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IMPROVING STRENGTH OF BLACK COTTON SOIL BY USING SCRAP RUBBER TYRE POWDER

Madhu [1], Prof. Mallikarjun Honna [2], Dr. Vageesha S. Mathada [3], Vishal. M [4]

[1]PG Student, Department of Civil Engineering, Bheemanna Khandre Institute of Technology Bhalki, India
[2]Associate Professor, Department of Civil Engineering, BKIT Bhalki, India
[3]Professor, Department of Civil Engineering, BKIT Bhalki, India.
[4]Assistant Professor, Department of Civil Engineering, BKIT Bhalki, India.

Abstract - *Soil is a base of structure which actually supports the structure from beneath and distributes the load effectively, If the stability of the soil is not adequate then failure of structure occur in the form of settlement, cracks etc, Expansive soil like black cotton soil are more responsible for such situations and its due to presence of montmorillonite minerals, which has ability to undergo large swelling and shrinkage. The admixture i.e., scrap rubber tyre powder is blended with unmodified soil in varying different percentage of 0%, 5%, 10%, 15% & 20% to obtain the optimum percentage of admixture required for soil stabilization. The result show that maximum Dry Density and CBR values are improved after addition of scrap rubber tyre powder to the soil. In this comparative study laboratory tests such as Atterberg's limits. Compaction test and CBR tests were carried out.*

***Key Words*: Expansive Soil, Soil Stabilization, Scrap Rubber Tyre Powder, Optimum Moisture Content, Maximum Dry Density, CBR Tests, Atterberg's limits**

1. INTRODUCTION

Soil is formed by physical or chemical disintegration of rocks and it differs from their parent material in their characteristics. It also defined as the loose material which occupies the surface of the earth on while the foundation of the most of the structure will rest. Soil improvement in it's the modification of any property of a soil to further develop its designing exhibition like strength, decreased compressibility, diminished penetrability, or further developed ground water condition. There are different strategies utilized for the improvement of the soil dependent on the development action and kind of soil. Soils are the most elements settled to build their strength and durability or to save you disintegration and residue preparations in soils. The predominant factor is the manufacturing of a soil material or framework in an effort to keep under the plan use situations and for the planned lifestyles of the designing project. The properties of soil shift an awesome association at higher places or in precise instances even at one spot; the accomplishment of soil adjustment relies upon soil checking out. Different techniques are utilized to settle soil and the method to be validated in the lab with the soil object prior to laying it on the sector.

2. LITERATURE REVIEW

Mr. Rajvinder kaur et al. [2019]: It has done the performance of black cotton soil is stabilized by utilizing tyre rubber powder. For the evaluation the exceptional crumb rubber powder have been selected. She was found that the strength of black cotton soil is increases with expansion of 10% crumb rubber powder. From the examination, expansion of 10% CRP to the soil increase CBR value.

Rushikesh V. Langote et al. (April 2018): had done the performance of black cotton soil is stabilizing by utilizing waste shredded rubber tyre chips. The test CBR esteems increment through expansion in percentage of rubber tire shred and found to be maximum for 8% rubber tyre. The attachment esteems extensively decreases with expansion in level of rubber tire shred may be due orientation of rubber tyre.

C H Kusuma Keerthi et al. (2018): In the investigation challenge is made to stabilize black cotton soil using scarp rubber tire. From this review it is seen that extensive improvement in CBR of black cotton soil treated with scrap rubber tyres. while the level of rubber powder increase the CBR esteem decrease only at range 5% rubber powder may give effective dry density and will give higher CBR values dry density and CBR values goes on decreasing with 10% 15% 2% of rubber powder.

Umesh Dhiman et al. (May 2017): performed review on black cotton soil mixed with rubber tire chips. The significance of UCS is greater in contrast with that of parent soil. The maximum UCS value of 1.75kg/cm2 has been seen by soil treated with 18% of tire scrap (R-425µ) passing 600µ and held on 425 µ IS sieve.

