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STABILIZATION OF BLACK COTTON SOIL USING WASTE DRY PAINT AND SAW DUST

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Abstract - *Strengthening of Black cotton soil (BCS) is very necessary and important process during any construction practices, since BC soil is well known for its dramatic nature. It causes damages to the construction practices, thus in the present work dry paint waste and wood saw dust are used as strengthening material for BC soil. Paint solid waste is dumped to landfills thus creating an environment problem so its use in soil improvement can minimize the problem. Wood saw dust is excogitated as an unwanted product from saw mills. Engineering properties of BCS is determined by varying percentages of dry paint waste 2%, 4%, 6% and 8% by weight of soil mass and 1.5%, 3%, 4.5% and 6% wood saw dust by weight of soil mass which gives the highest dry density less optimal moisture content. By the addition of dry waste paint and wood saw dust the effect of soil can be increased up to certain extent.*

Key Words: **Black cotton soil (BCS), Dry paint Waste (DPW), Optimal Moisture content (OMC), Wood saw dust (WSD).**

1. INTRODUCTION

Foundation is the most vital part of any structure, the stable the foundation the higher the load bearing capacity of the structure. The foundation should withstand the load acting on it by the structure. Hence, to build a efficient foundation the soil present under it should also be strong.

Normally BC soil shrinks and swells during dry and wet conditions. BC soil is known for their poor properties such as rigorously hard and compact as stone under dry condition and in contrary it swells and becomes smooth and loses its strength completely in wet conditions. Hence they may damage the foundation.

To upgrade the Engineering characteristics of BC soil the stabilization method is necessary by adding additives to the soil. The stabilization method carried in laboratory or by field test.

In this experimental work two additives were used as stabilizing materials which are waste products and easily available. The additives are, Dry paint waste and Wood saw dust.

Accession of solid waste requires a wide area for its disposal. Paint solid waste is dumped to landfills thus creating an environment problem so its use in soil improvement can minimize the problem.

Wooden floors in urban cities have drastically increased the residual formation of saw dust. Rapid urbanization also produces saw dust waste and the produced waste is dumped in open areas which is not a nature friendly option.

Wood saw dust is excogitated as an unwanted product from saw mills. The increased reliance on wooden furniture and wooden floors in urban cities has drastically increased the residual formation of saw dust. Rapid urbanization also produces saw dust waste and the produced waste is dumped in open areas which is not a nature friendly option.

2.LITERATURE REVIEW

2.1 Akshaya Kumar Sabat

The stabilization of soil was done with ceramic dust and various tests were conducted to know the behavior of the soil and by this work it concluded LL, PL and PI were decreased and CBR unconfined strength increased. For the sub-grade of flexible pavement can be used up to 30% ceramic dust to strengthening the soil.

2.2 KV Madurwar, PP Dahale, AN Burile

The sodium silicate was used to stabilize the BC soil. For this laboratory tests were conducted from this it concludes LL, PL and PI were decreased the major test were conducted to know the compressibility of the soil with the addition of sodium silicate. By this unconfined and CB ratio increased. So by the addition of sodium silicate characteristics of the soil can be improved.

2.3 CC Ikeagwuani

Two add-on were used to stabilization of BC soil such that fraction of saw dust and lime added with the mass of soil. Basic tests and major tests were conducted to know the behavior of soil with the additives. The compressibility of the soil was increased and LL, PL and PI were decreased from this the strength of the BC soil increased. It concludes that the additives added to BC soil supports in strengthening the soil.

2.4. Vivek , Vinod K. Sonthwal : The marble dust powder and saw dust were used to strengthening the BC soil to know how it effects the BC soil. LL, PL and PI were decreased and compressibility increased. These additives used as a stabilizing material and improves the strength of the soil.

2.5 Bayshakhi Deb Nath: The stabilization of soil was done with wood ash and various tests were conducted to know the behavior of the soil and by this work it concluded LL, PL and PI were decreased and CBR unconfined strength increased. The wood dust can be use to strengthening the clayey soil.

3.MATERIALS AND MIX PROPORTION

3.1 MATERIALS USAGE

Black Cotton Soil (BCS):

The soil which is used in this experiment is collected from the site near the jadhav hospital, Bhalki, Bidar dist, Karnataka state, India.

Table -1: Basic Properties of Black Cotton Soil

S. No.	Properties	Value
1	Colour	Black
2	Specific Gravity	2.43
3	Liquid Limit	44.00%
4	Plastic Limit	17.94%
5	Plasticity Index	26.06%
6	Maximum Dry Density	1.69 gm/cm^3
7	ptimum Moisture Content	18.01%
8	Unconfined Compressive Strength	0.89 kg/cm^2
9	California Bearing Ratio	1.51%
10	Free Swell Index	46.67%

DRY PAINT WASTE (DPW):

Dry Paint waste collected from the Asian paint office, company in Kalaburgi. It is directly disposed into land, soil get polluted and creating environmental issues. In this project we used it as potent reinforced material to enhance the Dry density and CBR Values of black cotton soil.

