Advance Physics Letter

Study of Strengthening of Black Cotton Soil

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Abstract - The main aim of this paper is to check the behavior of straw in geotechnical application and to evaluate the effects of straw on black cotton soil by carrying out California Bearing Ratio test on soil sample and find the results obtained are compared for the soil sample and draw the comparative graph.

Key word- Black Cotton Soil, CBR, SPT, Straw.

I. INTRODUCTION

Here we know that the properties of black cotton soil i.e. low strength. The black cotton soil is also known as expansive soil i.e. if we add some amount of water soil will expand and if there we remove the water the soil shrinks. So by this investigation we check the improvement in strengthening of black cotton soil. For this research we use agriculture waste i.e. Straw.

II. LITERATURE REVIEW

There are many experiments was performed with black cotton soil with numbers of waste materials like Fly ash, Crusher Dust, Rice Husk ash, Lime.

III. EXPERIMENT

Scope of work

The experimental work consists of the following steps:

1. Determination of the maximum dry density (MDD) and the corresponding optimum moisture content (OMC) of the soil by Standard Proctor compaction test

2. Determination of the bearing capacity by California Bearing Ratio test

PREPARATION OF SAMPLE

Following steps are carried out while mixing the straw with soil

- All the soil samples are compacted at their respective maximum dry density (MDD) and optimum moisture content (OMC), corresponding to the standard proctor compaction tests.
- Contents of straw in soil is herein decided by percentage weight of soil
- The different values adopted in present study for the percentage of straw is 0 , 3 and 5
- In the preparation of samples, if straw is not used then, the air-dried soil was mixed with an amount of water that depends on the OMC of the soil.
- If straw reinforcement was used, the adopted content of straw was first mixed into the air-dried soil in small increments by hand, making sure that all the straw were mixed thoroughly, so that a fairly homogenous mixture is obtained, and then the required water was added.

STANDARD PROCTOR COMPACTION TEST

Proctor compaction test: This experiment gives a clear relationship between the dry density of the soil and the moisture content of the soil. The experimental setup consists of (i) cylindrical metal mould (internal diameter- 10.15 cm and internal height-11.7 cm), (ii) detachable base plate, (iii) collar (5 cm effective height), (iv) rammer (2.5 kg). Compaction process helps in increasing the bulk density by driving out the air from the voids. The theory used in the experiment is that for any comparative effort, the dry density depends upon the moisture content in the soil. The maximum dry density (MDD) is achieved when the soil is compacted at relatively high moisture content and almost all the air is driven out, this moisture content is called optimum moisture content (OMC). After plotting the data from the experiment with water content as the abscissa and dry density as the ordinate, we can obtain the OMC and MDD. The equations used in this experiment are as follows: Wet density = weight of wet soil in mould gms/volume of mould cc Moisture content % = (weight of water gms/ weight of dry soil gms) X 100 Dry density γd (gm/cc) = wet density / (1+ moisture content/ 100)

CALIFORNIA BEARING RATIO TEST

It is the test used to determine the bearing capacity of sub grade soil for design of flexible pavement.

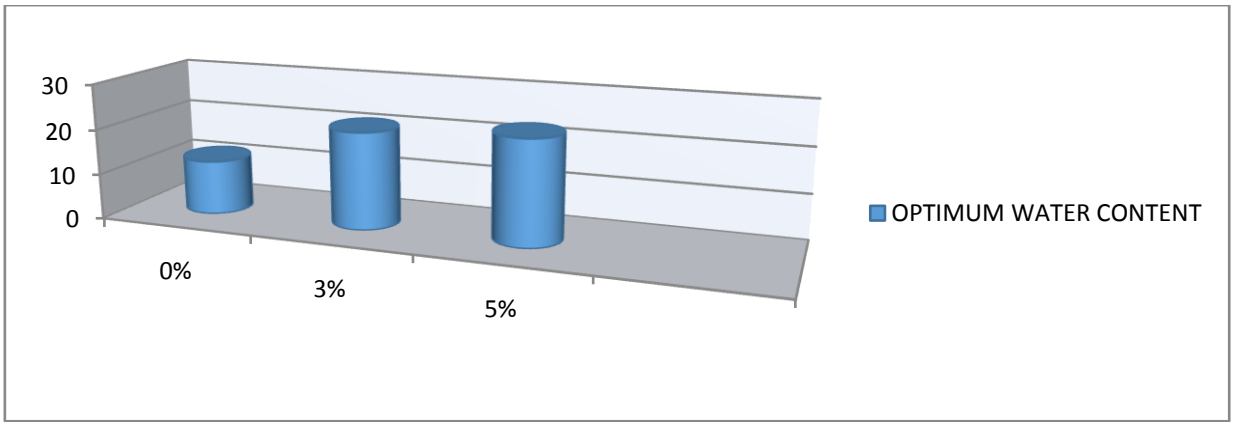
- There are two types of methods in compacting soil specimen in the CBR moulds

i. Static Compaction method.