3. MATERIAL AND METHODOLOGY

3.1 MATERIAL:

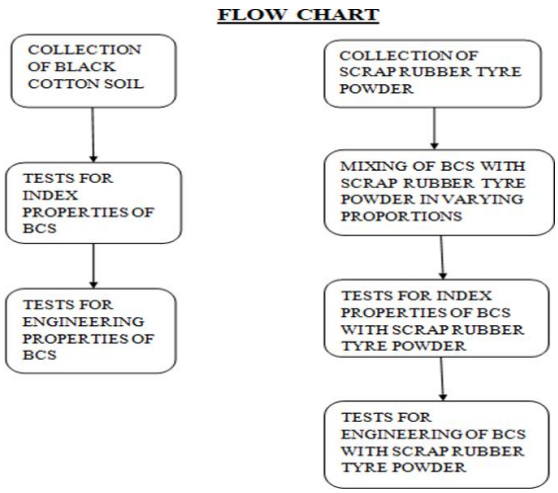
3.1.1 BLACK COTTON SOIL: Black cotton soil was gathered from kalyani layout Bhalki. From an open exhuming at a profundity of 1.2m underneath earth surface. At deep the soil is in black color, the penetration attributes are deficient to average. The actual property of the soil is organized in beneath table

3.1.2 SCRAP RUBBER TYRE POWDER: Scrap rubber tyre powder is collected near national tyre retreading mart Nilanga road, Bhalki.The tyre waste material it can be utilized as a light weight material either as chips, powder, crumb, shredded and as entire and its implementation in geotechnical engineering show to be effectual into soil stabilization.

3.2 METHODOLOGY:

TEST (ENGINEERING PROPERTIES) CONDUCTED ON BLACK COTTON SOIL:

- Proctor soil compaction test
- California bearing ratio



4. RESULTS & DISCUSSION

4.1 INDEX AND ENGINEERING PROPERTIES OF A BLACK COTTON SOIL:

Table 4.1: Basic Properties of Black Cotton Soil

SL NO	PROPERTIES	VALUE
1	Color	Black
2	Specific gravity	2.42
3	Plastic limit	30%
4	Liquid limit	58%
5	Shrinkage limit	6.5%
6	Maximum dry density	1.62g/cc
7	Optimum moisture content	22%
8	CBR VALUE	3.15%

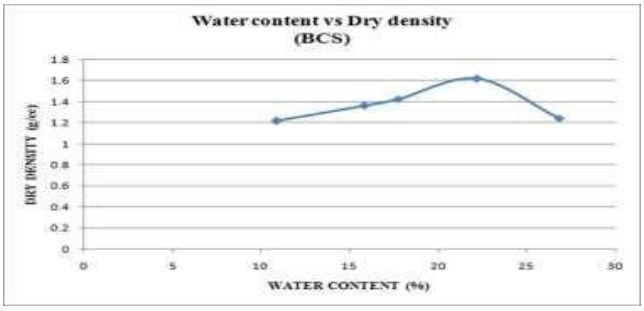


Fig 4.1.1: Compaction Test for BC Soil

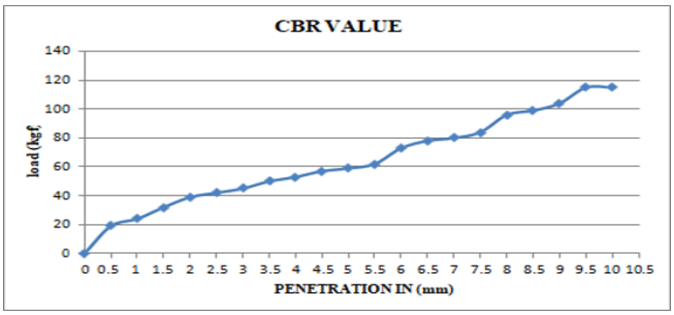


Fig 4.1.2: CBR Test of BC Soil

4.2 PROPERTIES OF BLACK COTTON SOIL IS REPLACED BY VARIFYING PROPORTION OF SCRAP RUBBER TYRE POWDER

TRIAL 1: BLACK COTTON SOIL + 5% OF SCRAP RUBBER TYRE POWDE

TABLE 4.2.1: Properties of Black Cotton Soil Replaced By 5% Scrap Rubber Tyre Powder

SL NO	PROPERTIES	VALUES
1	Specific gravity	2.42
2	Plastic limit	28%
3	Liquid limit	56%
4	Shrinkage limit	6.3%
5	Maximum dry density	1.86g/cc
6	Optimum moisture content	20.68%
7	CBR VALUE	7.0%

