SOIL STABILIZATION BY USING VARIOUS SOIL STABILIZERS

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ABSTRACT:

Safe and Economic disposal of industrial wastes and development of economically feasible ground improvement techniques are among the important challenge being faced by the engineering community.

In this investigation, an attempt has been made to study the possibility of utilizing ground nut shell these are the hazardous industrial waste for stabilization of soil, since bulk utilization of ground nut shell is feasible in the case of geotechnical applications like construction of embankments, earth dams, and highway and air field pavements.

Soil stabilization is the process of improving the engineering properties of the soil and thus making it more stable. It is required when the soil available for construction is not suitable for the intended purpose. In its broadest senses, stabilization includes compaction, pre-consolidation, drainage and much other such process. However, the term stabilization is generally restricted to the process which alters the soil material itself for improvement of its properties. A cementing material or a chemical is added to a natural soil for the purpose of stabilization.

Soil stabilization is used to reduce the permeability and compressibility of the soil mass in earth structures and to increase its shear strength. Soil stabilization is required to increase the bearing capacity of foundation soils. However, the main use of stabilization is to improve the natural soils for the construction of highways and airfields. The principles of soil stabilization are used to controlling the grading of soils and aggregates in the construction of bases and sub bases of the highways and airfields.

KEYWORDS:stabilization, ground nut shell, OMC, CBR.

INTRODUCTION:

Soil stabilization is the permanent physical and chemical alteration of soils to enhance their physical properties. Stabilization can increase the shear strength of a soil and/or control the shrink-swell properties of a soil, thus improving the load bearing capacity of a sub- grade to support pavements and foundations. Stabilization can be used to treat a wide range of sub-grade materials from expansive clays to granular materials.

Geotechnical properties of problematic soils such as soft fine-grained and expansive soils are improved by various methods. The problematic soil is removed and replaced by a good quality material or treated using mechanical and/or chemical stabilization. The chemical stabilization of the problematic soils (soft fine-grained and

expansive soils) is very important for many of the geotechnical engineering applications such as pavement Q1structures, roadways, building foundations, channel and reservoir linings, irrigation systems, water lines, and sewer lines to avoid the damage due to the settlement of the soft soil or to the swelling action (heave) of the expansive soils.

Chemical stabilization involves mixing chemical additives (binding agents) with natural soils to remove moisture and improve strength properties of the soil (sub-grade). Generally, the role of the stabilizing (binding) agent in the treatment process is either reinforcing of the bonds between the particles or filling of the pore spaces.

When you build a basement, you want to build on solid ground, or as solid of ground as possible. If you are working in an area that is made up of clay or other expansive soils, youmay want to consider stabilizing the ground with lime. Treating the ground with lime gives a much more stable surface to work within brief the stabilization of soil is necessary for

- Scarcity of good quality aggregates / soil for road construction.
- Encouraging the use of Industrial Wastages in building low cost construction of roads.
- Effective utilization of locally available soils and other suitable stabilizing agents. Benefits of the stabilization process can include: Higher resistance (R) values.

Reduction of plasticity, Lower permeability, Reduction of pavement thickness, Elimination of excavation - material hauling/handling - and base importation, Aids compaction, Provides “all-weather" access onto and within projects sites.

ADMIXTURES:

Requirements for Using Waste Material

- Free from organic matter
- Should not swell or decay as influenced by water
- Should not be soluble in water
- Particlesshouldbemoderately porous

LIME AS A STABILIZATION ADMIXTURE:

Lime stabilization is done by adding lime to soil.It is useful for stabilization of clayey soils. When lime reacts with soil, there is exchange of cations in the adsorbed water layer and a decrease in plasticity of the soil occurs. The resulting material is more friable than the original clay, and is, therefore, more suitable as sub grade.Lime is produced by burning of lime stone in kilns. The quality of lime obtained depends upon the parent material and the production process. There are basically 5 types of limes.

i. High calcium, quick lime - CaO

ii. Hydrated high calcium lime – $Ca(OH)_2$

iii. Dolomite quick lime – CaO + MgO

iv. Normal hydrated dolomite lime – $Ca(OH)_2$ + MgO

v. Pressure hydrated dolomite lime –$Ca(OH)_2$ + $Mg(OH)_2$

The quick lime is more effective as stabilizer than the hydrated lime; but the latter is moresafe and convenient to handle. Generally, the hydrated lime is used. It is also known as slaked lime. The higher the magnesium content of the lime, the less is the affinity for water and the less is the generated during mixing.

