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Soil Stabilization of Cochin Marine Soil Using Locally Available Materials

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ABSTRACT

A large portion of our nation, especially Kerala is covered with marine soil. Marine soil is also found in the states of West Bengal, Orissa, Andhra Pradesh, Tamil Nadu etc. These soils are highly saturated, soft, sensitive and normally consolidated. They usually have a low density, low shear strength and expansive in nature. Hence, there is a need for improvement of their properties. When paved roads are built on these type of soft soil, large deformation occurs, which increase the maintenance cost and lead to interruption of traffic service. The main objective is to study the effects of Waste Paper Sludge Ash on the engineering properties of marine soil and the reinforcing effect of randomly distributed coir fiber on the engineering properties of marine soil. WPSA considered as finely waste product resulting from the combustion of wastepaper sludge in paper recycling factories. It is classified as Class-C fly ash and it possesses cementitous properties and pozzolanic properties that resulting in the self-cementing characteristics**.** 8 %, 10 % and 12% WPSA added to the soil and conducted test for analysis of strength properties of soil. Laboratory experiments results showed that 10% is the optimum percentage of Waste Paper Sludge Ash which is mixed in the soil for obtained higher strength. To improve the soil properties fibers are also used for stabilization. The fibers are normally 50–350 mm long and consist mainly of lignin, tannin, cellulose, pectin and other water soluble substances.0.6%, 0.8% and 1% coir fiber is added to soil and conducted test for analysis the reinforcing effect of coir fiber and the optimum percentage of fiber content is 0.8% when it is mixed with soil.

Key Words: Marine Soil, Coir Fiber, Waste Paper Sludge Ash (WPSA)

I. INTRODUCTION

For any land-based structure, the foundation is very important and has to be strong to support the entire structure. In order for the foundation to be strong, the soil around it plays a very critical role. So, to work with soils, we need to have proper knowledge about their properties and factors which affect their behavior. The process of soil stabilization helps to achieve the required properties in a soil needed for the construction work.

In India, the modern era of soil stabilization began in early 1970's, with a general shortage of petroleum and aggregates, it became necessary for the engineers to look at means to improve soil other than replacing the poor soil at the building site. Soil stabilization was used but due to the use of obsolete methods and also due to the absence of proper technique, soil stabilization lost favor. In recent times, with the increase in the demand for infrastructure, raw materials and fuel, soil stabilization has started to take a new shape. Here, in this project, soil stabilization has been done with the help of randomly distributed coir fibers and waste paper sludge ash obtained from waste materials. The improvement in the shear strength parameters has been stressed upon and comparative studies have been carried out using different methods of shear resistance measurement. soil stabilization is the treatment of soils to enable their strength and durability to be improved such that they become totally suitable for construction beyond their original classification.

The soil found in the ocean bed is classified as marine soil. It can even be located onshore as well. The properties of marine soil depend significantly on its initial conditionsClay is an impermeable soil, meaning it holds

water, as opposed to permeable soil that allows water to rapidly drain, like a gravel or sand. The shrink and swell movements are due to changes in soil moisture. Providing uniform soil moisture next to and under your foundation is the only best thing to reduce or minimize the damaging effects of expansive soil.

Natural fiber geotextiles can be a feasible solution for cases where these products are meant to serve only during the initial stage and final strength is achieved by soil consolidation due to the passage of vehicles. These natural materials include coir, which is the husk of coconut, a common waste material where coconuts are grown and subsequently processed. Coir fiber is strong and degrades slowly in comparison to other natural fibers due to high lignin content. The degradation of coir depends on the medium of embedment and climatic conditions and is found to retain 80% of its tensile strength after 6 months of embedment in clay (Rao and Balan, 2000).

II. MATERIALS AND METHODS

In order to study the effectiveness of using coir fibers and lime stabilization for improving the subgrade properties, tests were conducted on samples reinforced with the same. The properties of materials used for experimental investigations are presented below.

Cochin Marine Soil

The marine soil collected from Kundanoor region in Ernakulum district, obtained from a bore hole depth of 15m from the construction site of a three storied building is used for the study. Hydrometer analysis was conducted on the soil sample as per IS specifications (IS: 2720 (Part 4) - 1985) and the results are presented in Fig. 3.1. Liquid limit and plastic limit was determined as per IS specifications (IS: 2720 (Part 5) - 1985). Specific gravity of soil was determined according to IS: 2720 (Part 3) - 1980. Water content - dry density relationship was found out using light compaction test as per IS: 2720 (Part 7) - 1980.The properties of marine soil are Specific Gravity = 2.53, Liquid Limit =46.5%, Plastic Limit = 27.9 % , MDD = 1.66g/cc, OMC = 20%, Unconfined Compressive Strength = 341.2 kN/ m2.

