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SOIL STABLIZATION ON BLACK COTTON SOIL USING RBI-GRADE 81

GAGAN V S[1], LIKHITA G R[2], MEGHA S[3] , PRUTHVIRAJ T N[4],Dr.B.SHIVAKUMARA[5],MANASA H G[6]

[1234]UG Student, Dept. of Civil Engineering, STJIT college, Ranebennur
[5]Principal ,STJIT college ,Ranebennur, Karnataka, India
[6] Assistant Professor, Dept. Of Civil Engineering, STJIT college, Karnataka, India

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Abstract - *An attempt has been made in this study to improve the properties of black cotton soil using RBI (ROAD BUILDING INTERNATIONAL)GRADE 81 ,here we have taken the soil sample near DAVANGERE, KARNATAKA, INDIA and conducted experiments for both untreated and stabilizer treated soil, later we have compared the results obtained .The various tests were conducted i.e specific gravity, liquid limit, plastic limit, plasticity index ,optimum moisture content ,maximum dry density, California bearing ratio ,in this study we have taken the increasing % of RBI as 0%,2%,4%,6% and hence there is a improving property of expansive soil with economic rate.*

Key Words: BLACK COTTON SOIL, RBI GRADE 81,STABILIZER etc …

1. INTRODUCTION

Soil is the indispensable element of this nature. Swelling and shrinkage of expansive soil cause differential settlements resulting in severe damage to the foundations, canal linings, etc. Black cotton soils which are basically an expansive soil, are found predominant. where An attempt has being made to improve the performance of this soil by using chemical admixtures RBI Grade 81 (ROAD BUILDING INTERNATIONAL GRADE 81). In this Project work the stabilization of Black cotton soil is done using RBI-GRADE81. RBI Grade 81 is an odourless beige powder that is composed of a number of naturally occurring compounds.

1.1 LITREATURE REVIEW

Alaka Sreedhar and Girish Mailar(2016) " Soil stabilization using RBI Grade 81"tested that for given samples the RBI Grade 81 stabilizer is added in different % except for sample 0 since the sample 0 is an untreated black cotton soil for which no stabilizer is added. In sample 1 the ratio of RBI Grade 81 stabilizer & soil is 1: 99, for sample 2 the ratio is 2 : 98, for sample 3 the ratio is 4 : 96 & for sample 4 the ratio is 6 : 94. The results of Optimum moisture content for sample 0 is 16.6, after the supplementation of stabilizer, hence OMC raises as the % of stabilizer is raised & with different percentages Maximum dry density goes on decreasing with increased percentage of RBI Grade 81.

Proff. S.S Razvi1,et al.,(2015) "Study of stabilization of RBI GRADE 81" it is observed that RBI Grade 81 additives may be successfully used to enhance the engineering properties of soil particularly CBR. It has been observed that CBR value increases with RBI content 1.5%-3.5%, for black cotton soil .It is observed that value increases significantly after addition of 1.5% RBI content. The stabilized soil can be used as a sub grade, sub base, and base course without aggregate .The test result indicates that RBI Grade 81 may be used to save natural resources like aggregate and murum.

Prayati Singh and Prof. R.K.Yadav(2017),"Effect of RBI grade 81 on Geotechnical properties of expansive soil"they made an attempt to modify engineering properties, by using RBI Grade 81. Atterberg's limit, Compaction, California Bearing Ratio (C.B.R.), Unconfined Compressive Strength (U.C.S.) tests were carried out after curing of samples for 7 days, 14 days and 28 days. RBI Grade 81 percentage varied from 2% to 6% . It was observed that there was a considerable decrease in the liquid limit and swell index with the increase in addition of stabilizer, and an increase in the CBR and UCS results with the increase in the dosage of the stabilizer.

1.2 OBJECTIVES

1. To study the basic properties of untreated and treated (i.e. with RBI-GRADE81) Black cotton soil.

2. To study the compaction characteristics of Black cotton soil and soil stabilized with RBI Grade -81 under varying dosages.

3. To evaluate the changes in strength characteristics of treated and untreated soil specimens by California bearing ratio test (CBR) with varied dosages of RBI Grade -81.

2. MATERIALS

After collection of materials ,experiments are conducted for knowing the properties of soil.

RBI-GRADE 81:RBI-Grade 81 is a unique and innovative product that was developed for the stabilization of wide spectrum of soils in an efficient, least-cost manner.

Black Cotton Soil: Expansive soils are called as Black Cotton soil. Most of these soils are black in colour and are good for growing Cotton.All the black soils are not expansive soils and all the expansive soils are not black in colour.