Fig.01: Dry paint waste

WOOD SAW DUST (WSD):

Wood Saw Dust is collected from carpenter shop at Bhalki. Then removed the other unwanted particles present in it.

Fig.02: Wood Saw Dust

3.2 Mix Proportion

The following mix proportion samples are used:

a. Parental Black Cotton Soil(BCS)

b. BCS + 2% DPW + 1.5% WSD

c. BCS + 4% DPW + 3% WSD

d. BCS + 6% DPW + 4.5% WSD

e. BCS + 8% DPW + 6% WSD

4. RESULTS AND DISCUSSIONS

4.1 STANDARD PROCTOR TEST (MDD AND OMC):

It is laboratory test which is accurate in calculating the MDD and OMC of the soil compared to other test. The soil compacted in three layers by a hammer at a specified height.

From the compaction curve highest dry density is obtained by plotting a graph between OMC and MDD. The point corresponding to moisture level is known as optimal moisture content.

Table - 2: Compaction Test of BCS

SI No	Water added (%)	Dry Density(gm/cc)
1	8	1.40
2	10	1.49
3	12	1.50
4	14	1.54
5	16	1.56
6	18	1.52

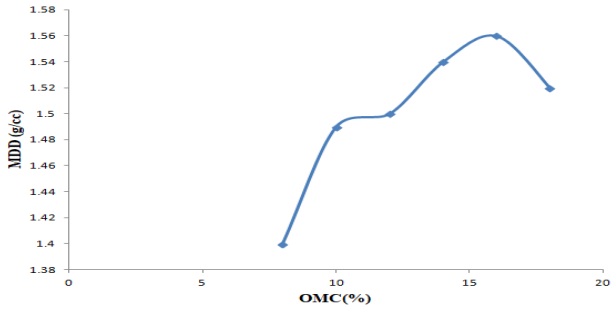

Chart – 1: Graph for Compaction test of BCS

Table – 3: MDD and OMC for DPW and WSD

SI No	Description	MDD (%)	OMC(%)
1	BCS	1.56	16
2	BCS + 2% of DPW	1.55	16
3	BCS + 4% of DPW	1.53	16
4	BCS + 6% of DPW	1.53	16
5	BCS + 8% of DPW	1.22	16
6	BCS + 1.5% of WSD	1.51	12
7	BCS + 3% of WSD	1.3	14
8	BCS + 4.5% of WSD	1.48	14
9	BCS + 6% of WSD	1.45	14

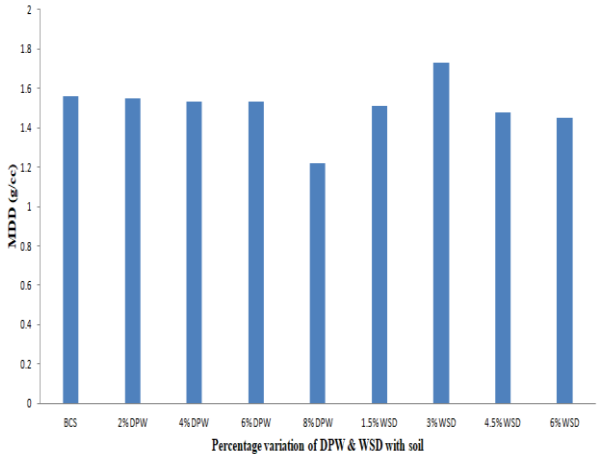

Chart – 2 : MDD for DPW and WSD on BCS

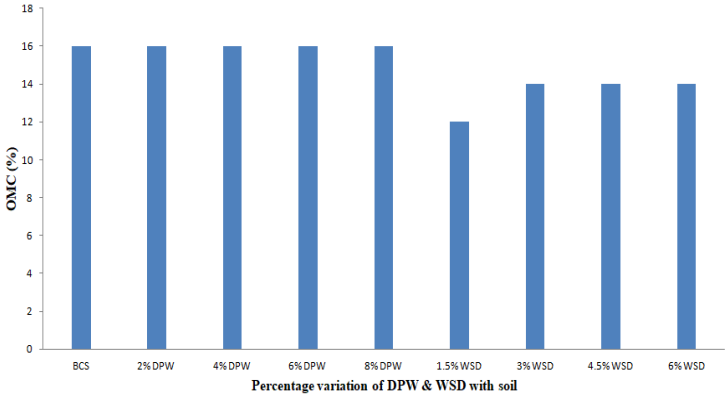

Chart – 3 : OMC for DPW and WSD on BCS

4.2 CALIFORNIA BEARING RATIO METHOD

CBR test is conducted to find out the thickness of constituent layers of pavement either in laboratory or in field.