Figure: 1 Marine soil

Coir Fibre

The coir fibers used for the study was collected from Coir Flex factory in Alappuzha district. It was air dried to remove moisture. The coir fiber used was of diameter 0.15mm. Coir fibers of aspect ratios (ratio of length of the fiber to its diameter) of 60, 80 and 100 were used. It was cut into various lengths as a natural reinforcing material. Unconfined Compressive Strength = 346.14kN/m2.

Paper Sludge Ash

The paper sludge used for the study is collected from Hindustan Newsprint Limited, Peruva at Kottayam district. Here deinked paper sludge is been used. The paper sludge used contains calcium carbonate (CaCo3) which is then burned at 700-800 degree Celsius, and this CaCo3 is converted to calcium oxide (CaO) that is lime. Lime thus improves the cementitious and pozzolanic properties.

III. LABORATORY EXPERIMENTATION

Based on Indian standard procedures various tests were carried out in the laboratory for finding the geotechnical properties of Cochin marine soil, waste paper sludge ash and coir fibre used during the study.Unconfined compression test and compaction behaviour using standard proctor test were conducted by using different percentages of waste paper sludge ash and coir fibre when mixed with marine soil and found out the optimum percentages for

both admixtures.The details of the tests are given in the sections.As per the IS specifications laboratory eeperiments were conducted.

Specific gravity : The specific gravity of the soil has been determined using pycnometer , as per IS: 2720 (part III - 1980).

Grain size analysis : The sieve analysis of the soil has been conducted using Hydrometer as per IS :2720 (part IV-1965).

Liquid limit : The test has been carried out using the standard Casagrade apparatus as per IS 2720 (part V – 1965).

Plastic limit : The plastic limit has been determined according to the IS : 2720 – (part V -1970).

Standard proctor test : Compaction behaviour has been found out as per IS : 2720 –(part VIII -1980).

Unconfined compression test : The UCC test were conducted by using unconfined compression testing machine. According to IS: 2720 (part 10 – 1973). Different UCC ratios was selected for the waste paper sludge ash and coir fibre which is mixed with marine soil and the details are given in table 1.

Table 1 Different percentages of waste paper sludge ash and Coir fibre

Admixture	Different percentages (%)
Waste paper sludge ash	8,10,12
Coir fibre(10 and 20 mm length)	0.6%,0.8%,1%

IV.RESULTS AND DISCUSSIONS

Index properties : The results of specific gravity test using pycnometer was obtained as 2.53.The liquid limit of plain soil is 46.9% and when it is mixed with waste paper sludge ash (WPSA) with different percentages can be seen that with the increase in the percenage of ash the liquid limit also increases from 46.9% to 53.33%.The plastic limit tests on marine soil with different percentages of WPSA shows that as the percentages increases the plastic limit of soil goes on increasing from 27.79% to 35.68%.The maximum value was obtained for 10% of WPSA.

Compaction : From the test series conducted with WPSA for the percentages 8%,10%,12 % it is observed that the maximum dry density increases from 1.66 g/cc to 13.012 g/cc at 10% of WPSA beyond which it decreases as shown in Figure. For coir fibre test series maximum dry density was observed at 0.8% of fibre content 10mm length as shown in Figure.

Unconfined Compression Test (UCC) : The results of UCC tests on marine soil treated with different percentages of waste paper sludge ash and coir fibre are shown in Figure.From the results it can be seen that with the increase in percentage of ash content the UCC value increases to 1.47% for 10% of WPSA. As the coir fibre content increases the UCC ratio also increases and the maximum value was observed at 0.8% of fibre content for 10mm length as 1.418.

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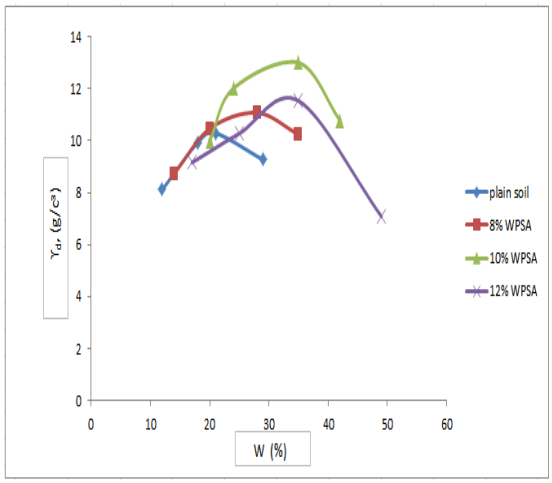

