Stabilization of fine grained soil using RBI grade 81

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***Abstract*: Soil stabilization is one of the processes used for improving engineering properties of soil. There are various materials used as stabilizing agents. In this paper, RBI grade -81 mixed in different percentages with clayey soil and silty soil and its effect on engineering properties of soil is investigated after conducting California Bearing Ratio test and Unconfined compressive strength test. Observations are made for the changes in the properties of the soil such as Maximum dry density (MDD), Optimum moisture content (OMC), California Bearing Ratio (CBR) and unconfined compressive strength (UCS) values are determined on 0%, 2%, 4%, and 6% percentages of RBI. It has been find out that MDD goes on increasing and OMC goes on decreasing with the increase in percentage of RBI Grade-81. The CBR value of soil goes on increasing up to 6% of RBI grade 81. The results indicate that RBI grade 81 is effective in improving stability of both the clayey as well as silty soil mass.**

***Keywords*: RBI grade 81, Optimum moisture content, maximum dry density, California bearing ratio, unconfined compressive strength.**

I. INTRODUCTION

II. Soil is the basic construction material. It supports the sub structure of any structure and it is the sub-grade which supports the sub-base/base in the pavement. the improvement of soil at a site is indispensable due to rising cost of the land, and there is huge demand for high rise buildings. Soil stabilization can be defined as any physical, chemical, biological method of changing the available natural soil in order to meet the engineering properties of soil. Soil stabilization is a technology which enhances the soil characteristics in order to improve mechanical & load bearing properties through technological methods like soil improvement. Soil stabilization method is suitable for heavily soaked soils, which is not suitable for road or traffic construction since required rate of compaction cannot be achieved. The main resolution of soil stabilization is to progress the California bearing ratio of the available soil by four to six times & to improve unconfined compressive strength on site materials which in turn creates a solid & a strong base & sub base courses. The stabilizer used in this paper is RBI grade 81 and shows considerable increase in MDD, CBR, and UCS of both soil sample.

II. LITERATURE REVIEW

Vinay et. al. (2011) investigated the strength properties for two types of soils. A local loamy soil and clayey soil were stabilized with RBI-81. Durability test, flexural strength, permeability test were carried out on untreated soils and soils treated with 1, 2, 4% RBI-81. A considerable increase inthe strength values of CBR, UCS was reported.

Madurwar et al. (2013) made an attempt to modify engineering properties of black cotton soil by using RBI-81 and sodium silicate. After then Atterberg limit , CBR and UCS test were conducted out on the sample of soil with RBI-81 in proportion of 2% & 6% with curing period of 7,14 &28 days. Which finally made them to come to the conclusion that the normal soil which was having 2.33% CBR & 2.69% UCS has been increased to 10.03% & 3.62% at 14 days curing by adding 2% RBI-81 & 8.03% & 2.97% with 7 days curing. After then authors increased the percentage of RBI-81 from 2% to 4% which gave them result of 18.87% & 4.44% with 14 days curing and 16.24 % & 3.96% with 7 days curing. Overall the final conclusion which has been made by them was that the UCS & CBR value increases with increase in RBI 81.

Sushant et. al (2010) carried out an investigation to study the influence of RBI Grade 81 and lime on the stabilization of blast furnace slag and fly ash. Standard proctor test and unconfined compressive strength test for different combinations of the stabilizing agents were conducted. It was concluded that UCS of stabilized sample increases with increase in the period of curing. But the percentage of increase in strength was more upon lime addition compared to addition of RBI-81. Application of RBI Grade 81 chemical stabilizer causes the liquid limit to decrease and the plastic limit to increase, thereby decreasing the plasticity index of red soil under investigation. The most significant influence occurs mainly in the expansive soil than in the red clay soil studied by YOTAM Engineering Limited.

