RBI Grade-81 Used As a Soil Stabilizer in Road Construction

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Abstract- *Road infrastructure in India is developing at a very fast pace. A good pavement is needed for the safe, comfortable and economical movement of traffic. If the in situ soil has no adequate strength, either soil from other sites are to be used or the available soil has to be stabilized so that it attains sufficient strength to carry the traffic load. Soil can be stabilized with RBI grade 81 and then can be used in Sub grade and also as Sub base and base Layers. The whole Pavement can be constructed by using RBI grade 81 thus reducing energy consumed and placing of unbound granular material (WBM/WMM) without compromising on Strength and durability. Various samples have been made by taking soil with 0% RBI Grade-81 content; 2% RBI Grade-81 content; 4% RBI Grade-81 content; 6% RBI Grade-81 content; 8% RBI Grade-81. The CBR sample is prepared by 7 days curing and 4 days soaked period. The comparison of the strength results with or without RBI Grade 81 has been done. It has been found that RBI Grade 81 is a unique and innovative material which results in saving the extra cost of the pavement.*

Keywords- RBI Grade 81, Subgrade, Stabilization, CBR Value

I. INTRODUCTION

For the construction and maintenance of rural roads catering to low volumes of traffic, local soil is not only the cheapest but also the highly versatile road material [1]. The locally available black cotton soil is not suitable as a subgrade material due to low CBR value and swelling characteristics. The CBR value of soil can be improved by adding chemical stabilizers, such as RBI Grade 81, Bio- enzymes, Terrazymes etc. To improve CBR value and enhance swelling characteristics, RBI Grade 81 and moorum can be used. These additives can also help to reduce the crust thickness of roads due to which construction cost can be reduced. Pradeep Muley et. al [2] based on their study found that quality of local moorum has been improved by adding stone dust. This investigation deals with mechanical stabilization of moorum with mixtures of stone dust. D S V Prasad et. al [3] carried out the study and the results of CBR test for moorum reinforced with different percentage of waste plastics, soaked CBR value were increased from 8.0% to 16.42% with 0.30% of waste plastics and there after decreases.Kolay, P.K. et. al [4] based on there experimental study, reported that the maximum dry density for pond ash sample is found to be increased while the optimum moisture content decreases with increase in the pond ash content. Joel H. Beeghly [5] carried out the studies by using lime with coal fly ash in stabilization of soil subgrade and granular aggregate base course. It is observed that UCS and CBR value improved considerably as compared to lime use alone. Aykut Senol et. al [6] based on their experimental work quantified the effect of fly ash stabilization on four different types of soft subgrades encountered using locally available fly ash in Wisconsin. For improvement in engineering properties of soils, a combination of lime and fly ash is beneficial for lower plasticity and higher silt content soils. The lime alone works well to stabilize clayey properties of soft subgrades such as unconfined compressive strength and CBR was investigated. Raju Sarkar et. al [7]studied physical properties and geotechnical characteristics of pond ash collected from different thermal power plants. The variability in the properties of pond ash is due to several reasons, such as type of coal, degree of pulverization of coal, changes in coal supply, chemical, mineralogical and geotechnical aspects are important in assessing its behavior when used in geotechnical engineering application

II. MATERIALS FOR STUDY

Soil: The soil sample selected is obtained from link road of Sinhagad road, Vadgaon bk. Pune, and the following tests are conducted on the soil sample. The soil contains 32.5% sand, 67.5% silt & clay. B. RBI Grade-81: RBI Grade 81 is a powder that is composed of a number of naturally occurring compounds. It is odourless, the pH of saturated paste is 12.5. It improves the structural properties of a wide range of soils. It is particularly effective with silty-clayey soil with low geo-mechanical qualities. RBI Grade 81 works by hydration reaction. Pore space is filled by a crystalline growth. An irreversible interparticle matrix is formed. Through the addition of low dosages of RBI Grade 81 the volume stability of the soil is increased significantly. The reaction of RBI Grade 81 with soil particles produces as an inter-particle matrix that binds soil particles together into a rigid mass. This binding of the soil particle, through both chemical bonds and

frictional forces, serves to limit the pore volume of the created rigid stabilized soil system. RBI Grade 81 is insoluble in water, non UV degradable, inert and chemically stable. It forms a dust free surface and is simple to apply and hardens fast. It is durable and permanent. It is environmental friendly and aesthetically pleasing. Strength of soil treated with RBI Grade 81 increases with age. It gains strength till about one year after application to soil. Permeability of soil mass decreases with addition of RBI Grade 81 as they reduces pore spaces. The use of RBI Grade 81 does not produce expansive salts when used in soils with clay content. Hence they do not cause cracks due to volume change. RBI Grade 81 converts clay irreversibly into cementitious calcium silicate and aluminum hydrates. RBI Grade 81 creates a volume stable layer with very small capillary spaces. The stabilized soil is bound into an irreversible matrix where cracking is highly improbable. Hence maintenance costs are low or non-existent for roads constructed using RBI Grade 81.

