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Improvement of Soil by Using Natural Material (JUTE AND GYPSUM)

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Abstract: Generally clay exhibits undesirable engineering properties like poor bearing capacity and higher compressibility. Thus the improvement of the soil at site is indispensable. There are many stabilizers to improve the strength of soil like Jute, Gypsum, fly ash, rice husk ash, cement, lime used rubber tyres etc. In the present Study , we added jute and gypsum as stabilizer to improve the properties of clayey soil . Locally available clayey soil is used in this study . The objective of this study is to improve the strength of the clayey soil by making soil-jute and soil-jute-gypsum mixture. six specimens are prepared to investigate the properties of soil out of which three specimens are prepared by adding 1% of jute with varying length of 1cm,2cm and 3cm and the remaining three specimens are prepared by adding 1% jute and gypsum each with varying length of 1cm,2cm and 3cm of jute . Standard proctor test and unconfined compressive strength test are conducted to analyse the optimum moisture content (OMC), Maximum dry density (MDD) and compressive strength of soil mixture.

I. INTRODUCTION

Practice of urbanization and industrialization is so rampant these days. Though there is bountiful supply of soil, the cheapest construction material, it may exhibit some uncovered properties for intended construction purpose at .such as construction on soft soil like clay appears to be difficult and it causes substantial distress to the overlying structure as it possesses low shear strength, high compressibility, the 'shrink-swell' behaviour of clayey soil can endanger the construction work causing excessive settlement at the site. Again soil can be collapsible or liquefiable which are difficult to handle.In search of the suitable.

A. Ground Improvement And Its Necessity

It is a well-established fact that the load coming from the superstructure is ultimately borne by the soil. Hence when a project encounters, soil, feasibility is the first and the foremost thing to be studied. The characteristics of the soil vary from one place to another. Often soil at particular site lacks in desirable properties causing distress to overlaying structure. It may exhibit low shear strength, higher compressibility etc. such as sandy has propensity to liquefaction where as expensive soil imbibes lot of water posing threat to small structures, canal linings, pavements. Hence when a unsatisfactory condition is met, possible alternative solution can be either of

1) Abandon the site
2) Remove and replace the soil
3) Redesign the planned structure accordingly
4) Treat the soil to modify its properties or ground improvement

The last method listed above is known as ground improvement technique or soil stabilization. The leaning tower of Pisa is a classic example of such geotechnical engineering practice and ground improvement technique.

II. METHODLOGY

Methods of soil stabilization can be broadly classified under two categories and these are as follows:

1) Stabilization without additives

2) Stabilization without additives

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A. Stablization Without Aditives

1) Mechanical Stabilization: This approach involves improvement of soil by compacting to denser state or by changing the gradation of soil. This can be achieved by either of following methods

a) compaction
b) Addition or removal of soil particles
c) Blasting

2) Stabilization by Drainage: The strength of soil depends upon the effective stress which in turn is adversely affected by ground water and hence excess pore water must be expelled out by using following methods

a) Application of external load
b) Electro osmosis
c) Application of Thermal gradient

3) Ground Reinforcement: The following methods also help in increasing the shear strength of soil significantly.

a) Stone columns and soil nailing
b) Geo-synthetics
c) Grouting

B. Soil Stablization With Additives

So many additives have been employed with different type soil with varying degree of success. An additive is satisfactory when it upgrades the quality of soil but all the requirements can't be met at a time. For better results more than one additive can be introduced checking the stability.

1) Cement stabilization
2) Lime stabilization
3) Bitumen stabilization
4) Salt stabilization
5) Fly ash stabilization

Selection of appropriate method should be based on type and degree of improvement required, type of soil and its characteristics, possible damage to the adjacent structures, pollution of ground water resources, durability, of materials involved, and time available for the project associated cost.

III. RESULTS AND DISCUSSION

A. Compaction on Parent Soil

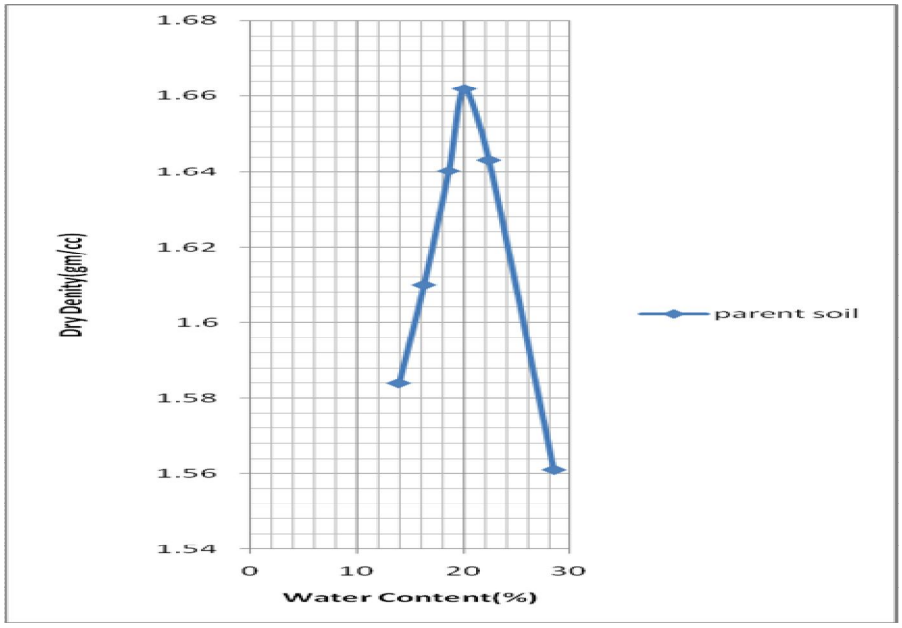
The test is done on the parent soil first. The maximum Dry Density is found to be 1.66 gm/cc at Optimum Moisture Content of 20.04. The process of testing is followed as discussed earlier.