Table -2.1: Properties of admixture

SL No.	Physical Properties of RBI-GRADE 81	
1	Odour	Odorless
2	pH	12.5 (Saturated Paste)
3	Specific Gravity	2.5
4	Solubility	Insoluble in water
5	Freezing Point	None, Solid
6	Flammability	Non-flammable
7	Self-Life	12 month(Dry Storage)
8	Storage	Dry Storage
9	Bulk Density	700 kg/ m3

Table 2.2Chemical Composition of RBI-GRADE 81

SL. No	Constituent	Percentage
1	Calcium	52-56
2	Silicon	15-19
3	Sulphur	9-11
4	Aluminium	5-7
5	Magnesium	0-1
6	Manganese, Potassium, Copper, Zinc.	0.1-0.3
7	Water	1-3
8	Fibers(Polypropylene)	0-1
9	Additives	0-4

Table -2.3: Constituents of soil

SL No.	Constituent	In Percentage
1.	Organic Content	0.4-2.4
2.	$CaCO_3$	5-15
3.	SiO_2	5-15
4.	SiO_2 / Al_2O_3	3.5
5.	Montmorllionite minerals	30-50

3. METHODOLOGY

To achieve the objectives of our project,various tests were conducted to know the index property of the soil as per relevant IS 2720 Code. Further tests were conducted using RBI-GRADE 81 with increasing dosages to know the behaviour of soil on addition and to check the strengthening of subgrade on addition.Following are the tests which were conducted as per IS CODES for mixes.

- Basic test for black cotton soil.
- For BC soil + RBI GRADE 81.

Plasticity index:

- It is the difference between the liquid limit and Plastic Limit. The test was carried out confirming to IS 2720:Part V.

Optimum Moisture content:

- The optimum moisture content for a specific compactive effort is the moisture content at which the maximum density is obtained. The test was carried out confirming to IS 2720:Part XIII.

Specific Gravity:

- It is defined as the ratio of the weight of given volume of soil particles to the weight of an equivalent volume of pure water at stated temperature. The test was carried out confirming to IS2720: Part IV.

Liquid limit:

- It is defined as the minimum water content at which the soil is still in the liquid state. The test was carried out confirming to IS 2720 : Part V.

Plastic limit:

- It is the water content corresponding to an orbitatary limit between the plastic and the semi-solid state of consistency of soil.The test was carried out confirming to IS2720:Part V.

Maximum Dry Density:

The maximum density of a material for a specific compactive effort is the highest density obtainable when the compaction is carried out on the material at varied moisture contents. The test was carried out confirming to IS 2720:Part XIII.

California Bearing Ratio:

It is the ratio of force per unit area required to penetrate a soil mass with standard circular piston at the rate of 1.25 mm/min. to that required for the corresponding penetration of a standard material. The california bearing ratio test is penetration test meant for the evaluation of subgrade strength of roads and pavements.The test was carried out confirming to IS 2720:Part XVI

4. RESULTS AND DISCUSSION

Sr. No.	Particulars	Soil+0%RBI Grade 81	Soil+2%RBI Grade 81	Soil+4%RBI Grade 81	Soil+6%RBI Grade 81
1	Specific Gravity	2.88	1.75	1.47	1.45
2	Liquid Limit (%)	50	44.44	42.8	33.33
3	Plastic Limit (%)	55	57.1	71.4	75
4	Plasticity Index (%)	5	12.66	28.6	41.67
5	MDD(kg/m^3)	1.776	1.786	1.787	1.808
6	OMC(%)	16.55	20.33	17.37	16.50
7	CBR(%)	7.136	7.42	14.56	28.22

TABLE-4: COMPARISION OF RESULTS OBTAINED

In these experiments we have conducted on black cotton soil with varying % of stabilizer in increasing proportion I.e,0%,2%,4%,6% of RBI GRADE 81 admixture.

Liquid limit:

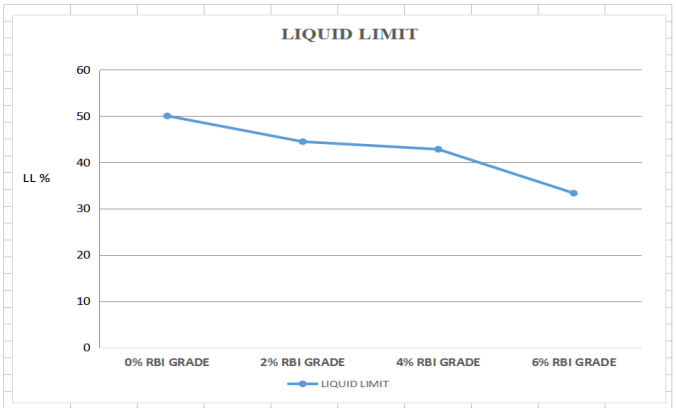

FIG: 4.1 LIQUID LIMIT

Liquid limit value for untreated soil is 50% & values for stabilizer mix soil are 44.44%, 42.8%, 33.33% ,by adding the stabilizer there is a decrease in value of liquid limit i.e, maximum value of 50% to 33.3% was decreased.