Test was conducted for soil with Dry paint waste and wood saw dust separately at their proportions.

$$\text{CBR} = \frac{Testload}{S\tan dardload} \times 100 \text{ (OR)}$$

$$\text{CBR} = \frac{Stress}{S\tan dardload} \times 100$$

Tale – 4: CBR for DPW and WSD

SI No	% of material added	CBR value for DPW	CBR value for WSD
1	5	3.12	4.12
2	10	6.98	5.12
3	15	4.39	6.8
4	20	4.12	4.32

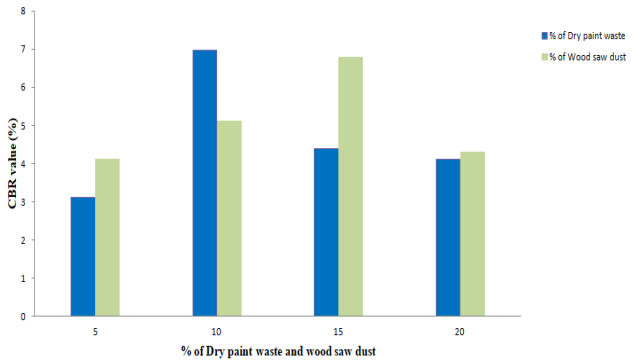

Chart – 4 : CBR for DPW and WSD

Fig.03: CBR test Setup

5. CONCLUSIONS

The trial work is conducted on BC soil by replacing the certain percentage of the mass of the soil with dry paint waste and wood saw dust in order to uplift the strength and characteristics of the soil.

Improving the characteristics of the soil leads to better load bearing capacity, shear strength of the soil without any adverse effect on the nature.

a) From the SPT (compaction) :

- In BC soil added various percentage of dry paint waste obtained highest dry density 1.55 g/cc at 16 % of OMC value with respect to 2% of dry paint waste.
- In BC soil added various percentage of wood saw dust obtained maximum dry density 1.73 g/cc at 14 % of OMC value with respect to 3% of wood saw dust.
- Hence from the above result it is clear that adding dry paint waste and wood saw dust to the BC soil improves the density of the soil.

b) From the CBR test:

- The CBR trial is conducted for BC soil with various % of Dry paint waste obtained 6.98% by replacing 10% of the mass of the soil by dry paint waste.
- The CBR test is conducted for BCS soil with various percentages of wood saw dust obtained 6.78% by replacing 15% of the mass of the soil by wood saw dust.

Even by CBR test, the results obtained are better compare to BC soil

REFERENCES:

[1] Soil Mechanics and Foundation Engineering by Dr. B. C. Punmia.

[2] Geotechnical Engineering by Shashi K.

[3] Gulati & Manoj Datta, Tata McGraw Hill.

[4] Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers.

[5] Geotechnical Engineering by Dr. B. J. Kasmalkar, Pune Vidyarthi Griha Prakashan.

[6] K. J. Osinubi, J. E. Edeh, and W. O. Onoja, "Sawdust Ash Stabilization of Reclaimed Asphalt Pavement," J. ASTM Int., vol. 9 (2), pp. 1-10, 2011.

[7] Stabilization of expansive soil using waste ceramic dust by Akshaya Kumar Sabat. 2012

[8] Comparative study of black cotton soil stabilization with sodium silicate by KV Madurwar, PP Dahale, AN Burile.2013

[9] A.O. Ilori and E.A. Udo, "Investigation of geotechnical properties of Lateritic soil with Saw Dust Ash", IOSR Journal of Mechanical and Civil Engineering

[10] (IOSR-JMCE Vol. 12, 2015).

[11] Compressibility characteristics of black cotton soil admixed with sawdust ash and lime by CC Ikeagwuani . 2016

[12] Prediction of strength development in black cotton soil stabilized with chemical additives by PC Naveena, SV Dinesh, B Gowtham, TS Umesh . 2017

[13] Effect of Marble Dust Powder & Wood Sawdust Ash on UCS and CBR Values of Soil by Vivek , Vinod K. Sonthwal. 2017

[14] Geotechnical Properties of Wood Ash-Based Composite Fine-Grained Soil by Bayshakhi Deb Nath .2018

[15] Stabilization of black cotton soil subgrade using sawdust ash and lime by CC Ikeagwuani, IN Obeta, JC Agunwamba . 2019

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