B.M.Patil[14] Manages the change in properties of sub grade soil by using soil stabilizer and provincially available poor materials. Where they completed standard proctor test on treated and untreated soil test and estimation of MDD and OMC were discover. The soil was treated with moorum and RBI 81 with distinctive extents tried for drenched CBR quality, MDD and OMC which came about for blend of soil: RBI Grade 81 in the extent of 100:0, 98:2, 96:4 the soaked CBR values are observed to be 2.56%, 4.89%, and 8.79% and for blend of soil: moorum: RBI Grade 81 in the extent of 100:0:0, 90:10:0, 80:20:0, the soaked CBR qualities are observed to be 2.56%, 2.41% and 2.84% and for blend of soil: moorum: RBI Grade 81, the extent of 78:20:2, 76:20:4 the splashed CBR qualities

are observed to be 4.56%, 14.76% separately. This shows that the CBR value of sub grade soil can improved by using moorum along RBI 81 and development expense can be reduced to definite limit.

Anitha.K.R. et al. (2009) investigates the effect of using a new stabilization product, RB1-81 on kaolinite, red soil, & Lateritic soil. This study revealed that both soaked and un-soaked CBR increased significantly with the addition of RB1-81 for kaolinite, Red soil & lateritic soil. During this experiment the CBR specimen were prepared with different percentage RB181 i.e. (0%, 2%, 4%, 6%, & 8%) water content of 1% + OMC was added for preparation of specimen. CBR test were done at 0, 7 & 11 days of curing. CBR test at 11 days was done after soaking for 4 days, for the sample which has been cured for 7 days. After all experiment the author came to the conclusion that un-soaked CBR did not vary much for red soil and lateritic but it increased 16 times for kaolinite. It has also been found that soaked CBR increased 16, 14 & 4 folds with the addition of optimum percentage of RB1-81 recommended for red soil, lateritic and kaolinite respectively.

Haricharan T.S et al.(2013)evaluated the influence of RBI -81 stabilizers on properties of black cotton soil through laboratory investigation. Black cotton soil with varying percentages of RBI -81 that is 0, 0.5, 1, 1.5, 2 & 2.5 percent were studied for moisture density relationship and strength behavior of soil. In this experiment many several tests & analysis were made like Liquid Limit, Plastic Limit along with UCS & CBR. After conducting all the tests the author gets the result that UCS which treated with RBI-81 has increased up to 1032 KN/m² which was earlier 208 KN/m² after 28 days curing i.e. about 250% as compared to virgin soil. Further the CBR value improved approximately by 400% as the CBR value of virgin soil was 1.34% which has increased up to 14% after mixing 2.5% RB1-81 and 7 days curing period. Overall the plasticity index of the RB1-81 treated soil was found to be encouraging.

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III.MATERIAL USED

After collecting soil samples, laboratory testing was done to assess the type of soil by evaluating its basic properties.Soil used is collected locally from Jabalpur city of Madhya Pradesh.

Table -1: Basic Properties of Soil

Property	Clayey soil	Silty soil
Liquid Limit	58%	40%
Plastic Limit	28.6 %	26%
Plasticity Index	29.4%	14%
Optimum Moisture Content	25%	16%
Maximum Dry Density	1.551 g/cc	1.61 g/cc
% Passing 75 micron sieve	96.68%	92.35%
Engineering classification	CH	MI

Similarly, the properties of stabilizer used here that is RBI grade 81 were studied as given in the manual provided by the Alchemist technology limited (2010),New Delhi. RBI Grade 81 can be expanded as Road Building International Grade 81. It is a major material which was created for altering the various types of soil through an inexpensive approach. RBI Grade 81 is an eco-friendly, inorganic, hydration activated powder based stabilizer which combines along with the soil particles to create layers that are interconnected through a complex bury atom structure. It is a road construction material patented worldwide & in India. .It is a Cementitious power stabilizer which is grey in color, non-flammable & also acts as waste binder. It modifies the engineering properties of soil by providing rapid infrastructure development. .A Company called Legend Developers in New Delhi supplies RBI Grade 81 (Road Building International Grade 81). The company has the license to manufacture it and has patented it. The product has recently been accredited by Central Road Research Institute, New Delhi. A combination of naturally occurring compounds form RBI Grade 81.Developed Countries like Germany, South Africa, Italy, Spainetc makes use of RBI Grade 81 to a great extent. Hence "It is defined as an inorganic chemical stabilizer which modifies the engineering properties of soil."