Plastic limit:

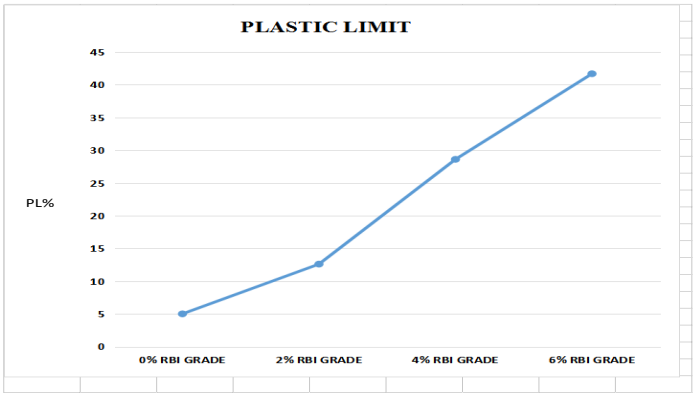

FIG:4.2 PLASTIC LIMIT

The value of plastic limit value for untreated soil is 0% addition of stabilizer is 55% & the values for stabilizer mix soil for increasing proportion are 57.1%,71.4% & 75% by adding the stabilizer there is an increase in the value of plastic limit.It increases for respective proportions from 55% to 75%.

Plasticity index:

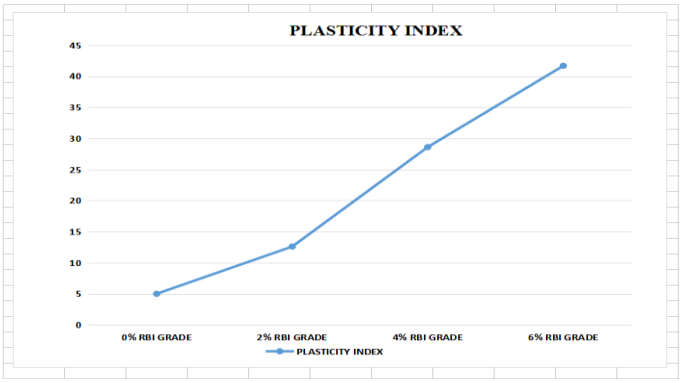

FIG:4.3 PLASTICITY INDEX

Plasticity index values for untreated soil ,the values for increasing proportion of stabilizer are 5%,12.66%,28.6% & 41.67%, by adding the stabilizer there is an increase in plasticity index as it is a difference of LL & PL .

Maximum Dry Density:

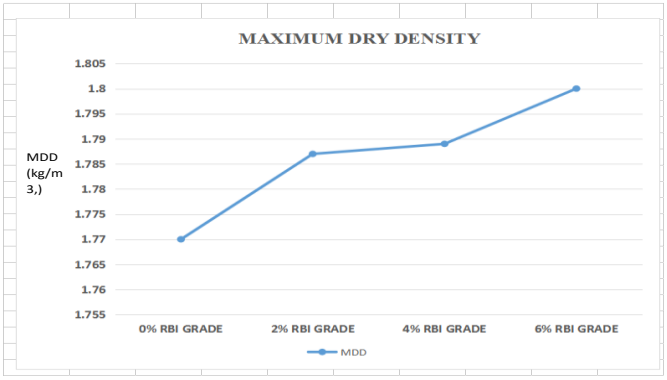

FIG:4.4 MAXIMUM DRY DENSITY

MDD value for untreated soil is 1.776 kg/m^3 & the values for stabilizer mix of soil are 1.786kg/m^3,1.787kg/m^3, 1.808kg/m^3,by adding the stabilizer there is an increase in the value of MDD. It has been observed that MDD increases with corresponding values from 1.776 to 1.808 .