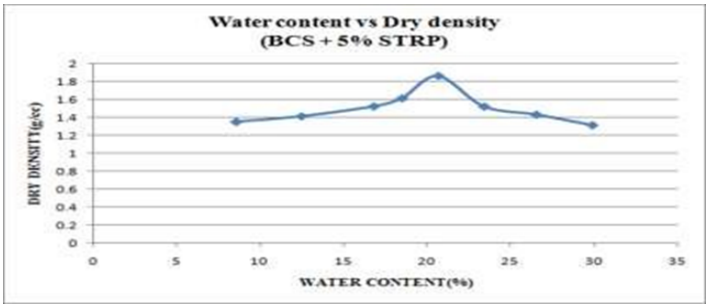


Fig 4.2.1: Compaction Test for BC Soil Replaced By 5% of Scrap Rubber Tyre Powder

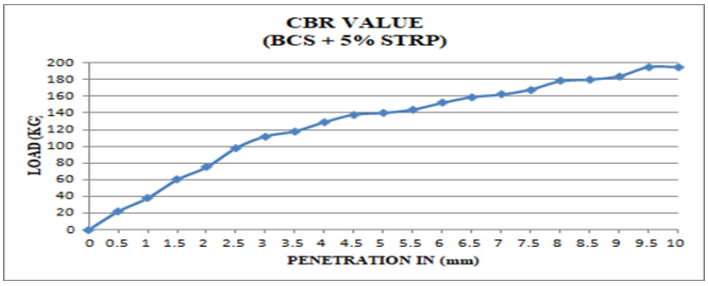


Fig 4.2.2: CBR Test for BCS Replaced By 5% of Scrap Rubber Tyre Powder

TRIAL 2: BCS + 10% OF SCRAP RUBBER TYRE POWDER

Table 4.2.3: Properties of Black Cotton Soil Replaced By 10% of Scrap Rubber Tyre Powder

SL NO	PROPERTIES	VALUES
1	Specific gravity	2.3
2	Plastic limit	25%
3	Liquid limit	55%
4	Shrinkage limit	6.2%
5	Maximum dry density	1.88g/cc
6	Optimum moisture content	20.0%
7	CBR value	9.87%

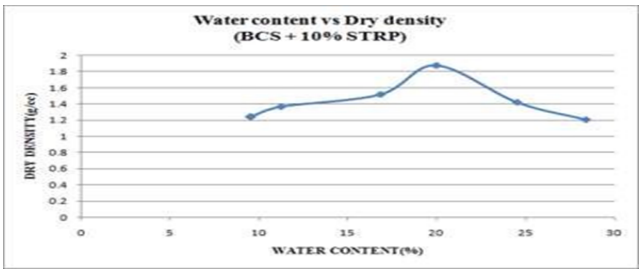


Fig 4.2.3.1: Compaction Test for BCS Replaced By 10% of Scrap Rubber Tyre Powder

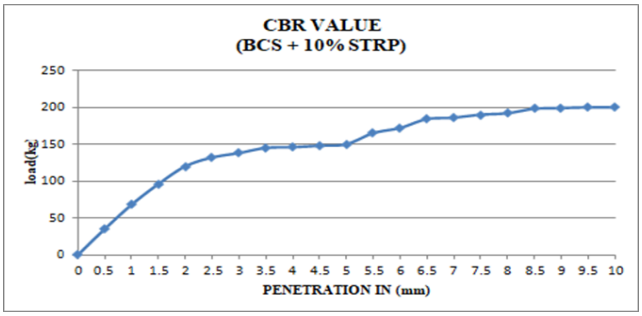


Fig 4.2.3.2: CBR Test for BCS Replaced By 10% of Scrap Rubber Tyre Powder

TRAIL 3: BCS + 15% SCRAP RUBBER TYRE POWDER

Table 4.2.4.: Properties of Black Cotton Soil Replaced By 15% Scrap Rubber Tyre Powder

SL NO	PROPERTIES	VALUES
1	Specific gravity	2.43
2	Plastic limit	26.5%
3	Liquid limit	56.5%
4	Shrinkage limit	6.35%
5	Maximum dry density	1.63g/cc
6	Optimum moisture content	21.21%
7	CBR value	6.93%

