STABILIZATION OF BLACK COTTON SOIL WITH WASTE PLASTIC STRIPS

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Abstract

Black cotton soil is fine textured and clayey in nature. It has high amounts of lime, iron, magnesium and generally low quantities of phosphorus, nitrogen and organic matter.In this project an attempt is made to reinforce and stabilize black soil with plastic bottle strips. The plastic strips were prepared and added at different mixing ratio (2%,4%,6%,8% and 10%) by weight and in aspect ratio(2mm*10mm).The experimental results showed that there was a significant improvement in shear strength parameters. The swelling and desiccation cracking behavior of the soil were also expressively reduced. There was a substantial reduction in the optimum moisture content and slight increment in maximum dry density. The optimum plastic content that results in optimum result can be selected based on the importance of the selection parameter for a specified engineering work. Stabilizing Black soils with waste plastic bottles simultaneously solves the challenges of improper plastic waste recycling that is currently a teething problem in most developing countries. The results obtained from this study favorably suggest that inclusion of this material in expansive soils would be effective for ground improvement in geotechnical engineering.

Keywords: Black cotton soil, Plastic strips, Soil stabilization, Ground improvement

Materials and methods

This investigation has been carried out with Black cotton soil collected from Maheshwaram and PET waste plastic bottle strips. Basic properties of the soil such as its density and plasticity were determined. The soil sample was taken randomly from Maheshwaram, Rangareddy area. About 45 kg of sample was collected at a depth of 0.5m after site clearance of 0.2m from two different locations within one meter square area and brought to the soil mechanics laboratory for the experimental work. And as for the PET plastic strips, PET raw plastic bottle strips have been used with a length and width of 10mm and 2mm respectively. These sizes and percentages of plastic strips used with local expansive soil is adapted from previous work .

Accordingly four different percentages by weight were used. The prepared PET plastic strips to have sufficient room to act independently and free from pressure by confinement of the mold and excessive overlap.The properties of PET plastic which is

used for bottling of drinking water has globally accepted standard and properties of the PET strips is given in Table 1 as follows .

Table 1 . Properties of PET plastic

Behavior parameters	Values
Fiber Type	PET
Tensile strength	350MPa
Modulus of Elasticity	1800N/mm^2
Density	0.945
Melting point	590 c
Resistance to acidic and alkali actions	Very good

In this investigation an attempt has been made to study the effects and outcomes of inclusion of waste PET plastic bottle fiber strips with 10mm length and width of 2mm respectively on the engineering properties of the soil mainly maximum dry density and the optimum moisture content behaviors. In order to quantify the compaction behavior and to know the overall plasticity character of the soil due to inclusion of waste PET plastic bottle fiber strips, a series of Standard Proctor Compaction tests and Atterberg Limit tests (plastic and liquid limit tests) to measure the consistency,CBR tests,ucs tests,swell index texts were conducted on the reinforced (PET plastic inclusive) and unreinforced(no PET inclusion) samples with unreinforced as well as reinforced soil samples.

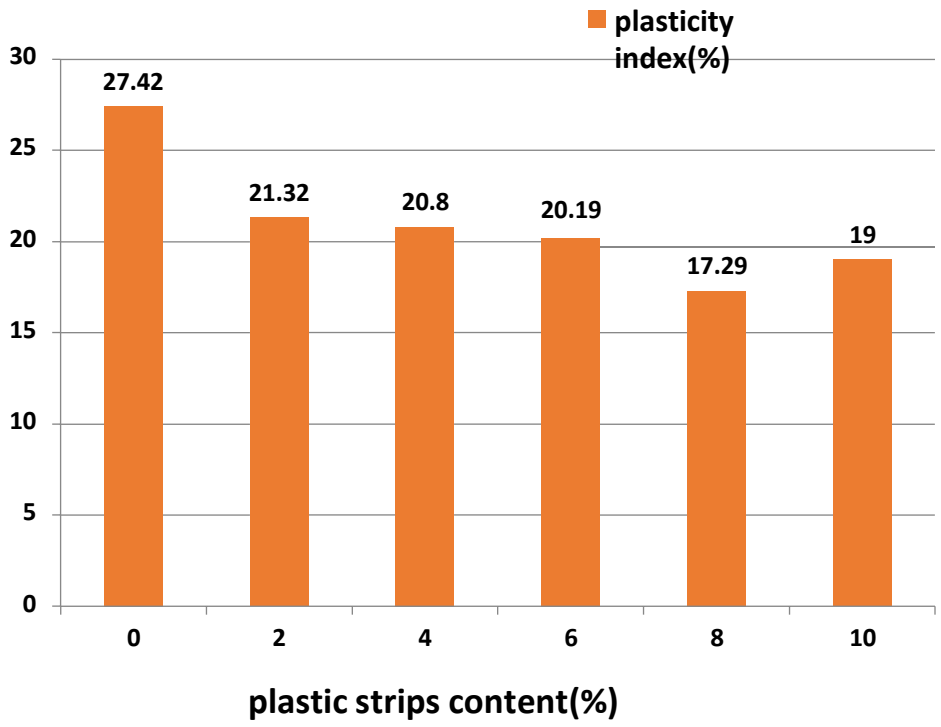
Plasticity index values

Table : 2

Platic in %	0	2	4	6	8	10
PL(%)	27.42	26.68	25	22.81	25.71	26
LL(%)	50.2	48	45.8	43	43	45
PI(%)	22.425	21.32	20.8	20.19	17.29	19

