EXPERIMENTAL STUDY ON IMPROVING THE BEARING CAPACITY OF FOUNDATION SOIL WITH INCLUSION OF GEOCOIRS

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Abstract: *Structure on the ground with adequate bearing capacity is one of the essential requirements for the stability of a structure. The properties of weak soil can be improved by inclusion and confinement by reinforcement. It can overcome the inadequate bearing capacity and excessive settlement problems of shallow foundations due to soft soil conditions. In this research, the ultimate bearing capacity of geo coir reinforced soil was determined by using both experimental methods and the effect of inclusion and confinement by geo coir's material in the soil was investigated. The soil used in this study was clay obtained from the Vamsadhara River left main cannel near Polavaram, Tekkali. The experiments were carried on with and without reinforcement of geo coir in layers of 1, 2, 3 withthree different thickness of half, one third and quarter spacing between consecutive layers in soil. The ultimate bearing capacity of soil for various configurations of geo coir was determined by plotting the load settlement curves for each set of tests. This study shows that the effect of geo coir's reinforcement in the soil is determined mainly by its placement in the soil. From the experimental test results of load settlement curves, well-defined ultimate load intensity was observed, and the soil was failed in general shear failure. In unreinforced soil, the ultimate bearing capacity is very low when compared to the ultimate bearing capacity of soil with reinforcement. The geo coir's in the soil reduces the settlement and increases the load bearing capacity of soil.*

Key words: Geo Coir's, Strength, Settlement

1. BACKGROUND OF THE STUDY

The concept of reinforcing the soil has been used in numerous ways over the years, in the form of bamboo, reed, timber planks, metal, etc. Soil reinforcement has evolved over time to meet changing needs and inventions in terms of material, form, and size. Initially, the composite construction material in the form of metallic strips and soil was replaced by sheet- type reinforcements in soil. Afterward geotextiles, geogrids, and geocells, among many other geosynthetics, have outstripped all others.

One of the most essential requirements for foundation stability is a structure on the soil with sufficient bearing capacity. The construction of any structure in poor soil condition is adifficult task for a civil engineer. The method of reinforcing is a cost-effective solution for civil engineering projects, can be used to overcome the insufficient bearing capacity and excessive settlement problems of shallow foundations due to weak soil conditions (Sridhar and Prathapkumar 2017).

Analytical solutions or experimental studies can be used to determine the ultimate bearing capacity of the soil. Many theories were developed to find the ultimate bearing capacity by analytical methods such as Terzaghi's analysis, Meyerhof's analysis, Vesic's bearing capacity equation, etc.(Sadoglu et al.2009). The soil is generally weak in tensile strength and is mainly depends on environmental conditions. The properties of weak soil can be improved by ground modification techniques such as mechanical modifications, hydraulic modifications, chemical and physical modifications, inclusion and confinement by reinforcement, etc. Many researchers employed an experimental method to estimate soil bearing capacity using geosynthetic reinforcement. (Dash and Rajagopal 2007; Biswas, Krishna 2016). The bearing capacity of geosynthetic reinforced soil was determined using numerical analysis by Manash and Debarghya (D. Chakraborty and Kumar 2014).

Due to rapid growth across India, especially in recent decades, there has been a shortage of good quality land. Weak soil or collapsible soil creates

serious negative consequences for a project under consideration if they are not improved significantly. The inclusion and confinement by reinforcement were chosen for this study among the several ground improvement approaches because of their variety in technical, economic, and application aspects (Patra et al. 2006). The soil's tensile strength is increased by inserting reinforcement in the tensile stress direction. The reinforced soil is used as a construction material due to soil-reinforcement interaction, frictional resistance, and adhesion properties of the reinforcement. The geosynthetic-reinforced base can provide lateral and vertical confinement, a tensioned membrane effect, and a more extensive stress distribution than an unreinforced base (Krishnaswamy 2007).

2. OBJECTIVES OF THE STUDY:

The main objective of this study is to investigate the effect on bearing capacity by incorporating geo coir into the soil andidentify the optimal potential configuration of geo coir for getting the maximum advantage of strength improvement through a parametric study.

