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ENHANCING THE ENGINEERING PROPERTIES OF ALLUVIAL SOIL USING EGG SHELL POWDER

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ABSTRACT

Chemical admixtures like lime, cement, and bitumen for stabilization of soil is costly. As a result, therefore a cheapest alternative used to minimize the cost. This study assesses the laboratory investigation into the possibility of using ESG powder to enhance the engg. properties of alluvial soil. 3 different amounts of eggshell powder (2, 4, and 6% by wt. of dry soil) used in the examination. So, experimental tests such as Atterberg's limit, specific gravity by density bottle, particle size distribution, standard proctor test were conducted. Results showed that increasing the ESG powder quantity improved the atterberg limits, specific gravity by density bottle, proctor test up to a point, while reducing the swelling property and plasticity of alluvial soils generously.

KEYWORD: *Eggshell powder, alluvial soil*

1. INTRODUCTION

Soil is an important natural material. All depends upon the soil. For long term good performance of pavement structures is mainly affected by the strength and durability of the sub grade soils. In-situ sub-grades don't provide the all support required to gain desirable performance.
Different layers in roads gives strength for withstanding against the heavy loads due to traffic movement. Therefore sub-grade is an important feature as it gives support to all upper layers. Sub-grade is the naturally occurring soil and having the different properties as the soil quality varies. So, if sub-grade soil is not good, then it requires improvement in its properties.

2. LITERATURE REVIEW

SATYAM TIWARI, et al (2016): He explains the "Use of Fibre Materials Waste for the Stabilization of Soil", and had an investigation on how the polypropylene fibre waste affects the unsaturated soil's shear strength by conducting a direct shear stress test on two different samples of soil. The added fibre reinforcement percents are 0.25, 0.15, 0.5, and 0, based on the increase of 0.3% in specific gravity of the soil. Soil with reinforcement and without reinforcement has a difference of 18.18% in their liquid limit.
SHAILENDRA SINGH, et al (2013): He stated that by using lime in three different ratios i.e. 6%, 4% and 0% we can stabilize the BC soil. Many tests have been done on BC soil with the lime in the above percentages for the soil to be stabilized. It is founded that MDD decreases by 5.6% at 4% lime content and 2.4% at 4% lime content. It is concluded that if we add 4% lime the L.L down by 12.1% and if we add 6% lime, the L.L. down by 17.7%. Mixing various lime proportions i.e. 10%, 8%, 6%, 4%, 2%, 0%, So the tests are conducted on BC on soil in the laboratory.
ANKIT JAIN, et al (2016): He gives the "Effect of lime on the index properties of black cotton soil". Swelling property of BC soil goes down 60% to 14% by adding lime content in increasing ratio. P.I. of soil goes down from 37.16% to 10.43% when Lime is added to soil by 8% and he also shows that, L.L. of soil goes down from 67.49% to 52.01% with increase in lime content by 8%. Swelling characteristic of soil is goes down at an optimum dose of lime 8%. shear quality. Moreover, it was

derived that due to low unequivocal gravity of plastic pieces there is decreases in MDD and OMC of the Soil.

3. OBJECTIVES

1. To study the different properties of soil in Gujarat region(alluvial Soil)
2. To Study the properties mix of material egg shell powder for soil stabilization.
3. To study different mix proportion at different moisture content with types of soil available. (alluvial Soil)

4. EXPERIMENTAL INVESTIGATIONS

4.1 Need of Study

Alluvial soils often retain at least a partial record of the history of alluvial deposition. As soils develop on stable or truncated surfaces, they also record the passage of time since deposition, landform stability, and/or truncation. Therefore, alluvial soils are useful for soil-geomorphic studies.

4.2 Materials

4.2.1 Alluvial Soil

4.2.2 Eggshell Powder

This element is a natural source of Ca with other different elements (e.g. Sr and F) which is having a good effect on soil stabilization.

Table 1. Chemical Properties of Egg Shell Powder

S.No.	PARAMETERS	PERCENTAGE %
1	Magnesium carbonate	1
2	Calcium phosphate	1
3	Organic matter	4
4	Calcium carbonate	94

Table 2. Physical Properties of Egg Shell Powder

S.No.	PARAMETERS	VALUES
1	Sp. Gravity.	0.85
2	OMC.	1.18
3	Bulk Den.(g/m^3)	0.8
4	Particle Den. ($g//m^3$)	1.012
5	Porosity(%)	22.4

Fig. 1 Egg Shell Powder

4.3 Preparation of samples

The various steps are performed while mixing the fibre to the soil are as followed:-

1. Soils samples are compacted in correspondence to the SPT test at their OMC and MDD
2. Eggshell powder added to the soil according to the weight of soil.