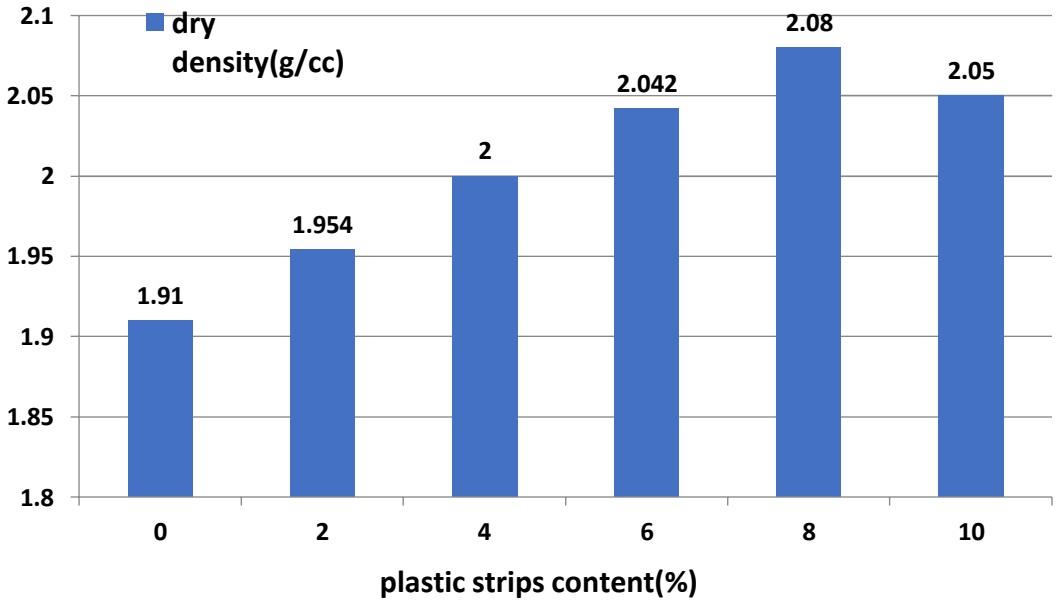
variation in plasticity index with different % of plastic strips

Graph : 1



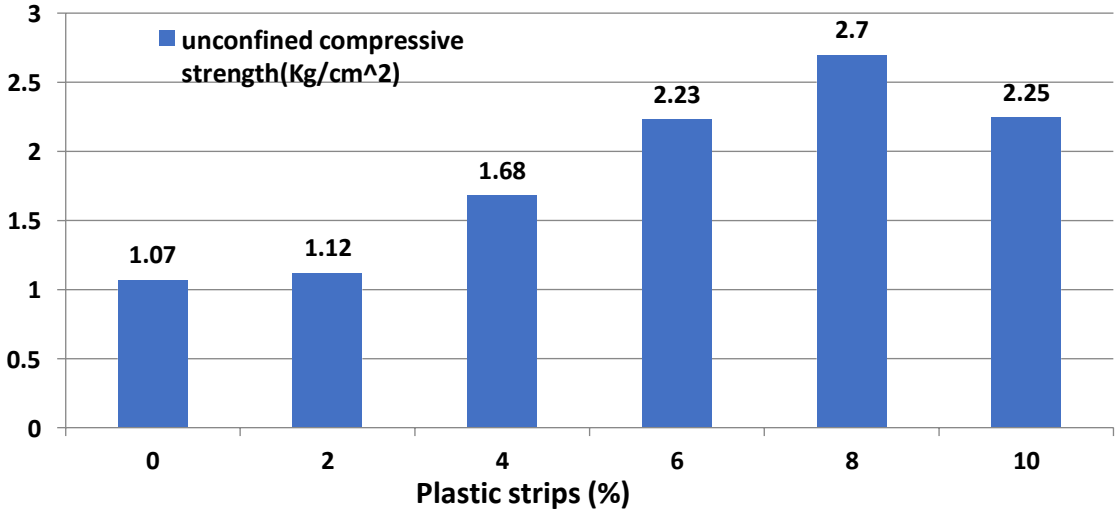
variation in dry density with different percentagesOf plastic strips