Optimum Moisture content:

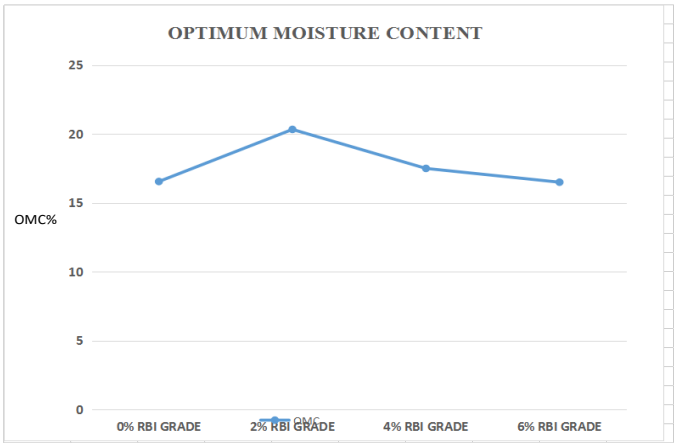

FIG:4.5 OPTIMUM MOISTURE CONTENT

OMC value of the untreated soil sample was 16.55% & values for stabilizer mix soil for increasing RBI proportion is 20.33%,17.37%,16.50%, by adding the stabilizer there is a decrease in the value of OMC.It has been observed that OMC decreases with the values from 16.55 to 16.5 for corresponding proportions.

California Bearing Ratio:

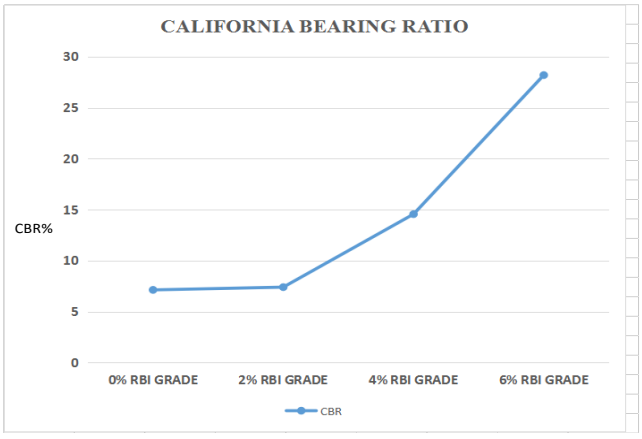

FIG:4.6 CALIFORNIA BEARING RATIO

The CBR value of the untreated soil sample was 7.136% C.B.R. values for mix of soil: RBI 81 for proportion of 2%,4%,6% was found to be 7.42%, 14.56% and 28.22% respectively,By adding the stabilizer increase proportion,.It has been observed that there is an increase in values of CBR.

Specific Gravity:

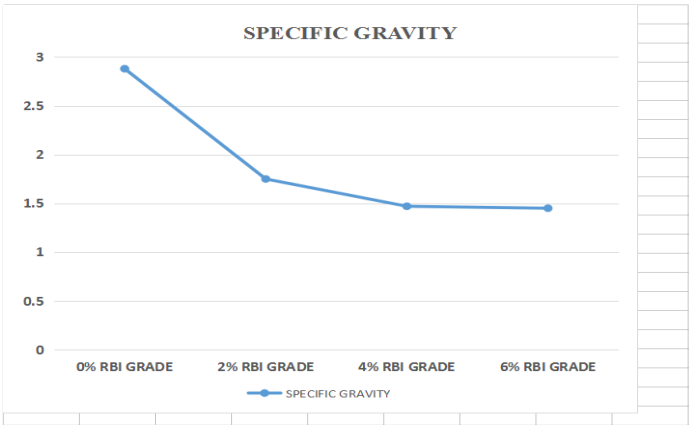

FIG:4.7 SPECIFIC GRAVITY

FIG:4.8 Block Cotton Soil

FIG:4.9 RBI GRADE-81

FIG:4.10 EXPERIMENTAL SAMPLE

Specific gravity of untreated soil is 2.88 & values for stabilizer mix soil for increasing RBI proportion is 1.75, 1.47, 1.45 respectively,by adding the stabilizer there is a decrease in the value of specific gravity.Its observed that specific gravity is decreased by value from 2.88 to 1.45.

5. CONCLUSIONS

Addition of RBI-Grade 81 significantly improves the index properties of soil.The study of variations of different parameters viz. liquid limit, plastic limit, plasticity index, maximum dry density, optimum moisture content and California bearing ratio with the addition of RBI-Grade 81 suggest that the effects of RBI-Grade 81 treatment vary depending upon the quantity of RBI-Grade 81 that is mixed with the black cotton soil and therefore for each parameter of the study soil samples. It all effects with increasing % i.e 0%,2%,4%,6% Liquid limit &OMC decreases .Plastic limit,Plasticity index, MDD, CBR increases with this increase in RBI. Stabilizer can be extended upto 8% to 12% maximum for better stabilization of soil. The main use of this stabilizer is reduces time of construction by up to 40%,there is a drastically increases the strength of roads, Makes soil water-resistant & prevents damage to road foundations.

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