Specific objectives

1. to investigate the effect on bearing capacity by incorporating geo coir into the soil
2. toidentify the optimal potential configuration of geo coir for getting the maximum advantage of strength improvement through a parametric study
3. To address the beneficial use of geo coir to overcome the bearing capacity problem.

Hypothesis

H 1: Soil with varying water content has varying bearing capacity.
H 2: More no of geo coir layers as significant effect on load bearing capacity of soil.
H 3: Settlement of various Geo coir reinforcement showed an improvement over virgin soil.
H 4: Varying Geo coir layers with consistency of soil showed an improved trend in settlement and bearing capacity.

3. METHODOLOGY OF THE STUDY

3.1General

In this research, the experimental set-up was established to investigate the ultimate bearing capacity of soil using geosynthetic reinforcement. The concentrated load was applied on the mild steel square model footing using the static load frame. The experimental work carried out in this study comprises of

1.Tests on the soil to find index properties and engineering properties.

2.The experiments on geo coir reinforced soil to find the bearing capacity by varying the water consistency below the plastic limit and by placing geo coir layers with three different thickness of half, one third and quarter spacing between consecutive layers of soil.

3.2Materials used

Mainly two materials, geo coir of different aperture sizes and clay, were used in the laboratory testing to determine the ultimate bearing capacity and settlement of reinforced soil.

Geo coir of aperture's GSM700 &GSM900 was used in this research, which is shown in fig

Table3.2:Detailsofanumberof experimentaltests

S.NO	Typeofgeocoir	NoofCoir Layers	Watercontent	Nooftests
1	0	0	18%,22%,26%	3
2	GSM700	1	18%,22%,26%	3
3	GSM700	2	18%,22%26%	3
4	GSM700	3	18%,22%26%	3
5	GSM900	1	18%,22%,26%	3
6	GSM900	2	18%,22%,26%	3
7	GSM900	3	18%,22%,26%	3
Totalnotestsonreinforcedsoil				21

4. LITERATURE REVIEW

The term often used to refer to the role of logistics in recycling, waste disposal, and management of hazardous materials; a broader perspective includes all relating to logistics activities carried out in source reduction, recycling, substitution, reuse of materials and disposal (Brito & Dekker, 2004).

Among the multiple definitions of quality that can be found in literature, the most comprehensive one is the following: ‘‘Quality is meeting or exceeding the needs and expectations of customers.’’ This means that quality is more than a product that simply works properly. It may also include the concepts of performance, appearance, availability, timely and proper delivery, reliability, maintainability, cost-effectiveness and low price. Quality Management (QM) includes all activities ensuring that products and services fit their purpose and meet the predetermined specifications.

The history and evolution of QM, from the mere inspection and QC of the past to the contemporary QA, Total Quality Management (TQM) and the various modern QM techniques, such as Six Sigma, Quality Function Deployment, etc., have led to the development of theories, processes, methods and tools that are crucial to organization development and performance improvements.

The roots of QM in early 1920s when Shewhart developed the inspired ‘‘Control chart’’ Over the years, his work has evolved due to the contribution of various researchers. In the late 1940s, Americans, such as Deming, Juran, etc., developed further the concept of QM in Japan. These quality gurus and their theories were then followed by the respective Japanese experts, namely Ishikawa.

Along with this evolution, over the years, the industrial world understood little by little the usefulness of QM standards, such as ISO 9000, ISO 22000, ISO 14000, etc., which were initiated to establish a framework on how businesses should manage their key processes. Standards can improve the organization of enterprises, whether they manufacture products or they offer services, regardless of their size or field of activity. Moreover, they can assist businesses in clarifying their objectives and, more importantly, in avoiding expensive mistakes and nonconformities.

