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UCS study and review of clayey soil

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Abstract: ***In engineering, soils plays an very important role in construction because whenever we starting any type of project firstly we have to analysis the properties of soil. In many projects engineers have to face various types of difficulties while constructing pavement & road designing in low strength soil such as developing cracks ,pavements settlements. In this paper, we will tell how to enhance the strength of soil by adding various types of admixtures and how to use supplementary binders coming from the solid waste. And therefore, various tests have been performed to predict the consistency limits of particular soil.***

Index Terms :- **BLAST FURNANCE SLAG, CLAYEY SOIL, FLY ASH , SOIL STABILIZATION,UNCONFINED COMPRESSIVE STRENGTH(UCS)**

1. INTRODUCTION

Nowadays, each and every countryget developed day-to-day in construction activities whether it's roads, malls, etc and for all this construction, soil stabilizationplays an important role just like for any construction projects , firstly werequired stabilized soil because soil base behave like a foundation and then after this further construction get startedfor example,highway and runway required stabilized soil for its foundation and on this soil foundation whole construction get depend . In simple words, soil stabilization is the process to improve the properties of soil such as strength, plasticity, durability, permeability and compressibility. As per the research, improving the properties of soil required more cost and the best way to tackle this problem is to utilize waste material like blast furnace slag, rice husk , fly ash ,etc and this actually reduces construction cost.

In this paper, we will discuss that how to evaluate the strength of clayey soil by using various waste materials. And for stabilization of clayey soil we have to perform various test as per the procedures with different of additives such as CBR Test, UCS Test. As we discuss earlier, soil stabilization is a method in which soil get improve and which also increases the strength of soil. This process is only get possible by adding various suitable admixture like industrial waste, rice husk , blast furnace, etc. Nowadays, various new technique comes in a market, in which quantity of waste material get reduces and improves the soil by adding non-recyclable waste material such as plastics, bamboos, fly ash ,etc. According to CPCB (Central Pollution Control Board) more than 9200 tons a day of plastic waste get accumulated in India. India will manage plastic waste in two ways. The first is recycling of waste material into other materials. The second method is incineration but it will required right equipment because incineration is very much expensive and cause various type of pollution. After incineration, this waste product get used in soil stabilization.Nowadays this incineration waste product plays an very important role in construction of roads and embankments.

2. MATERIAL

2.1 Rice husk ash : Nowadays, rice has become one of the most cultivated crop all over the world and the process of separating of rice grain from its husk produce huge amount of waste material and which does not decomposed easily. But the fact is that rice husk contain silica and if we use this silica somehow in constructionpurpose then we over all reduce cost of projects.

2.2 Blast furnance slag:- Blast furnace slag is a nonmetallic calcium-silicate-based product removed from the top of molten iron during its extraction from ore in a blast furnace. Depending on the cooling method the BFS can be produced as air-cooled, granulated, expanded and pelletized (De Brito and Saika, 2013; Patel et al., 2004).

3. LABORATORY STUDIES

Unconfined compressive test is used in all geotechnical designs because it is one of the quickest and affordable methods of measuring shear strength of soil.
Unconfined compression test is basically a laboratory method. It is the special case of tri-axial test in which confining pressure test is zero it means there is no first stage. Hence, no rubber membrane is required and without rubber membrane dry soil and sand can't be held in position hence this is applicable for saturated clays and silts.

Apparatus required for unconfined compressive test

1. Unconfined compression apparatus.
2. Dial gauge and ring dial gauge.
3. Weighing machine and oven.
4. Stop watch and sampling tube.
5. Vernier calipers.
6. Long Spilt mould
7. Knife and sample extractor

Procedure

- Firstly collect the sample of soil by pushing a sampling tube into the ground.
- Proper grease/oil inside the split mould to prevent from the sticking problem.
- Now by a suitable method, saturate a soil sample in the sampling tube.
- Eject the sample from the sampling tube to the split mould with the help of knife or extractor.
- Now the ends of the specimen will be trimmed in the spilt mould and get weighted.
- Remove the specimen from the split mould.
- Now measuring the dimension of specimen such as length, diameter with the help of vernier caliper.
- Then the sample should be placed between the bottom and top plate of the compression machine.
- Adjust the dial gauge and provide ring dial gauge to zero.
- Now a compression load is applied, so that the lower plate of the machine rises to produce an axial strain at a rate of ½ to 2% per minute.
- The dial gauge and ring dial gauge reading should be note down from time to time.

