilizers mixed with black cotton soil.

EXPERIMENTAL

II.EXPERIMENTAL MATERIAL

Ground granulated blast furnace slag(GGBS), Zycobond, Terrasil.

GGBS is obtained by quenching molten iron slag (a by-product of iron and steel-making) from a blast furnace in water or steam, to produce a glassy, granular product that is then dried and ground into a fine powder. It has a cementations property which acts as binding material for the soil.



GGBS

Zycobond is a sub-micron acrylic copolymer emulsion with long life of above 10 years for bonding soil particles. It imparts water proofing and resists water ingress through the unpaired areas like shoulders and slopes.



Zycobond

Terrasil is nanotechnology based product produced by Zydex Industries Ltd., Gujarat. Terrasil is water soluble, ultra violet and heat stable, reactive soil modifier. It improves the frictional value, reduces water permeability and maintains breathability of the soil layer.

B. Soil

Black cotton soil is one of major soil deposits of India. They exhibit high rate of swelling and shrinkage when exposed to changes in moisture content and hence have been found to be most troublesome from engineering consideration. The rate of montmorillonite is more in black cotton soil which causes expansiveness and crack occurs in soil without any warning which is dangerous for construction.

III. TEST ON BLACK COTTON SOIL

- Liquid limit test
- Plastic limit test
- Standard proctor test
- CBR test

Index and physical properties of material used

Property	BC soil	GGBS
Specific gravity	2.60	2.84
Liquid limit (%)	78	40
Plastic limit (%)	45	NP
Plasticity index	33	NP
Shrinkage limit (%)	16	-
Sand (%) (4.75–0.075 mm)	1	1
Silt (%) (0.075–0.002 mm)	29	99
Clay (%) (00.002 mm)	70	0

Physical properties of Zycobond

Parameter	Value
Colour	Milky White
Odour	No
Flash point above	100oC
Explosion hazard	No
Ignition temperature	above 200oC
Solubility in water	Dispersible
pH value	5-6

Physical properties of Terrasil

Property	Description
Appearance	Pale yellow liquid
Density	1.01g/ml
Viscosity at 25oC	20-100 Cp
Solubility	Forms water clear solution
Flash Point	>80°c
Freezing point	5°c

IV. EXPERIMENTAL SETUP

Result of P.L, L.L and P.I with 0% to 15% using GGBS, ZB and TS

Sr.no	GGB S(%)	Liquid limit	Plastic limit	Plasticity index
1.	0%	59.79%	36.05%	23.74%
2.	5%	57.05%	33.90%	23.15%
3.	10%	54.80%	32.07%	22.73%
4.	15%	51.01%	29.20%	20.81%

Result of OMC and MDD with 0% to 15% GGBS,

Sr no.	GGBS(%)	OMC%	MDD
1	0%	17.8	1.95
2	5%	17.5	1.98
3	10%	17.1	2.01
4	15%	17.2	2.04

Result of Unsoaked CBR with 0% to 15% GGBS, ZB and TS

Trail no.	GGBS, ZB & TS (%)	2.5mm Penetration(%)	5mm Penetration(%)
1	0%	4.28	4.10
2	5%	4.84	4.42
3	10%	5.63	4.88
4	15%	4.96	5.01

Result of Soaked CBR with 0% to 15% GGBS, ZB and TS

Trail no.	GGBS, ZB & TS (%)	2.5mm Penetration(%)	5mm Penetration(%)
1	0%	2.84	2.69
2	5%	3.41	3.10
3	10%	3.93	3.57
4	15%	3.80	3.60

V. CONCLUSION

- For soil used in study there was a increase the percentage in the CBR value for unsoaked condition in both sample,when it is stabilized with GGBS, zycobond and terrasil.
- All the other parameters remaining same, higher the stabilizer percentage rate, higher was the improvement in soil properties.
- But we saw in the study when the percentage rate of stabilizer is increase at 15%, the CBR value of unsoaked and soaked condition are decreasing in both sample.
- In the present study was found that the improvement in soil are batter than the previous study in soil stabilization with GGBS.
- With the increases of GGBS,ZB(zycobond) and TS(terrasil) percentage optimum moisture content goes on decreasing while maximum dry density goes on increasing, hence compatibility of soil increases and making the soil more dense and hard.
- With percentage increases of stabilizers specific gravity goes on increasing, thus making the soil denser.
- With the increases of stabilizers percentage, percentage of finer goes on decreases, which strengthens the soil.
- At the and is notified that 10% (GGBS, ZB, TS) giving significant improvement in CBR value in study.

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