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STUDY OF THE STRENGTH CHARACTERISTICS OF THE SOIL PROCESSED WITH FLY ASH AND RECRON 3S

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Abstract - *This paper summarizes the ongoing researches about the strength characteristics of soil Processed with Fly Ash and Recron 3S. The main focus of this research was to improve the strength of soil & to obtain a optimum amount of soil- fly-ash – recron 3s mix. The objective of study was to increase the strength of clayey soil using fly ash & recron 3s. As we know fly ash act as a cement material & recron 3s act as a reinforcing material. As clay shows high shrinkage, swell characteristics & low bearing capacity. There is a need to improve the strength characteristics. So the main focus of this research was to increase the strength characteristics of soil. The tests performed in laboratory was Pycnometer test for specific gravity, Casagrande's test for liquid limit, plastic limit test, Standard proctor test for determination of OMC & MDD, unconfined compression test & Direct shear test. Proportional of the recron 3s used was 0.2, 0.4, 0.6, 0.8 & 1.0 % and proportional of fly ash was 10, 15,20,30,40 & 50%.*

***Key Words*: OMC, Direct Shear Test, Optimum Moisture Content, Maximum Dry Density, Fly Ash.**

1. INTRODUCTION

Soil means earth's upper layer, which may be furrowed or dug, chiefly the separate material of the earth where plants and organic matter develops according to the Webster's dictionary. The word soil is derived from solium a Latin word. Soil is a material naturally available in universe. The cheapest available construction material is also soil, on the same hand it is very complex material too. Study of soil mechanics is complex thing too in itself. The high variability in characteristics and composition makes soil a complex material. The behaviour of soil varies from place to place and also with the change in the naturally occurring conditions changes the behaviour of the soil. The very first duty of geotechnical engineer s to check whether the engineering property of soil matches to the design requirements of an engineering structure or not.

1.1 General

This is very common problem for a construction engineer that the soil available at a particular site is unsuitable for the construction work. Strength, durability, stability and permeability are the main engineering properties of soil with which the soil engineer is concerned. Insufficient strength is a soil problem in many forms construction buildings, tunnels and other excavation, roads, air fields etc. this problem can lead to economic loss, and in also may lead to loss of human lives too. The study of engineering characteristics of soil is concerned with the stability of retaining structures, stable foundations, stability of slopes, earthen dams and underground structures, pavement construction.

Because of complex behaviour of the soil with respect to the engineering properties the soil has rendered it to following limitations.

- Theory of elasticity cannot be applied due to the non linear stress strain relationship.
- Strength and behaviour of soil depends on drainage, pressure, environment and many other factors, because of this same soil show different strength and dissimilar conditions.
- Soil at different locations is different in characteristics and composition so the results of soil at one place are different from other place.
- Interpretation of the results of tests not possible. Soil being a particular material the properties of soil changes as the particles shifts the positions

1.2 Statement of the problem

Method chosen here in present study is reinforced earth stabilization. Due to the availability of variety of materials commercially at cheaper rates has take momentum of use of reinforcement in improving the strength parameters of geo materials. Earth

reinforcement involves the basic principles which are simple and are used by mankind for centuries. The essential characteristics of earth reinforcement are that it is made up of two kinds of elements, reinforcement and soil grains. The basic mechanism of earth reinforcement is the generation of the frictional forces between the reinforcement and soil. Previous research has been done to find out the suitability of compacted fly ash in geotechnical construction like retaining walls, embankments etc. on the other hand these structures are needed to be protecting from getting wet in case to prevent the inherent strength of compacted pond ash, which is difficult to do in fields. Having this issue in mind fly ash soil has been modify the stress – strain behaviour of destabilized material, reinforcement has been used in the form of recron 3s fibre. Effect of fibre reinforcement on the stress – strain behaviour, strength parameters of the compacted mixes has been evaluated through a series of unconfined compressive stress tests, direct shear tests. From the results shown that the addition of fibre reinforcement is very proficient in increasing the failure load.

2. LITERATURE

SANTONI ET AL. (2001) in this study investigation was done on non plastic cohesion less soil which was reinforced with monofilament polypropylene fibre with dia. = 4, 15, 20 fibre length= 13 to 51mm and fibre content = 0to 1%. UCS test was performed at 2.6% base moisture content and 14% saturation. From UCS the obtained results that 0.8% fibre is optimum. Whereas at fibre content less than 0.6% causes softening and more than 0.85% leads to cause hardening. Also compressive stress improves gets improved by increasing aspect ratio.

KUMAE ET AL. (2008) in this study black cotton soil with properties (specific gravity =2.72, LL=68% PL=49.65% OMC=29.4% and MDD=1.32gm/cc was reinforced with polyester synthetic. Also fly ash and lime are added to the soil. The investigation was done unconfined compression of randomly distributed fibres, lime and fly ash on the geotechnical characteristics of expansive soil. The result obtained shows that the fibre is more efficient when soil is subjected to tension rather than compression.

CHANDRA ET AL. (2008) in this study effect of polypropylene fibre was observed. Three different types of soils; clay, slit and silty sand were reinforced with polypropylene fibre of 0.3mm dia. Fibre was in cut pieces of length 15, 25, 30 mm and aspect ratio of 50, 80 and 100 respectively. The amount of fibre was 0.75, 1.5, 2.25, and 3% by dry weight of soil. Static triaxial test of unreinforced and reinforced soil were conducted and the results showed uniaxial compressive strength of 3.82, 4.83 and 9.73 Mpa respectively.