3. Water is added to air dried soil depends on the OMC of the Alluvial soil while preparing soil sample if Eggshell powder not added.
4. To get the fairly homogenous mixture, Eggshell powder should be mixed in oven dried soil mass efficiently and then water is added.

4.4 steps that to be followed in the experiments

4.4.1 Particle Size Distribution

Particle Size distribution, is a parameter (means of expression) which shows different sizes (Particle Size) of particles are present in what proportions (relative particle amount as a percentage where the total amount of particles is 100%) in the sample in which particle group to be analyzed.

Table 3:

S.N.	IS Sieve	ParticleSize D (mm)	Mass Retained (gm)	% retained	Cumulative % retained	Cumulative % finer(N)
1	4.75mm	4.750	16	3.2	3.2	96.8
2	2.36mm	2.360	22	4.4	7.6	92.4
3	1.18mm	1.180	48	9.6	17.2	82.8
4	600micron	0.600	42	8.4	25.6	74.4
5	300micron	0.300	40	8.0	33.6	66.4
6	150micron	0.150	172	34.4	68.0	32
7	75 micron	0.075	114	22.8	90.8	9.2
8	Pan		46	9.2	100	0
		Total =	**500**			

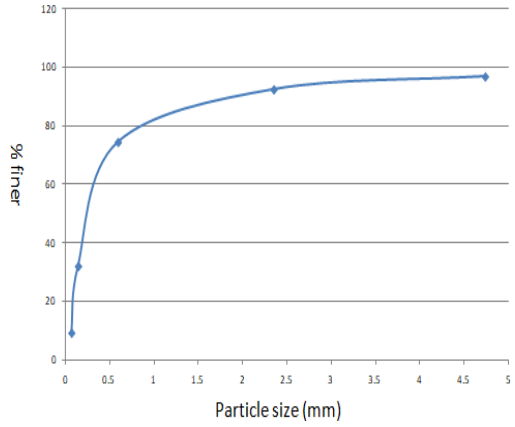

Fig. 2 Particle Size Distribution Graph

4.4.2 Atterberg's Limit

Atterberg's limits tests used for OMC for fine-grained clay and silty soil for transition b/w solid state, semi-solid state , plastic state, and liquid state.
The 3 Atterberg's limits: S.L., P.L. and L.L. The S.L. is the moisture present in soil due to which the vol. of the soil starts to increase.

Table 4. Atterberg's Limits Test

S.NO.	MIX PROPORTION	L.L%	P.L%	P.I.
1	SOIL +0%ESP	38	14	24
2	SOIL +2%ESP	35	15	20
3	SOIL +4%ESP	34	13	21
4	SOIL +6%ESP	32	14	18

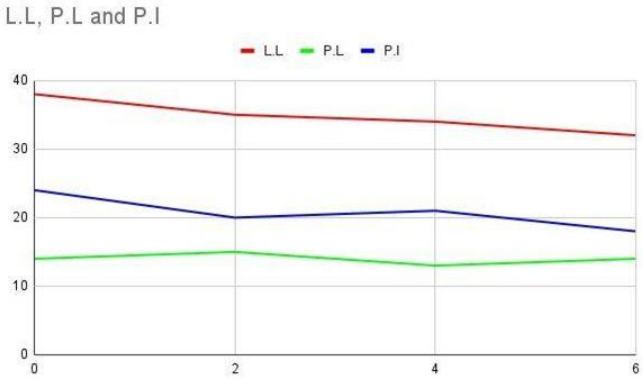

Fig. 3 Atterberg's Limits Graph

4.4.3 Specific Gravity using Density Bottle

Specific grav. bottles used for determinining liquid densities by differentiating the unsimilarity b/w an vacant and filled bottle and dividing by an equal vol. of water to find the sp. gravity. of the substance.

Table 5.

S. No	Parent Soil	Parent Soil + 2% ESP	Parent Soil + 4% ESP	Parent Soil + 6% ESP
1	2.29	2.43	3.64	3.79
2	2.19	2.11	3.39	2.32
3	2.32	2.48	2.37	2.49
Mean	**2.36**	**2.34**	**3.13**	**2.86**

4.4.4 Standard Proctor Test

The SPT have a 0.95-liter vol. cylindrical mould which is filled by the soil sample and compacted in 3 layers. These 3 layers are compacted by 2.5 kg wt. dropping 25 times on each layer from an height of 30 cm.