4. RESULTS AND DISCUSSION

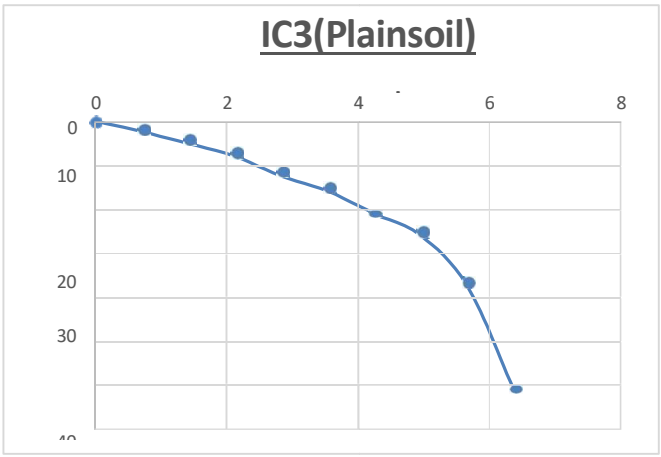
4.1General

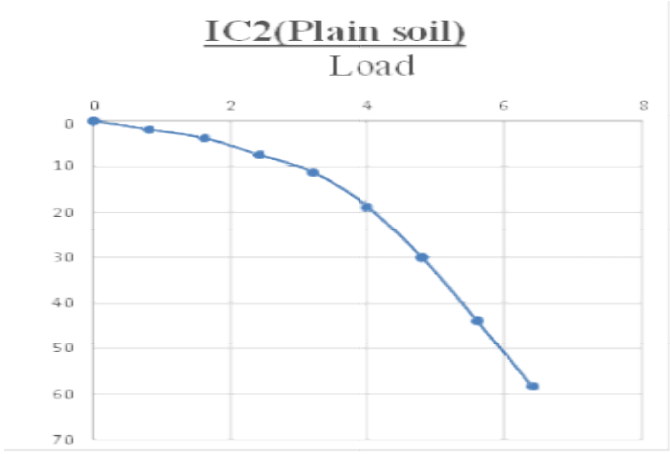
A set of experimental tests were carried out, on unreinforced soil and geogrid reinforced soil, using model square footing with central load. The number of geogrid layers was varied from N=1 to N=3 and changes in water content 18%,22%,26%. As the load increased gradually, the corresponding settlement was recorded, and load settlement curves for each layer of geo coir& water content and have been plotted.

Load Settlement curve for unreinforced soil

The primary test in this study was carried out on soil without inclusion of reinforcement. Loads on the footing were applied as centric forms. The results were plotted as load intensity versus settlement to different water content % for un-reinforcedsoil and it is presented in fig. 4.5.

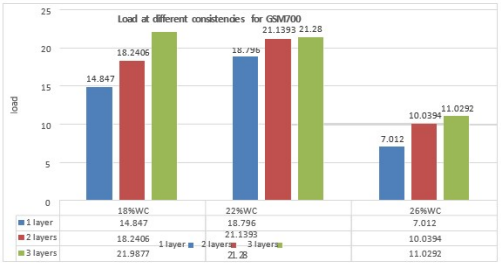
Loadintensityvssettlementwithvaryingwatercontent 18%,22%26%forunreinforcedsoil





Both GSM700 and GSM 900 will increase the intensity of load and decreasing the rate of settlement, we observe that the settlement will be less and load bearing capacity is more for 18% of water content.

Among the geo coirs (GSM 700 & GSM 900) GSM900 gives better load bearing capacity & settlement when we compared with GSM700.



Load intensity at different consistencies for coir GSM700

Conclusion

1.The inclusion of geo coir's in various layers into the soil increased the shear strength, bearing capacity and tensile strength of the soil.

2.The pattern of failure of soil at water content of 18% is found to be general shear failure and at water content of 22% & 26% is found to be punching failure.

3.Load Intensity & settlement of the plain Soil without Geo coir reinforcement is found to be 7.07tons&47.50mm,6.40tons&58.29mm,6.37tons& 61.15mm was found to 18%,22%and26% of water content.

4.Load intensity at layer3 of 18% water content found to be maximum value of 21.98 t/m2 with an increase of 2.10 times load intensity of plain soil.

5.Settlement at layer3 of 18% water content found to be minimum value of 10.41mm with an decrease of 4.56 times settlement of plain soil.

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