VISWANANDHAN B.V.S (2009) in this study the objective was to show the demonstrate the effect of randomly distributed fibres : (a) restraining cracking affinity of clay barrier subjected to differential settlement b) reducing swelling affinity of moist-compacted soil . Here in this study polyester fibers were used named as recron 3s. It is concluded that using recron 3s is a very effective method. It helps to hold back cracking of clay barrier of differential settlements. It is here advised to use homogeneous mix of geofiber- reinforced soil (GRS) as substitute fill material where expansive soil deposits are at the construction sites. Separate fibres are normally added and mixed with soil like as cement, lime etc and compacted well.

AYYAPAN S. ET AL. (2010) they stated in their study that fly ash is a waste merchandise and cause environmental pollution if it is not used properly, and also studied the influence of randomly distributed fibers on engineering properties of fine grained and coarse grained soils. Earlier the influence of randomly oriented polypropylene fibres in fly ash- soil mix has not been done in case of soil. This study was aimed to identify and quantify the influence of fibre variable i.e. content and length on performance of fibre reinforced soil-fly ash specimens. No. of UCS and CBR tests were carried out. Fibre was of different lengths 6mm, 12mm, and 24mm were used and the soil- fly ash mixes were compacted at MDD with low percentage of fibre i.e, 0 to 1.5% by weight.

SHARAN ALOK (2011) in this study the focus is on geo-engineering properties of compacted pond ash with fibre recron 3s inclusions in the strength properties of pond ash through direct shear test. UCS and CBR test. In the mix proportions the fibre was varied as 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6,0.7,0.8,0.9,1% of dry weight of pond ash. 6mm and 12mm fibres were used in this study. The undrained cohesion of reinforced specimens was increased with the fibre content. Also 12mm showed higher strength than of 6mm sized fibers.

SHARMA R. K.(2012) in this study author stated that the expansive soil causes no. of civil engineering

structural damages , especially to the low rise building. Laboratory work done here is on recron 3s of length 6mm and 12mm, fly ash and soil. Properties like grain size distribution, moisture- density relation and CBR are studied for soil mixed with fly ash in range of 20-80%. Ratio 70% soil and 30% fly ash was used further for addition of recron 3s fibre in range of 0.5-1.5%. From CBR test the best proportion was 70: 30: 0.5%.

KHUNT KRISHNA (2013) in this study the stabilization black cotton soil used as sub grade material for road is done. As the bituminous roads are affected by temperature, traffic load, rainfall etc. these problems are solved here by using fly ash, lime and recron 3s. These materials were mixed in various proportions and were investigated by CBR test. 84% soil, 12% fly ash, 3% lime and 1% recron 3s by weight was the best proportion was achieved by CBR test. It was concluded that when the recron 3s was mixed with soil and fly ash the results were excellent as it may results in solving problems like cracking, potholes and failure of pavements.

3. PROPOSED WORK

The main aim of the research work in this dissertation was to concern itself with In the present experimental study, the soil's properties are improved by the addition of fly ash and recron 3s fibre. Fly ash will be used as stabilizing agent to improve some properties and the recron 3s will be acting as the reinforcement's material. Both fly ash and recron 3s fibre worked well to improve the properties of soil which are unconfined compressive strength.

4. CONCLUSIONS

On the basis of the investigation, the following conclusions have been made:

- With the increase in quantity of fly ash OMC value increases MDD decreases.
- When the recron 3s fibre quantity increases the OMC values increase and MDD decreases.
- 15% fly ash was optimized for the further work.
- The best value obtained from results of UCS for 1 week and 2 week curing period is 672.1KN/m^2 and 710.2 KN/m^2.
- The best ratio obtained was 84.2% soil: 15% fly ash : 0.8% recron 3s.
- With the increase of recron 3s in soil fly ash mixes the cohesion intercept and angle of shearing resistance increases
- The best value of cohesion intercept and angle of shearing resistance are 62.2KN/m^2 and 29.1^0 respectively.

5. FUTURE SCOPE

- Here in this study compaction test, UCS test and direct shear test are performed, for further work CBR value, triaxial test, permeability, durability test should be performed.
- Other proportions should be tested for better use of fly ash and recron 3s.
- UCS test is performed here for 1 and 2 week, the curing period should be increased.
- Direct shear test should be performed with curing period.
- The work here is done on clay soil, work using recron 3s and fly ash should be performed on other type of soil.

REFERENCES

1. Alok Sharma (2011) "*strength characteristics of fibre reinforced compacted pond ash*" Thesis submitted at NIT Rourkela, may 2011

2. B. Pandey, K. Bajaj and AP Singh (20130 " *soil stabilization using pozzolanic material and jute fibre*" proceedings of Indian geotechnical conference, December 22-24, 2013 roorkee.

3. B. V. S. Viswanadham (2009) IIT Bombay, "*model studies on geofiber- reinforced soil*" IGC 2009 Guntur, India.

4. Kumar, A.., Walia, B.S. and A. bajaj (2008) " *influence of fly ash, lime and polyester fibres on compaction and strength properties of expansive soil*" journal of materials in civil engineering, vol.19(3), 2008: pp. 242-44.

5. Krishan khunt (2013)" *use of additive material in sub grade for road construction*" IJJETT-vol. 4.

6. S. Chandra, M.N. and P.P Nagrale (2008) "*mechanistic approach for fibre reinforced flexible pavements*" journal

of transportation engineering, vol. 134(1)(2008): pp 15-23.

7. Ravi mishra and S M Ali jawed (2014) "*geo fiber reinforced fly ash for ground improvement*" GJESR RESEARCH PAPER VOL. 1 ISSN: 2349-283X

8. R.K Sharma (2012) NIT Hamirpur " *subgrade characteristics of locally available mixed with fly ash and randomly distributed fibres*" ICEES 2012 march 17-18, 2012 Bangkok.