- Compress the specimen till its fail or 20% vertical deformation is reached, whichever is earlier.
- Now finally, the sample is oven dried to determine its water content.

3. LITERATURE REVIEW OF SOIL STABILIZATION

Priyanka M Shaka et.al. studied on Laboratory investigation on Black cotton soils and Red soil stabilized using Enzyme. The most important aspect in any project is its durability and economic criteria

R.R. Singh et al studied improvement of local subgrade soil for road construction by the use of coconut coir fibers. 0 to 1% White coir fibers were used for the investigation having diameter 0.5mm and length 3 to 5cm. Sample were tested in both soaked and unsoaked condition. Results showed that Unsoaked and soaked CBR values increases from 8.72% to 13.55% and 4.75 to 9.22% respectively. Unconfined compressive strength ranges between 2.75kg/cm2 to 6.33kg/cm2 with an addition of white coir.

Arpansenet al.st studied Soil stabilization using waste fiber materials This study investigate the use of waste fiber materials in geotechnical applications and to evaluate the effects of waste polypropylene fibers on shear strength of unsaturated soil by carrying out direct shear tests and unconfined compression tests on two different soil samples. The results obtained were compared for the two samples and inferences are drawn towards the usability and effectiveness of fiber reinforcement as a replacement for deep foundation or raft foundation, as a cost effective approach.

Hossain *et al.* (1991) conducted a study to examine the characteristics of alluvial silty soils with ordinary Portland cement and Portland cement-rice husk ash blend to assess their applicability for low volume road construction

4. RESULT AND DISCUSSION

The UCS results indicated that the unconfined compressive strength of the tested soil is 5.99 kg/cm2, but with the increasing proportions of rice husk ash, this value increases gradually and for mixing of 5% RHA with soil, the said value becomes 6.68 kg/cm2. However further increment of RHA, this value decreasing gradually with small variation and for addition of 20% RHA, this value remains as 6.65 kg/cm2 without mixing of any lime.

5. CONCLUSION

From this experimental study, the following conclusions can be made:

i) Utilization of waste materials like rice husk ash ,blast furnance slag in bulk quantity in the construction of subgrade/embankment for road project can reduce the accumulation hazard and environmental pollution.

ii) Addition of rice husk ash and lime in increasing proportion with the alluvial soil decreases the maximum dry density of the mixed soil. However the optimum moisture content of the mixed soil increases gradually with the increased percentage of rice husk ash and lime due to higher demand of water of rice hush ash for achieving maximum density compared to the virgin soil and as well as chemical reaction among these materials.

iii) The unconfined compressive strength increases gradually for addition of increasing amount of lime with the alluvial soil. Further mixing of rice husk ash upto 5% with clayey soil and with the increasing amount of lime upto 3%, this value increases again. However significant increment in the UCS value has been observed when 10% rice husk ash added with soil and 3% of lime and this value become as 15% more than the corresponding value of the virgin alluvial soil. So this mixed soil can be used as construction of subgrade of roadway pavement and will act as cost effective mix by reducing the individual layer thickness of pavement.

iv) After curing, the contribution of lime is become more prominent to enhance unconfined compressive strength of tested soil stabilized with varying proportion of lime and RHA.

REFERENCCES

Priyanka M Shaka (2016), ì Laboratory investigation on Black cotton soils and Red soil stabilized using Enzymeî , International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395 -0056, Volume: 03 Issue: 06