Standard Proctor test on parent soil

SI no	1	2	3	4	5	6
Wt of empty mould+ compacted soil (gm)	6205	6272	6345	6395	6410	6405
Wt of empty mould (gm)	4400	4400	4400	4400	4400	4400
Wt of sample (gm)	1805	1872	1945	1995	2010	2005
Density of sample (gm/cc)	1.805	1.872	1.945	1.995	2.01	2.005
Container no.	15	84	328	307	11	49
Wt of empty container (gm)	10.489	9.509	10.169	10.409	10.5	10.36
Wt of empty container + wet soil(gm)	36.71	35.9	32.96	31.37	44.86	43.51
Wt of container+ dry soil (gm)	33.51	32.21	29.39	27.87	38.59	36.17
Wt of water in the sample (gm)	3.2	3.69	3.57	3.5	6.27	7.34
Wt of dry soil(gm)	23.02	22.70	19.221	17.461	28.09	25.81
Water content, in percentage	13.901	16.250	18.5734	20.0446	22.3211	28.438
Dry density (gm/cc)	1.584	1.610	1.6403	1.6618	1.6432	1.561

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B. MC/DD Graph for Parent Soil



IV. DISCUSSIONS

A. Compaction Characteristics

From the proctor test, it has been observed that the optimum moisture content (OMC) increases by the addition of jute in parent soil and maximum dry density (MDD) decreases. Initially the OMC & MDD of the parent soil were 20.04 & 1.66 gm/cc respectively according to the proctor test conducted. But after the addition of jute with gradual increase in the jute length, it is observed that the maximum water content increases and maximum dry density decreases drastically. In addition by varying the length of the jute in present soil with the constant amount (1%) , it has been observed that the optimum moisture content of the mixture shows a decreasing tendency with increase in the jute length, i.e. for 1 cm length of jute optimum moisture content is 25.16, 24.56 for 1.5 cm jute length and 23.85 for 2cm jute length. Also the maximum dry density for the above jute varies as 1.56gm/cc, 1.58gm/cc and 1.16gm/cc for 1 cm, 1.5 cm and 2 cm respectively. The maximum dry density shows the increasing trend with the increase of the jute length in the soil mixture. From results it is clear that as optimum water content decreases maximum dry density increases as per the inverse relationship between MDD and OMC.

Again by addition of 1% gypsum with the above jute mixture, it shows slight increase in optimum moisture content of the respective jute mixture i.e.

1) For 1cm jute length mixture, the optimum moisture content is 25.16 for the jute mixture and 24.76 after the addition of 1% gypsum.
2) For 1.5cm jute length mixture, the optimum moisture content is 24.56 for the jute mixture and 24.12 after the addition of 1% gypsum.
3) For 2cm jute length mixture, the optimum moisture content is 23.85 for the jute mixture and 23.89 after the addition of 1% gypsum.

B. Unconfined compressive Strength Test

From the UCS test conducted for the same samples as described in the proctor test, the strength of sample shows increasing tendency with the addition of varying length of jute in a constant amount i.e. for parent soil strength obtained 1.7 kg/cm^2. But for the jute mixture the strength obtained $2kg/cm^2$, $2.3kg/cm^2$ and 2.8 kg/cm^2 for 1cm,1.5cm and 2cm jute length respectively. And again by addition of gypsum in the three jute mixture sample ,the strength shows a drastic increase, i.e.

1) 1cm jute length mixture shows an increase of strength from $2kg/cm^2$ to 3.3 kg/cm^2 after the addition of 1% gypsum.
2) 1.5cm jute length mixture shows an increase of strength from $2.3kg/cm^2$ to 5.2 kg/cm^2 after the addition of 1% gypsum.
3) 2cm jute length mixture shows an increase of strength from $2.8kg/cm^2$ to 5.3 kg/cm^2 after the addition of 1% gypsum.