TABLE 1 basic properties of soil

Properties of soil	Value	Properties of soil	Value
Specific gravity	2.10	CBR %	2.40
Liquid limit	58.00	UCS N/mm^2	0.34
Plastic limit %	31.23	Gravel % (4.75 to80.0 mm)	03.88
Plastic index %	26.88	Sand % (0.075 to 4.75 mm)	12.98
Dry density gm/cm^3	1.34	Silt and clay % (below 0.075 mm)	84.56
OMC %	25.60		

B. Moorum

The weathered rock fragments which are gravely and non plastic in nature is locally called as moorum. The granular moorum is collected from vadagaon area and tested in the laboratory for soaked CBR test. The properties of moorum used for experimental studies are as given in table 2.

TABLE 2 Properties of moorum

Sr. No	Properties of Moorum	Value
1	Maximum dry density%	1.45
2	Optimum moisture content %	10.45
3	Soaked CBR %	7.20

III. EXPERIMENTATION

The Standard Proctor Test is carried out on the untreated and treated soil samples as per IS Code and values of MDD and OMC were found out. The soil was treated with murum and RBI Grade 81 for different proportions tested for soaked CBR value, MDD and OMC.

IV. RESULTS AND DISCUSSION

4.1 Effect of RBI Grade 81 on MDD and OMC of soil The Standard proctor test was conducted on untreated soil,the values of MDD and OMC were found to be 1.43 g/cm3 and 25.80% respectively. The Standard Proctor test was also carried out on mixes of soil: RBI Grade 81 for proportions 100:0, 98:2, 96:4 and MDD and OMC, were found out. The obtained results are given in the table 3

TABLE 3 effect of rbi grade 81 on mdd and omc of soil

Soil:RBI Grade 81	MDD g/cm^3	OMC in %	Soaked CBR value
100:00	1.43	25.80	2.56
98:2	1.45	26.16	4.89
96:4	1.46	26.17	8.79

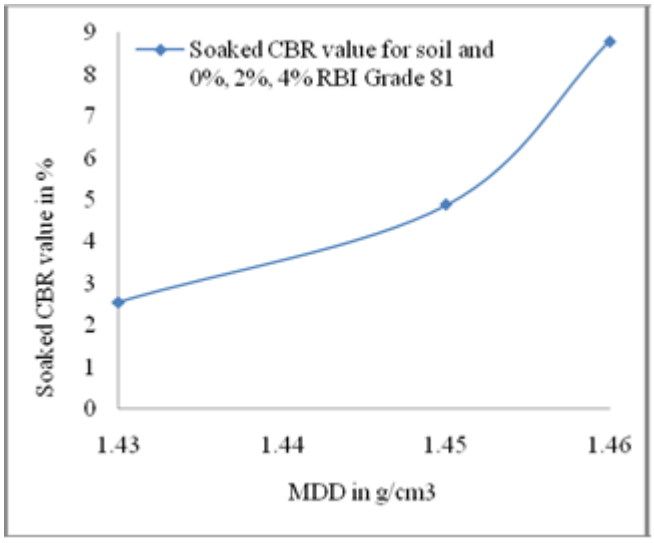

Fig.1. Effect of RBI Grade 81 on CBR and MDD of soil

V. ADVANTAGES OF RBI GRADE 81

- Construction time and cost reduction
- Drastically increases the strength
- Stabilization water proofs the soil.
- Treated layer are water resistant

- Reduces thickness, use of transport, and earth moving machinery substantially Longer durability which reduces maintenance

VI.BENEFITS OF RBI GRADE 81

The economic savings attribute able to the use of RBI Grade 81are in the following categories:

1. The ability of RBI Grade 81 to stabilize all situ soil avoiding the otherwise necessary replacement.
2. Saving on labour costs, contractor cost, engineering cost, equipment costs and raw material costs.
3. The increased productivity of the construction site, projects completed well ahead of schedule.
4. Complete elimination of on-going maintenance costs under all weather conditions.

VII. CONCLUSION

This work was intended to study the effect of stabilizer RBI Grade 81 in the stabilization of soil. Based on results of Atterberg's limits; standard proctor test and CBR test the following conclusions are drawn. The conclusions are based on the tests carried out on samples selected for study. The conclusions drawn from the study are

1. Liquid limit decreased and Plastic limit increased with the addition of RBI Grade 81. Decrease in liquid limit and increase in plastic limit indicates increase in strength.
2. Highly plastic soil can be stabilized with RBI Grade 81 and can be considered as stabilized sub base. So RBI Grade 81 is a good stabilizer.
3. With the addition of RBI Grade 81, PI decreased. The PI of soil is 9.4 which is reduced up to 4.7 with 8% of RBI Grade 81. Decrease in plasticity index shows that the volume change during wetting and drying with RBI Grade 81is less.
4. OMC increased and MDD decreased with addition of RBI Grade 81. MDD is decreasing with addition of RBI Grade 81 but there is increase in soaked CBR value with increased the addition of RBI Grade 81. So strength does not decrease with decrease in MDD.
5. CBR increased with the addition of RBI Grade 81. The CBR value of the existing soil was about 2%, which has been increased to 28.9% by adding 2% RBI after 7 days of curing and 4 days of soaking. At 8% RBI 81 content CBR value is 135.5 this means RBI Grade 81 is very effective stabilizer.
6. The cost of Pavement for soil + 2% of RBI Grade 81; Shows minimum cost among all other cases. By conventional method cost of the pavement is Rs. 2985418/- which is too much higher than the cost of Pavement for soil + 2% of RBI Grade 81.

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