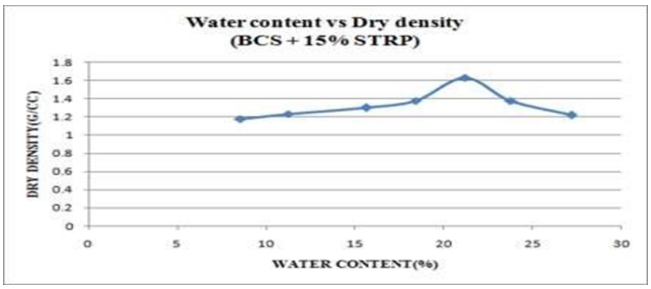


Fig 4.2.4.1: Compaction Test for BCS Replaced By 15% of Scrap Rubber Tyre Powder

TRIAL 4: BCS + 20% SCRAP RUBBER TYRE POWDER

Table 4.2.5: Properties of Black Cotton Soil Replaced By 20% Scrap Rubber Tyre Powder

SL NO	PROPERTIES	VALUES
1	Specific gravity	2.48
2	Plastic limit	27.5%
3	Liquid limit	57%
4	Shrinkage limit	6.4%
5	Maximum dry density	1.61g/cc
6	Optimum moisture content	21.62%
7	CBR value	4.20%