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V. CONCLUSION AND SCOPE OF FURTHER STUDIES:

A. *Conclusion*

This thesis, strength characteristics of soil-jute-gypsum mix has been studied .The following conclusion can be made on the basis of test results obtained from jute-gypsum stabilized clayed soil:

1) When the length of jute (1cm,1.5cm,2cm) is increases with constant addition of jute and gypsum(1%), the maximum dry density of soil-jute mixture and soil-jute-gypsum mixture increases with the decrease in optimum moisture content.

2) In the UCS test, when length of jute fibre increase in soil mixture then the compressive strength increases gradually. After addition of gypsum in soil mixture, the compressive strength increases suddenly.

3) Gypsum not only acts as a activator in this case but also reduces plasticity of soil.

4) Soil-jute and soil-jute-gypsum samples fail by formation of vertical cracks.

B. *Scope Of Further Studies*

Improving properties of soil become a matter of paramount importance today. Here an effort has been made to study the effect of jute and Gypsum. There are many alternatives available for doing the same. Here are some suggestions made for further progress:

1) Different waste materials from agricultural land, municipality or industries can be used to improve the soil making them boon to the urbanization.

2) Similar studies can be made at various water content.

3) Other type of soil can be used for further observations.

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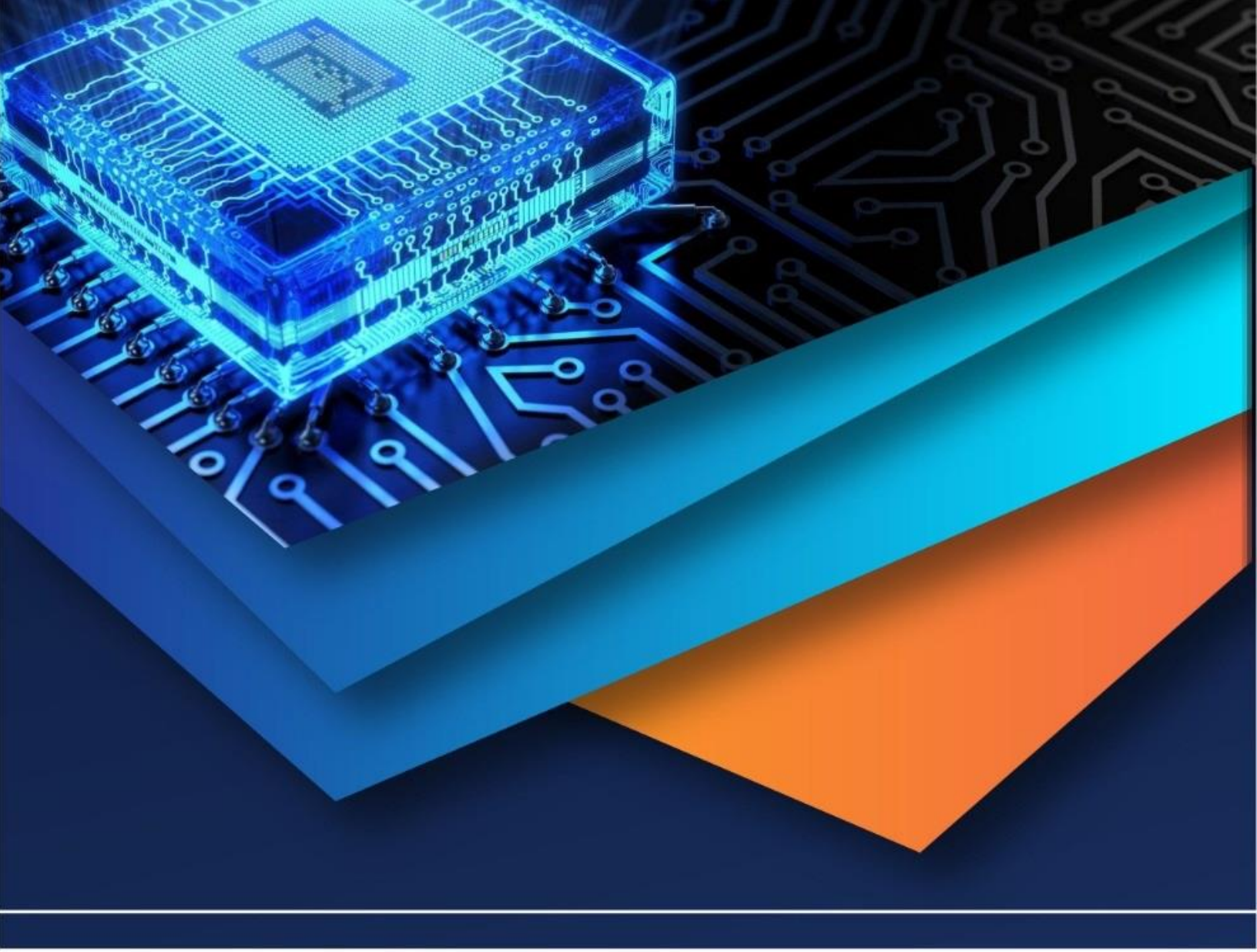
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