EXPERIMENTAL INVESTIGATION ON STRENGTH IN CLAY SOIL USING CALCIUM CARBIDE RESIDUE

R.Siva[1] J. Krishna Kumar[2] R.Hariharasuthan[3]

1, 2, 3 UG Scholar Civil Engineering, Arjun College of Technology, Coimbatore.

Abstract: The paper presents the Clay soils have the tendency to shrink when their moisture content is decrease and swell when their moisture content is increased. CCR is the one, which is produced in plenty of quantity. In each crusher unit about 20-25% of the production is CCR. In bulk use of CCR is possible through geotechnical applications as, Back-fill material, embankment, sub base material. It is a by-product of the acetylene gas production. CCR (Calcium Carbide Residue) as a treatment of soil is a technique to save Money and time on construction projects. Transform of clay soil into workable, compactable, friable material when CCR used. By CCR stabilization chemical changes in unstable clay soil which have long term effects. Experiments performed on CCR combined at different percentage with expansive soil .The test results such as Standard Proctors test, direct shear test, and unconfined compression strength obtain on clay soil. From this study conclusion drawn that the combination of equal amount of CCR is more effective, which is (5, 7, 9%) than the addition of CCR, to the clay soil in controlling the swelling behaviour.

Key words: Clay soil, Normal soil, Calcium Carbide Residue, Direct shear test, unconfined compression test.

I INTRODUCTION

Soil is defined as sediments or other accumulation of mineral particles produced by the physical or chemical disintegration of rocks plus the air, water, organic matter and other substances that may be included. Soil is typically a non-homogeneous, porous, earthen material whose engineering behaviour is influenced by changes on moisture content and density. Clay soil or clayey soil greyish in colour. Some clayey soil contains montmorillonite clay mineral which has high expansive characteristics. Montmorillonite is the most common of all the clay minerals in expansive clay soils. The mineral made up of sheet like units. Clay soils are inorganic clays of medium to high compressibility and form a major soil group in India. Clay soil has a high percentage of clay, which is predominantly montmorillonite in structure and pale grey or blackish grey in colour. Because of its high swelling and shrinkage characteristics, the Clay soil has been a challenge to geotechnical and highway engineers. The soil is very hard when dry, but loses its strength completely when in wet condition. The wetting and drying process causes vertical movement in the soil mass which leads to failure of a pavement, in the form of settlement, heavy depression, cracking and unevenness.

II MATERIALS

- Soil sample-1(clay soil)

Location: Valparai, Coimbatore.

- Soil sample- 2(Normal soil)

Location: Thamaraikulam, Coimbatore.

- Calcium carbide residue ,from manure shop

2.1 CLAY SOIL

Clay soils are inorganic clays of medium to high compressibility and form a major soil group in India. Clay soil has a high percentage of clay, which is predominantly montmorillonite in structure and black or blackish grey in colour. Because of its high swelling and shrinkage characteristics, the Clay soil has been a challenge to geotechnical and highway engineers. The soil is very hard when dry, but loses its strength completely when in wet condition. The wetting and drying process causes vertical movement in the soil mass which leads to failure of a pavement, in the form of settlement, heavy depression, cracking and unevenness.