Table-2 : Basic properties of RBI grade 81

Properties	Values
color	Grey powder
Odour	Odourless
Specific Gravity	2.5
Self Life	12 Months
Propylene Fibre%(By Mass)	1

IV. EXPERIMENTAL WORK

The properties of the soil sample are obtained from laboratory work as given in table 1. Atterberg limits, Modified proctor test for compaction, CBR were carried out as per Indian standards. All tests were carried out for different mixes of soil and RBI grade 81 and O.M.C., M.D.D. values are found. The California bearing ratio found for soil mixes and RBI grade 81 for different proportions.

V. RESULT AND DISCUSSION

Table 3- Effect of RBI 81 on Clayey soil sample

Clayey soil +RBI 81	Samples	Liquid limit	Plastic limit	Plasticity index	OMC	MDD
Clayey soil+0%	C0R	58	28.6	29.4	25	1.551
Clayey soil+2%	C2R	55	29.2	25.8	24.2	1.585
Clayey soil+4%	C4R	51	30.6	20.4	23	1.61
Clayey soil+6%	C6R	48	32.4	15.6	22.3	1.63

Table 4- Effect of RBI 81 on silty soil sample

Silty Soil +RBI 81	Samples	Liquid limit	Plastic limit	Plasticity index	OMC	MDD
Silty soil +0%	S0R	40	26	14	16	1.61
Silty soil +2%	S2R	38	26.4	11.6	15.5	1.65
Silty soil +4%	S4R	35.5	27.2	8.3	13.9	1.68
Silty soil +6%	S6R	33.2	28	5.2	12.3	1.72

A ..MAXIMUM DRY DENSITY:

This laboratory test is performed to determine the relationship between the moisture content and the dry density of a soil for a specified compactive effort . This laboratory will employ the tamping or impact compaction method using the type of equipment and methodology developed by R. R. Proctor in 1933.The test indicated an decrease in optimum moisture content and increase in Maximum dry density for clayey as well as silty soil mass.

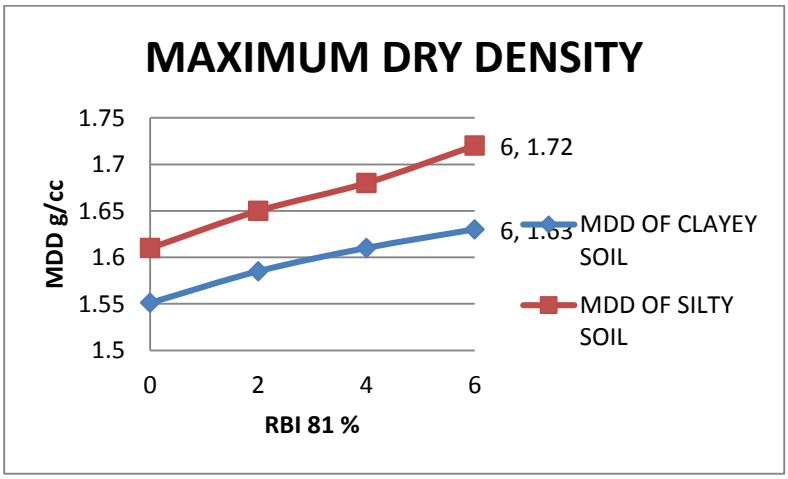

CHART 2: Effect of RBI grade 81 on MDD of clayey and silty soil

C. CALIFORNIA BEARING RATIO :

This is a penetration test developed by the California division of highways as a method for evaluating the stability of soil sub Grade and other flexible pavement materials.