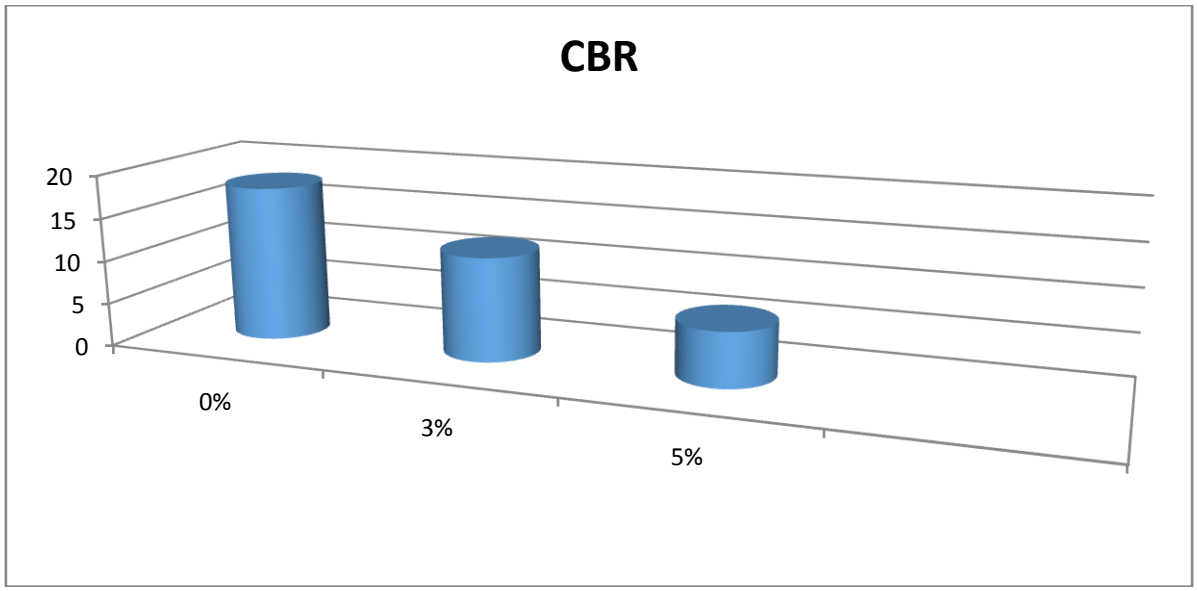
ii. Dynamic Compaction method.

- The material used in the above two methods shall pass 19mm sieve for fine grained soils and 37.50mm sieve for coarse materials up to 37.50mm.
- Replace the material retained on 19mm sieve by an equal amount of material passing 19mm sieve and retained on 4.75mm sieve
- Replace the material retained on 19mm sieve by an equal amount of material passing 19mm sieve and retained on 4.75mm sieve
- Replace the material retained on 37.50mm sieve by an equal amount of material passing 37.50mm sieve and retained on 4.75mm sieve.
- Place the mass of wet soil in mould and compact each layer being given 56 blows with 4.9 kg hammer.
- Remove extension colour and level the compacted soil to the top of the mould and place the mould in machine.
- Shear stress and gauge are set to zero and load is applied Take the readings of the load at penetration of 0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 4, 5, 7.5, 10 and 12.5.

Standard proctor test				
SPT ON PLAIN SOIL			**SOIL - 3kg**	
S. No.	**Water content**	**Wt. of soil in kg**	**Moisture content**	**Dry Density**
1	6%	6.115	11.10%	0.0038
2	8%	6.14	11.70%	0.00389
3	10%	6.24	12%	0.00399
4	12%	6.24	12.50%	0.00398
Soil+3% Straw			**SOIL - 3kg**	
S. No.	**Water content**	**Wt. of soil in kg**	**Moisture content**	**Dry density**
1	15%	5.995	15.30%	0.0037
2	18%	6.07	16.66%	0.00382
3	21%	6.09	18.75%	0.00384
4	24%	6.11	21.40%	0.00387
5	27%	6.075	23%	0.00382
Soil+5% Straw			**SOIL - 3kg**	
S. No.	**water content**	**Wt. of soil in kg**	**Moisture content**	**Dry density**
1	15%	6.008	20%	0.0037
2	18%	6.162	23%	0.00391
3	21%	6.097	25%	0.0038



CALIFORNIA BEARING RATIO		
	Penetration in mm	Proving ring reading
CBR ON PLAIN SOIL:	2.5	13
W/C: 12%	5.5	15.8
W/C 21.4%	2.5	7.2
STRAW 3%	5.5	10.6
W/C 23%	2.5	4.6
STRAW 5%	5.5	6



IV. CONCLUSION

After this experimental study, i.e. based on CBR test, it can be concluded that thickness of pavement decreases with less penetration with reinforcement.

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