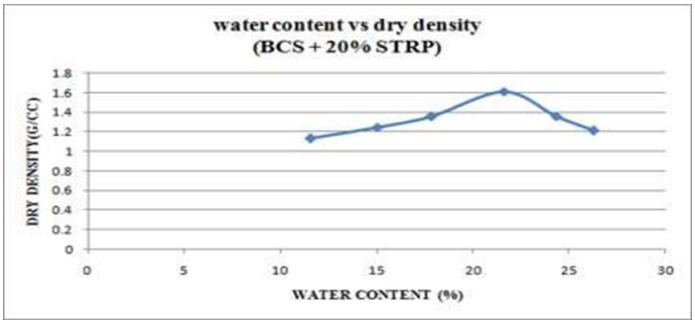


Fig 4.2.5.1: Compaction Test for BCS Replaced By 20% of Scrap Rubber Tyre Powder

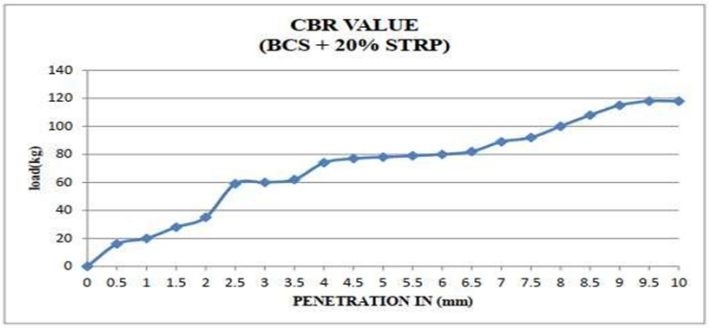


Fig 4.2.5.2: CBR Test for BCS Replaced By 20% of Scrap Rubber Tyre Powder

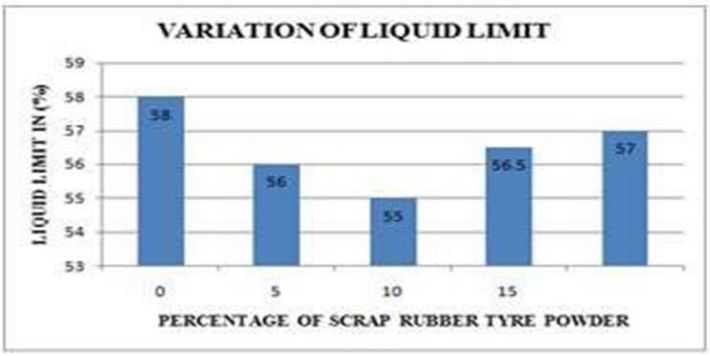


Fig 4.2.5.3: Variation Graph of Liquid Limit Values

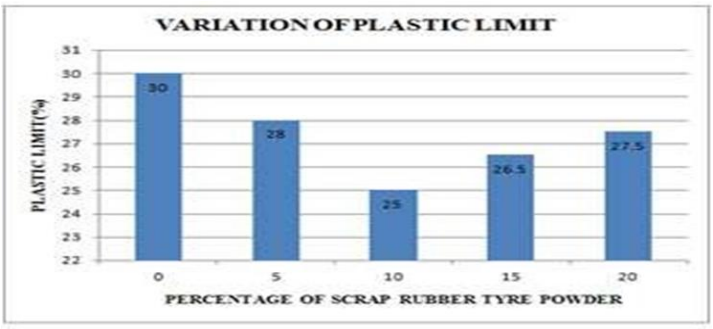


Fig 4.2.5.4: Variation Graph of Plastic Limit Values

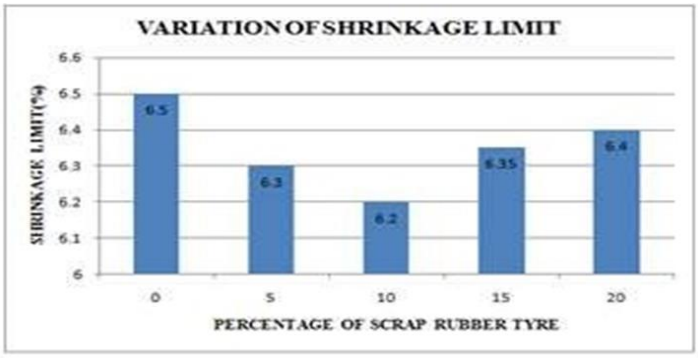


Fig 4.2.5.5: Variation Graph of Shrinkage Limit Values

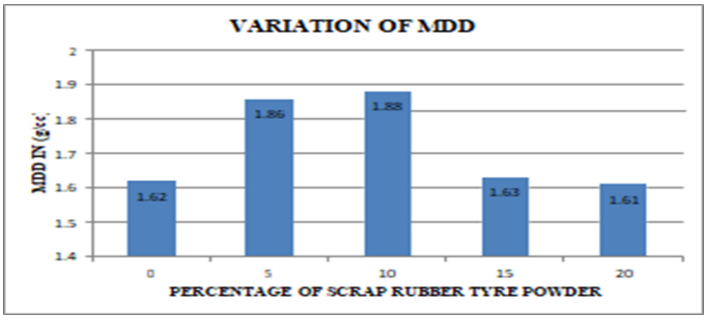


Fig 4.2.5.6: Variation Graph of MDD

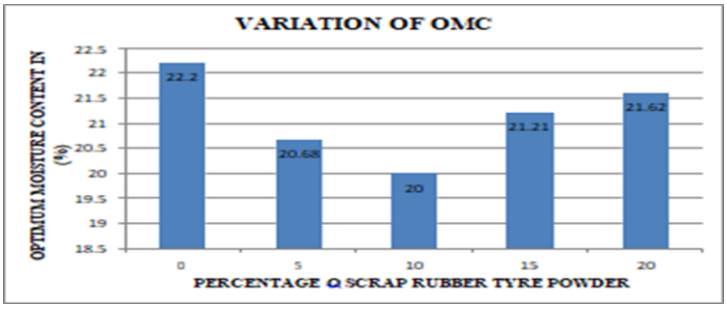


Fig 4.2.5.7: Variation Graph of OMC

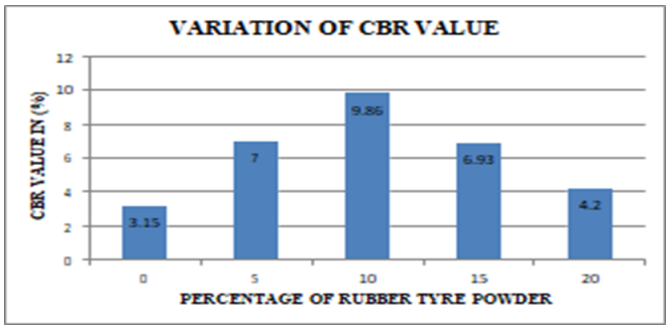


Fig 4.2.5.8: Variation Graph of CBR Values

5. CONCLUSIONS

→ Soil stabilization method by using scrap rubber tire powder successfully improves and existing poor and black cotton soil.

→ Scrap rubber tire cost are effective and available locally proves to be economical.

→ Plastic limit decrease from 30 to 25% for optimum dosages of 10% scrap rubber tire powder.

→ Decrease the liquid limit was observed from 58 to 55% for an optimum dosage of10% of scrap rubber tire powder.

→ Shrinkage limit important factor that influence the volume change of soil decrease from 6.5% to 6.2% of scrap rubber tire powder.

→ Due to decrease in porosity caused by addition of admixture and MDD value increases from 1.62g/cc to 1.88g/cc for 10% scrap rubber tire powder.

→ The OMC value decreases from 22% to 20% for 10% of scrap rubber tire powder.

→ The MDD & OMC value decreases generally for 15% scrap rubber tire powder.

→ The load bearing capacity was determine the Californian bearing ratio. Due to increase in strength CBR value increase from 3.15% to 9.86% for scrap rubber tire powder.

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