PROPERTIES OF GROUNDNUT SHELL:

Property	Range
Ash	22 - 29
Carbon	35
Hydrogen	4 - 5
Oxygen	31 - 37
Nitrogen	0.23 – 0.32
Sulphur	0.04 - 0.08

MATERIALS & METHODS:

Stabilization is carried out on soil by addition of Ground nut shell in different proportions and tests are conducted for studying the variation of different Geotechnical Parameters like optimum moisture content, maximum dry density and California bearing ratio in unsoaked conditions.

TESTS CONDUCTED:

The series of Tests conducted for determination of Compaction Characteristics (Optimum Moisture Content & Maximum Dry Density) and California Bearing Ratio (Unsoaked) for different proportions of Lime, Groundnut shell, Lime with groundnut shell with soil as given below:

1. Soil Only
2. Soil + 5% Lime
3. Soil + 10% Lime
4. Soil + 20% Lime
5. Soil + 40% Lime
6. Soil + 5% Groundnut shell
7. Soil + 10% Groundnut shell
8. Soil + 20% Groundnut shell
9. Soil + 40% Groundnut shell
10. Soil + 2.5% Lime + 2.5% Groundnut shell
11. Soil + 5% Lime + 5% Groundnut shell
12. Soil + 10% Lime + 10% Groundnut shell
13. Soil + 20% Lime + 20% Ground nut shell

All the tests are conducted as per the relevant IS Codes of Procedures.**RESULTS:**

Original soil is tested for index properties, compaction characteristics & California Bearing Ratio strength tests. After that soil is tested with addition of lime, groundnut shell & lime with groundnut shell in various proportions for determining the compaction characteristics & California Bearing Ratio strength.

The following table shows the geotechnical properties of the soil.

S.NO	PROPERTY	VALUE
1	LIQUID LIMIT %	41.2
2	PLASTIC LIMIT %	8.41
3	PLASTICITY INDEX %	32.79
4	O.M.C. %	7.6
5	M.D.D. g/cm^3	2
6	CBR VALUE(UN SOAKED) %	15

Table 1: Geotechnical properties of the soil

.The following table shows the dry density, OMC & CBR Value of the soil with stabilizers mixed in th different proportions:

PROPORTIONS	MAXIMUM DRY DENSITY (gm/cm^3)	OPTIMUM MOISTURE CONTENT (%)	C.B.R VALUE (%)
Soil	2	7.6	15
Soil + 5% Lime	1.954	9.77	55.9
Soil + 10% Lime	1.90	10.0	59.9
Soil + 20% Lime	1.893	10.10	81.9
Soil + 40% Lime	1.834	11.47	59.9
Soil + 5% Groundnut shell	1.870	9.34	39.66

Soil + 10% Groundnut shell	1.710	10.16	11.9
Soil + 20% Groundnut shell	1.239	16.38	2.44
Soil + 40% Groundnut shell	0.991	19.28	0.99
Soil + 2.5% Lime + 2.5% Groundnut shell	1.995	10.52	41.9
Soil + 5% Lime + 5% Groundnut shell	1.915	10.96	45.3
Soil + 7.5% Lime + 7.5% Groundnut shell	1.89	11.19	48.3
Soil + 10% Lime + 10% Groundnut shell	1.881	11.20	37.9

CONCLUSION

1. Optimum moisture content and maximum dry density decreases with increase in the lime content.
2. CBR value decreases with increasing the quantity of groundnut shell.
3. CBR value is high at 5% groundnut shell.
4. CBR value is high at 15% lime when compared to 5%, 10%, 20% of lime is mixed with soil.
5. CBR value is high at10% lime +10% ground nut shell when compared to the remaining proportions.
6. CBR value for soil+10% lime and soil+20% lime is same.
7. CBR gradually increases with increase in ground nut shell up to 2% for soil+5% lime
8. CBR value increases up to 15% addition of shells in and decreases at 20% shells in soil +10% lime.
9. CBR value gradually decreases with increase of ground nut shell content in soil+15% lime.
10. CBR value gradually increases with increase of shells in 20% lime with soil.
11. From the observations the strength at 20% lime is more. Hence 20% of lime may be used for strength purpose and for low traffic the ground nut shell may be used for economical purpose.

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