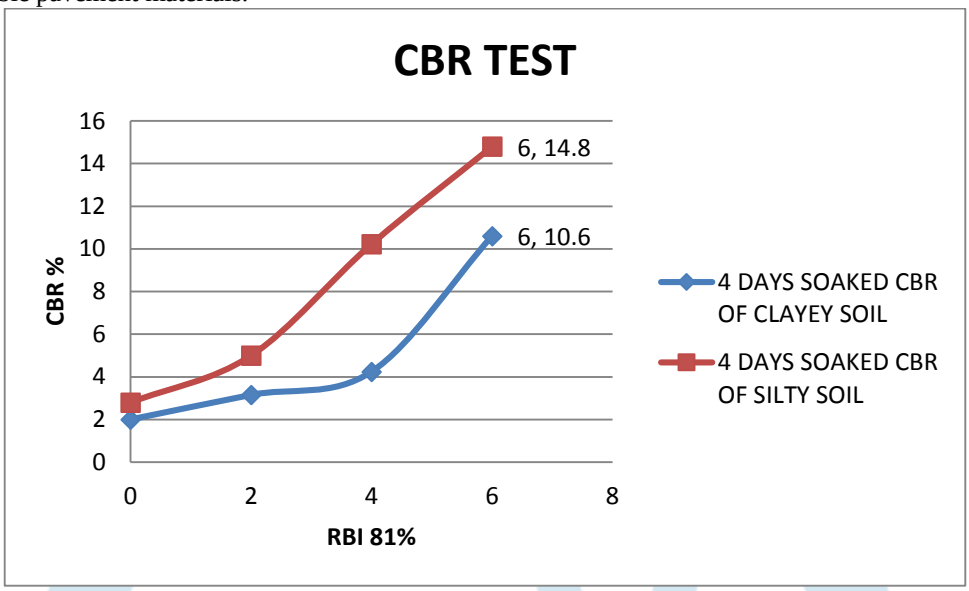

CHART 3: Effect of RBI grade 81 on CBR% of clayey and silty soil

D. UNCONFINED COMPRESSIVE STRENGTH :

This test was performed in accordance with IS 2720: Part 10. The results on the effect of varied dosages of RBI 81 on Unconfined Compressive strength for a curing period of 4 days are summarized . It was found that the changes in UCS were significant on addition of RBI 81 content after 4 days of curing.

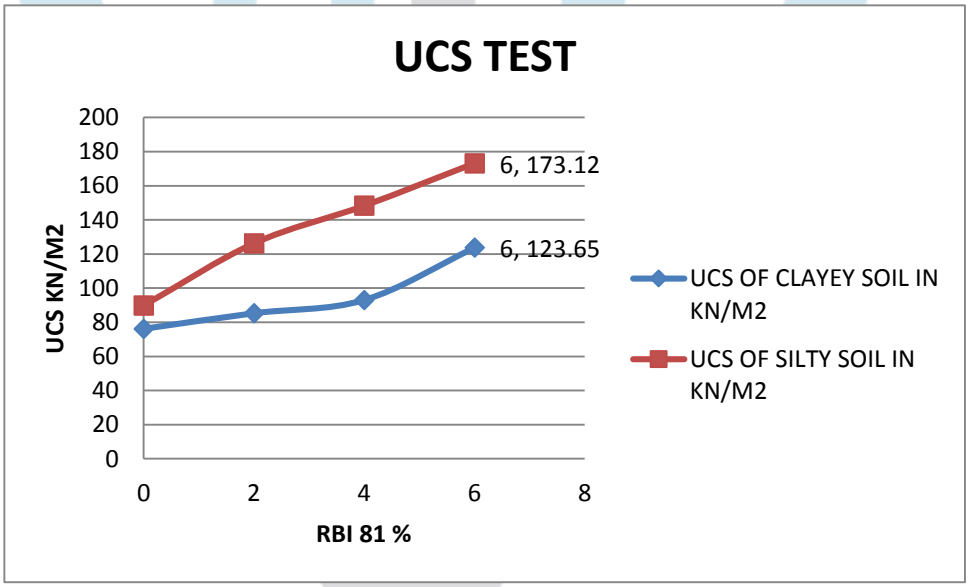

CHART 4: Effect of RBI 81 on UCS of clayey and silty soil

V. CONCLUSION

From this experimental study, it was found that with the increase of RBI 81 content in soil sample, the values of OMC reduces considerably and MDD increases. With the increase in RBI 81 content CBR and UCS values increases for both soil samples .Hence compaction ability and strength of soil increases making the soil dense and more stabilized as compared to untreated soil.

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