Table 6. Standard proctor test table

S.No	Mix Proportion	(MDD) gm/cm3
1	SOILSAMPLE + 0%ESP	1.55
2	SOILSAMPLE + 2%ESP	1.73
3	SOILSAMPLE + 4%ESP	1.82
4	SOIL SAMPLE+ 6%ESP	1.68

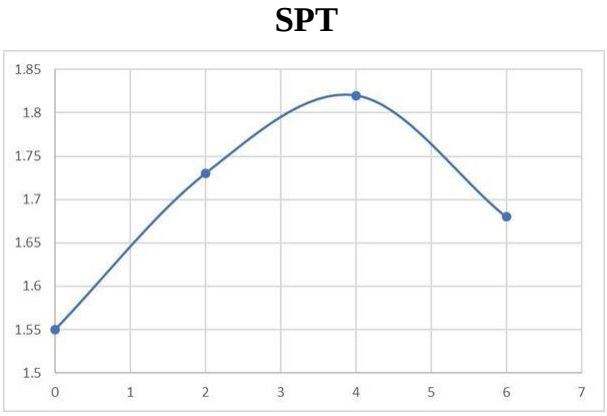

Fig. 4 Standard Proctor Test Graph

5. CONCLUSION

1. Alluvial soil is an intermediate plastic clay (CI) on IS classification system. Esp is used to stabilize the soil for road pavement construction.
2. It was observed that significant improvement is found when stabilized with egg shell powder, lime and brick dust content. However maximum improvement is found when stabilized with 6% Esp.
3. The MDD increases and OMC decreases when stabilized with egg shell powder. The MDD was found 1.82 gm/cubic cm at 12.3% OMC when stabilized with 6% Esp.
4. Firstly specific gravity decreases then achieve high specific gravity 3.13 at 6% esp.
5. So, egg shell powder may be utilized as a waste material to enhance the properties of subgrade soil and reduce the above adjacent layer thickness.
6. It can observed that the P.I. of the soil under study had decreased from 0% to 6%.therefore soil had become non-plastic with increase in the egg shell powder.
7. Eggshell powder is the sustainable material for stabilization of soil and to improve the load bearing capacity of the Road pavement.
8. Adequate results for stabilization of soil are proposed for the ESG containing15% by wt. of soil.
9. It is needed to conduct triaxial test for other parameters of soil.
10. It is recommended to use ESG in a fine stages despite of course stage to similarized the compatibility of soil and ESG powder.

REFERENCES

[1]. Ambaries Ghosh and Chillara Subbarao "Strength Characteristics of Modified withLime". Journal of Geotechnical and Geo environmental Engineering Vol.133.No.7,July2007.pp.757-7662007.
[2]. R. Sathish Kumar "Experimental Investigation on the Stabilization of Black CottonSoil using Lime" 2007.
[3]. Vijay Kumar Sureban "Improving CBR Characteristics of Black Cotton Sub grade For Better Pavement Performance" 2009.
[4]. Dr. Robert m. Brooks "Soil Stabilization with Lime international journal ofresearch and review in applied science 2009,ISNN-209-217
[5]. DK Soni, geotechnical engineering jounral "Effect of Freezing- Thawing and Wetting Drying on Tensile strength of Lime- Stabilized Black Cotton Soil." ISNN-00465 8828, 2008.
[6]. M. Jayakumar and Lau Che Sing "Experimental Studies on Treated Sub-Base Soil with Lime and Cement for Sustainable Design Recommendations", 3d international conference cots nov.8-92006.
[7]. M. Anjan Kumar, D. S.V, Prasad and G, V. R. Prasada Raju, "PerformanceEvaluation of Stabilized Fly Ash Sub bases" IOSRTEN 2011.INN 2250-3021
[8]. V G. Havanagi, A.K. Sinha, V.. Arora, S. Mathur "Waste Materials for Construction of Road Embankment and Pavement Layers", ISOR journal mechnical and civil engineering IOSR2009, 1SNN-2320-334X
[9]. Ravin M. Tailor, Dr M.D. Desai "Application of Lime Stabilization for Standardization of Urban Road Construction at Surat, South Gujarat", international conference on infrastructure development in India 2009, IN-635109
[10]. M. Jayakumar and Lau Che Sing 'Experimental Studies on Treated Sub-Base Soil With Lime For Sustainable Design Recommendations "world academy of science engineering and technology 2012.vol.-6