Graph : 2



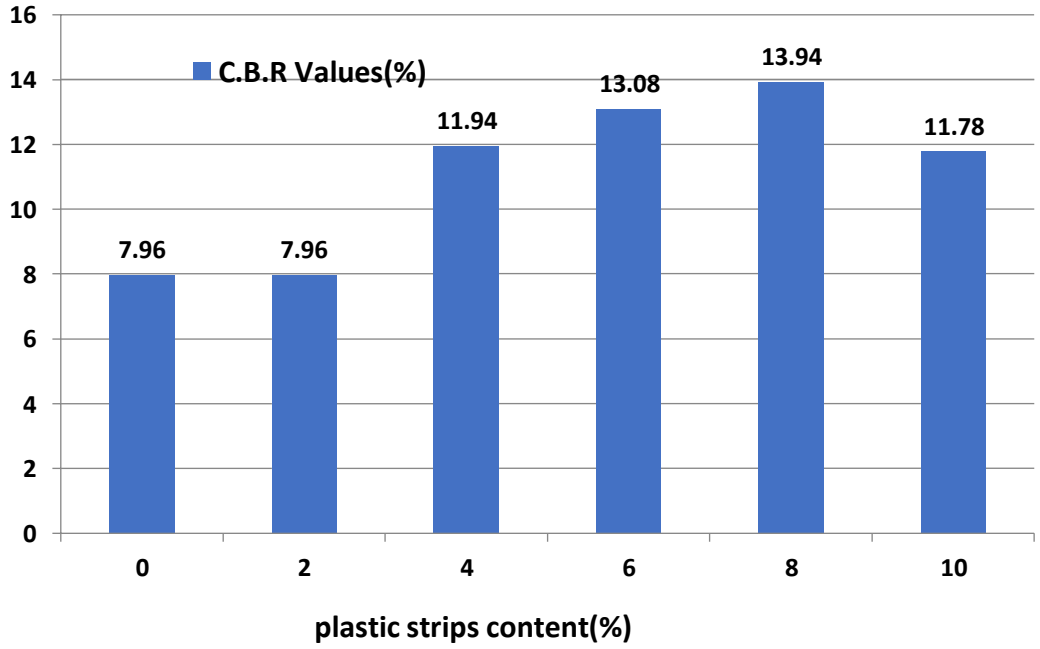
variation in ucc with different percentages Of plastic strips

Graph : 3

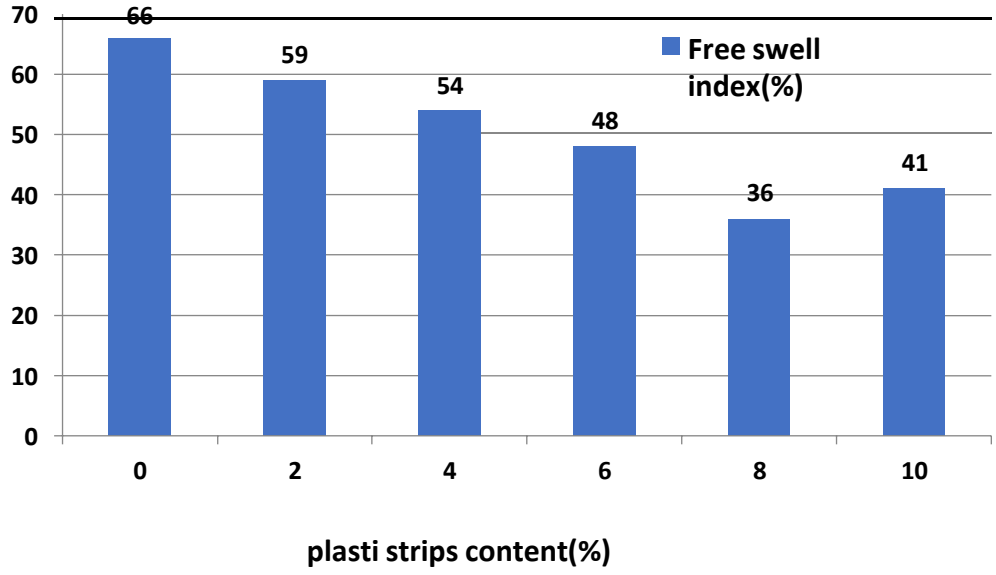


Variations in CBR values with different percentagesOf plastic strips

Graph : 4



Graph : 5 (Variation in FSI with different percentagesOf plastic strips)



CONCLUSIONS

- there is subtantial decrease in plasticity index when plastic strips were added from 27.42% to 17.29% at 8% plastic strips by weiht of soil

- There is substantial increase in MDD (Maximum dry density) with increase in addition of Plastic strip content up to 8% by weight beyond which it decreases.On 8% replacement Optimum Moisture Content and Maximum Dry Density were obtained as 14% and 2.08 g/cc.

- In Unconfined compression test it was observed that the Unconfined Compressive strength of the soil increased with the increase in percentage of plastic strips up to 8% by weight beyond which it decreases.The Unconfined Compressive strength of the soil is maximum when 8% (by weight of soil) of plastic strips is added to it. On 8% replacement Unconfined Compressive strength was obtained as 2.7 Kg/cm^2 which is comparatively more than Unconfined compression test of soil without plastic strips i.e. 1.07 g/cc.

- CBR of soil was improved when plastic strips are added,the maximum cbr value of soil is 13.94% at 8% plasic strips.

- Free swell index of soil has decreased from 66% to 36% at 8% plastic strips

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