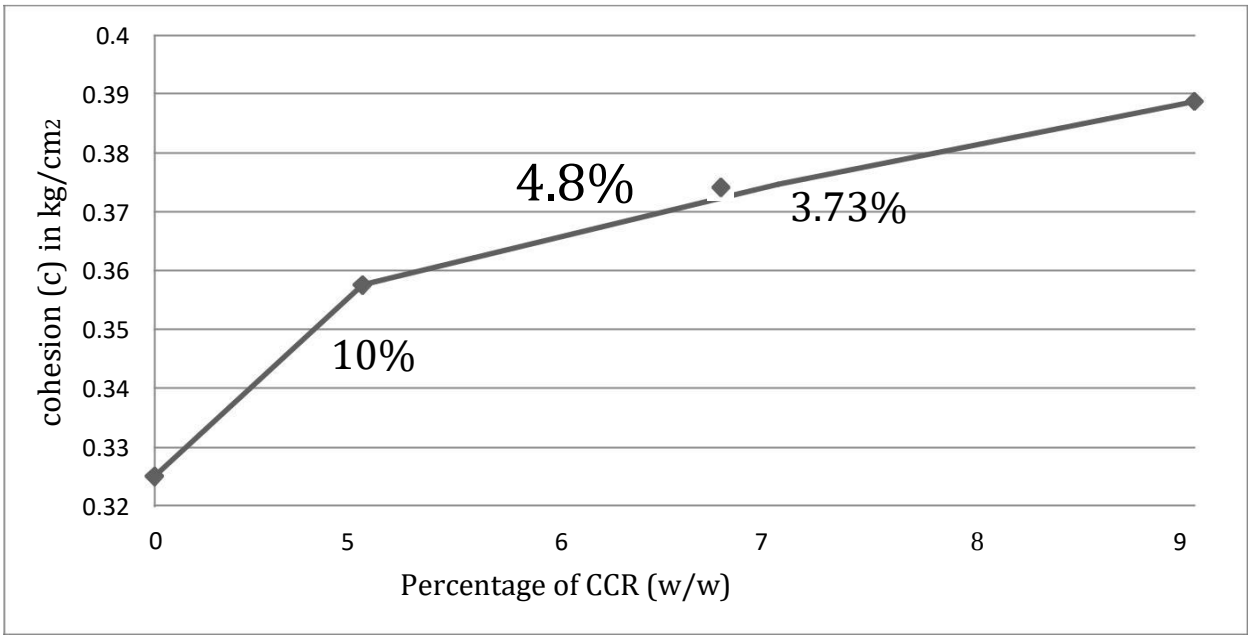
2.2 CALCIUM CARBIDE RESIDUE

CCR is a by-product from the acetylene gas production. This gas is used around the world for welding, lighting, metal cutting and to fruit ripen. The calcium carbide residue is produced by a simple process, which is obtained from a reaction between CCR and water to formation of acetylene gas and calcium hydroxide in a slurry form of calcium carbide residue mainly consists of calcium hydroxide Ca(OH)2, to improve the engineering properties of waste material by cementing agent it is an optional means of producing usable materials. High unit cost and energy intensive procedure of Portland cement are heavy force for the alternative cementitious additives.