Figure : 2 Compaction behaviour of marine soil with WPSA

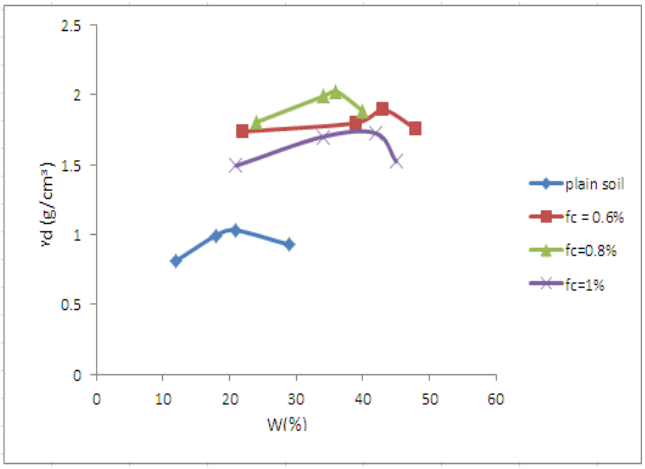

Figure : 3 Compaction behaviour of marine soil with Coir Fibre

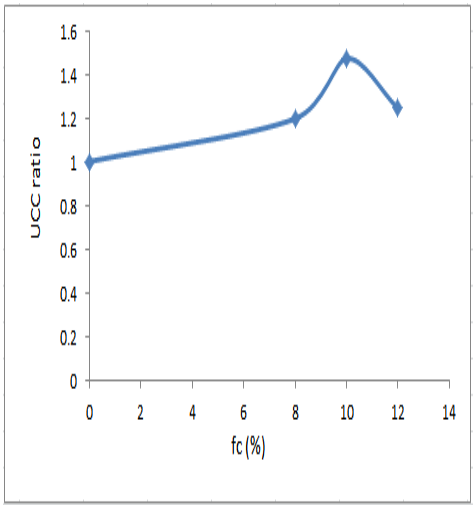

Figure : 4 unconfined compressive strength of WPSA on marine soil after 28 days curing

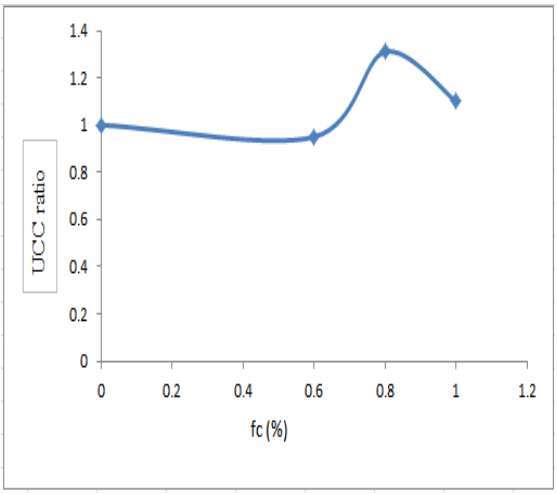

Figure : 5 unconfined compressive strength of coir fibre on marine soil of 10 mm length after 28 days curing

V.CONCLUSION

1. Optimum values of UCC ratio for coir fiber reinforcement was obtained for a fiber content of 0.8% for all the Test series.

2. As the fiber aspect ratio increases, the UCC strength of Cochin Marine Soil was found to be increasing.

3. UCC ratio as high as 1.418 was obtained for coir fiber reinforcement at a fiber content of 0.8% at a length of

10mm. 4.Optimum value of UCC ratio for ash treated soil was obtained for an ash content of 10%.

5. UCC ratio as high as 1.47 is obtained for ash treated soil at a ash content of 10% at a curing period of 7 days.

6. The influence of fiber aspect ratio and ash content has significantly influenced the strength of the soil and was found that the strength increased two times than that of plain soil.

VI.REFERENCE

- Dr.A.K. Sharma: **"**Review on Stabilization of Soil Using Coir Fiber"International Journal of Engineering Research Volume No.4, Issue.6, 01 June 2015.
- Meenu Prakash: "Comparison Between Paper Sludge and Rice Husk Ash as A Stabilizing Agent for Soft Soil" www. Iosrjournals.org International conference on Emerging trends in Engineering and Management
- Norazlan Khalid, Mazidah Mukri, Faizah Kamarudin, Mohd Fadzil Arshad**:** "Clay Soil Stabilized Using Waste Paper Sludge Ash (WPSA) Mixtures", *EJGE*, vol. 17(2012)
- Abhinav Rawat, Anupam Mital**: "**A Review Paper On Soil Stabilization Using Different Traditional and Non-Traditional"**,** ijrrest international journal of research review in engineering science & technology.
- Bindu Sebastin, Sobha Cyrus, Babu.T. Jose: **"**Effect of Inclusion of Coir Fiber On the Shear Strength of Marine Clay"; proceeding of India Geotechnical conference, December 15,2011, Kochi.
- Amu O.O; Fajobi A.B And Afekhuai S.O**:** **"**Stabilizing Potential of Cement and Fly Ash Mixture On Expansive Soil", Journal of Applied Science (2005).