III RESULTS & DISCUSSION

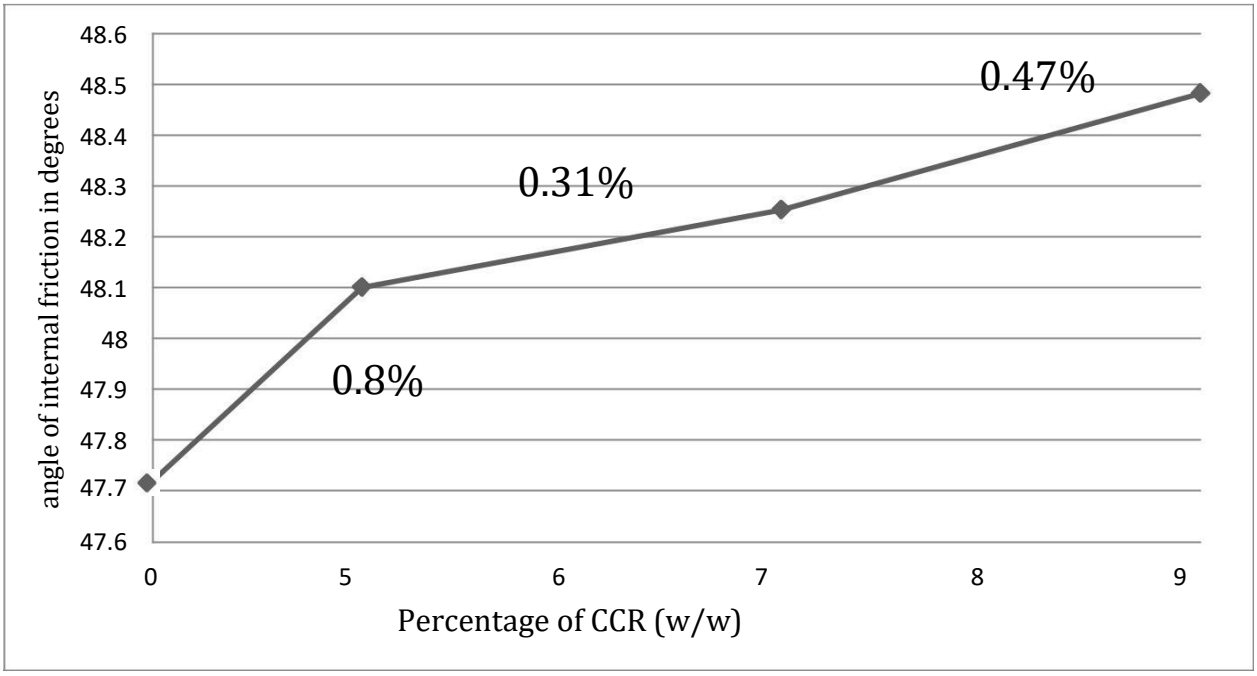
(a) cohesion and CCR content Soil

sample- 1



(b) angle of internal friction and CCR content

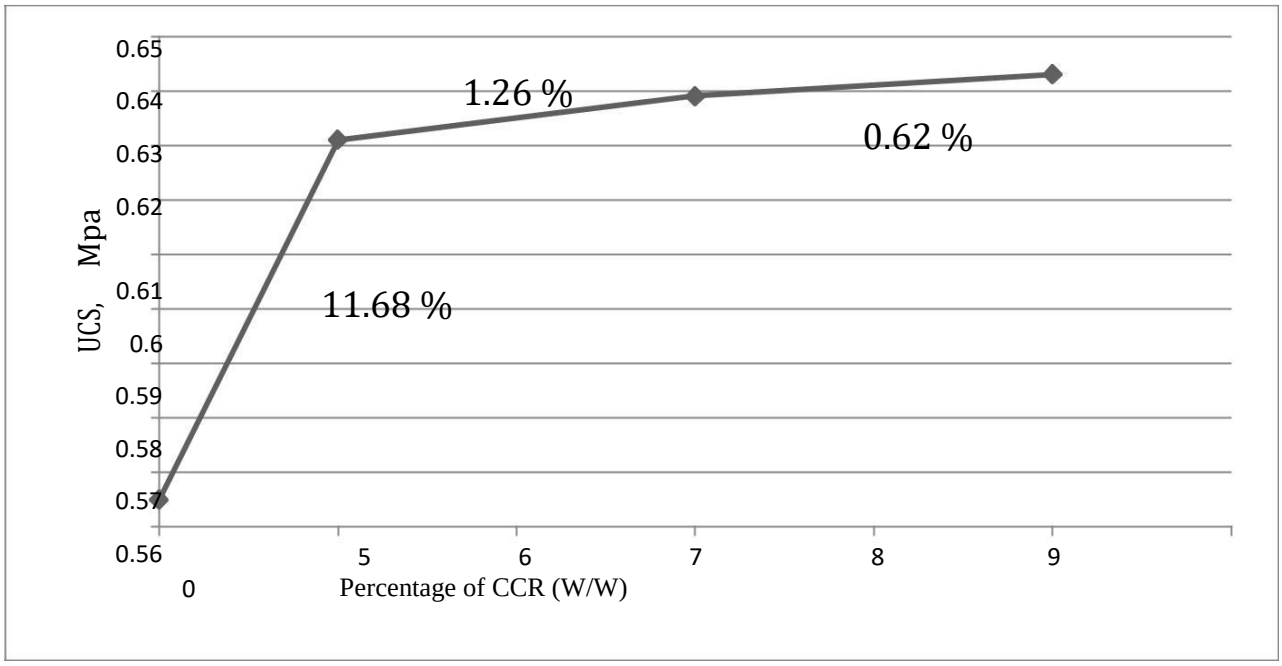
Soil sample- 1



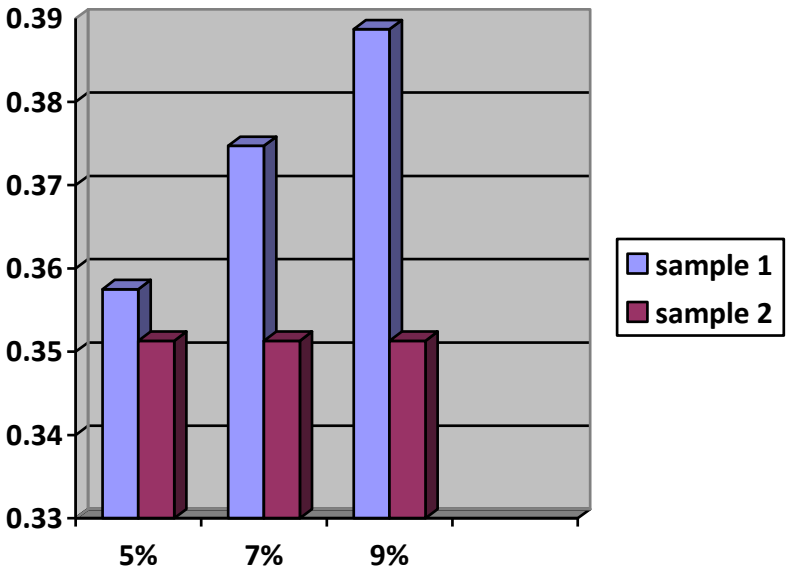
(c) The relationship between the UCS and CCR content

.

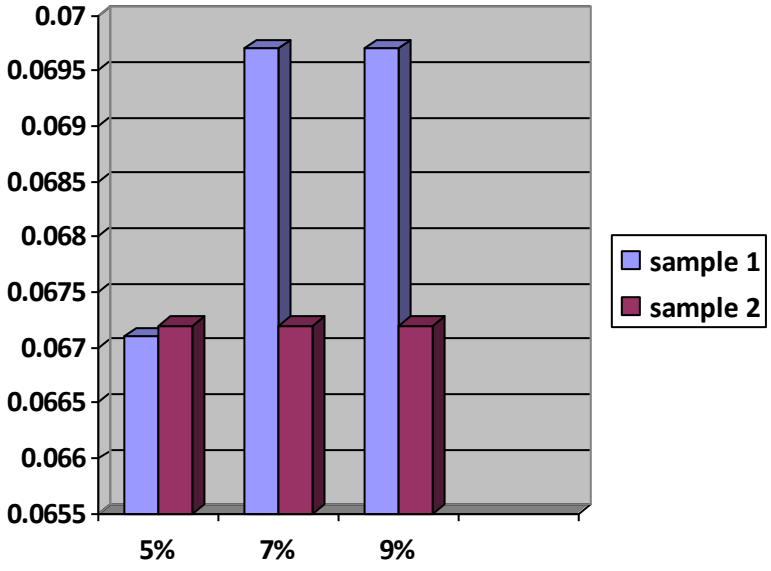
Soil sample- 1



Comparison of shear strength between soil sample- 1 and soil sample- 2



Comparison between soil sample-1 and soil sample- 2 for UCS



IV CONCLUSION

On the basis of present experimental study, the following conclusions are drawn:

- Based on direct shear test on soil sample- 1, with CCR of 5%,7%and 9%. The increase in cohesion was found to be 10%, 4.8% and 3.73% respectively. The increase in the internal angle of friction (φ) was found to be 0.8%, 0.31% and 0. 47% respectively. Since the net increase in the values of c and φ.
- The results from the UCS test for soil sample- 1 are also similar, for reinforcements of 5%, 7% and 9%, the increase in unconfined compressive strength from the initial value are 11.68%, 1.26% and 0.62% respectively . This increment is substantial and applying it for soils similar to soil sample-1 is effective.
- In our project we compare normal soil strength with CCR mixed clay soil, in 5, 7, 9%, we get strength on 9% in direct shear test and 7% in unconfined compression test. overall it can be concluded that CCR mixed soil can be considered to be good ground improvement technique specially in engineering projects on weak soils where it can act as a substitute to deep/raft foundations, reducing the cost as well as energy.

V REFERENCE

- S. A. Naeini and S. M. Sadjadi ,(2008) ," Effect of CCR on Shear Strength of Unsaturated Clays", EJGE Journal, Vol 13, Bund k,(1-12).

- Yetimoglu, T., Inanir, M., Inanir, O.E., 2005. A study on bearing capacity of randomly distributed CCR sand fills overlying soft clay. Geotextiles and Geomembranes 23 (2), 174–183.

- Chaosheng Tang, Bin Shi, Wei Gao, Fengjun Chen, Yi Cai, 2006. Strength and mechanical behaviour of CCR and cement stabilized clayey soil. Geotextiles and Geomembranes 25 (2007) 194–202.

- Mahmood R. Abdi, Ali Parsapajouh, and Mohammad A. Arjomand,(2008)," Effects of

  CCR on Consolidation, Hydraulic Conductivity, Swelling,

  Shrinkage Limit and Desiccation Cracking of Clays", International Journal of Civil Engineering, Vol. 6, No. 4, (284-292).

- Consoli, N. C., Prietto, P. D. M. and Ulbrich, L. A. (1999). ''The behaviour of CCR mixed soil.'' Ground Improvement, London, 3(1), 21–30.