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A STUDY ON SOIL STABILIZATION USING RBI GRADE-81

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Abstract- **Soil stabilization is a major concern in India where the civil engineering infrastructure is developing a t a very fast pace. Large area of country is covered with expansive soil which has poor engineering properties and not suitable for construction like highway subgrade. So soil stabilization is necessary to improve its engineering performance such as workability, stiffness, strength, permeability, compressibility and sensitivity. This review paper deals with the soil stabilization using a chemical additive RBI Grade-81. It is a very effective stabilizer and can be used in sub grade, sub base and base layer. The industrial waste like Pond ash, Fly Ash, Stone dust, Foundry Sand, Steel Slag etc can also be used with RBI Grade-81 as stabilizer to reduce the cost.**

Keywords- *Clayey Soil, Silty Soil, RBI Grade 81, Soil Stabilization, CBR*

I. INTRODUCTION

The poor engineering properties of soil have forced engineers to improve the properties of soil by various stabilizing techniques. Stabilization of soil is an effective method for improving the strength, stiffness and workability of the soil. Recently various polymer stabilizers have emerged and are being used for soil stabilization. RBI Grade-81 is one of them.

RBI Grade-81 (Road Building International Grade-81) is a chemical stabilizer which has been used by various researchers for improving the properties of different type of soils. It is an odourless beige powder, which is insoluble in water, non UV degradable and chemically stable. It forms dust free surface. It is durable, permanent and hardens fast. It is aesthetical and environmental friendly. It can be used with wide range of soils. The volume stability of the soil is increased significantly with the addition of low dosages of RBI grade-81. It reacts with soil by hydration reaction and strength of soil treated with it increases with age.

The Physical properties and Chemical properties of RBI Grade-81 are summarized in Table-1 below.

Table 1 Physical and Chemical Properties of RBI Grade-81

Physical Properties	RBI Grade-81	Chemical Properties	% By Mass
Appearance	Beige powder	Calcium Oxide (CaO)	52-56
Odour	Odourless	Silicon Dioxide (SiO2)	15-19
PH	12.5 (saturated paste)	Sulphur TriOxide (SO3)	11-Sep
Vapour pressure	Not measurable	Aluminium Oxide (Al2O3)	7-May
Flammability	Inflammable	Iron Oxide (Fe2O3)	0-2
Specific Gravity	2.5	Magnesium Oxide (MgO)	0-1
Solubility	In water 0.2pts/100pts	Fibers (polypropylene)	0-1
Freezing point	None, solid	Additives	0-4
Viscosity	None, solid		

Benefits of RBI Grade-81

The Benefits of RBI Grade-81 are as follows:-

- It reduces construction time by 40%
- The soil strength increases drastically
- It prevents foundation damage by making soil water resistant.
- It reduces the Aggregate requirement
- It reduces cost of transport & earth-moving by 60%
- It reduces the cost of maintenance
- It has longer durability
- It is environment friendly and has a small Carbon Footprint

Objectives of study

1. To evaluate the effect of RBI-81 on the basic properties of soil.
2. To study the influence of RBI-81 on California Bearing Ratio (CBR) of the soil.
3. To perform Grain size Analysis, Moisture content, Liquid limit, Plastic limit and CBR.

II. LITERATURE REVIEW

Some of the recent studies conducted with RBI Grade 81 as soil stabilizer are given below:

Alaka Sreedhar, Girish Mailar In this research field of Construction expansive soils pose a great problem especially for foundations, & using the locally available in situ soils is a big issue since they are not suitable for Construction. The most problematic soil in the field of Construction is the Black Cotton soil especially in foundations, since Black Cotton soil has a tendency to shrink and swell excessively. This can be avoided by conducting soil stabilization by making use of RBI Grade 81 powder.RBI Grade 81 is a Cement ictus powder stabilizer which can be mixed in proper proportions to achieve desired results. Here I have conducted Modified Proctor Test on Black Cotton soil in the following proportions 1%, 2%, 4%, 6% and obtained results for Optimum Moisture Content and Maximum Dry density. Optimum moisture content increases as the percentage of stabilizer is increased and Maximum dry density decreases. By making use of RBI Grade 81 stabilizer, excellent load bearing capacity is obtained. Keywords: Black Cotton soil, Load bearing Capacity, Maximum dry density, Modified proctor test, Optimum Moisture Content, RBI Grade 81, Soil stabilization.

Neelesh Raghuwanshi, Suneet Kaur In this research Soil stabilization is a major concern in India where the civil engineering infrastructure is developing at a very fast pace. Large area of country is covered with expansive soil which has poor engineering properties and not suitable for construction. So soil stabilization is necessary to enhance it is engineering performance such as workability, stiffness, strength, permeability, compressibility and sensitivity. It is a very effective stabilizer and can be used in sub grade, sub base and base layer. The industrial waste like Pond ash, Fly Ash, Stone dust, Foundry Sand, Steel Slag etc can also be used with RBI Grade-81 as stabilizer to reduce the cost.

Lekha B.M, A.U. Ravi Shankar In this research the study a new Proprietary Cementations Stabilizer (RBI Grade 81) is being used to study the improvement in engineering properties of Black Cotton (BC) soil. The collected soil samples were treated with RBI 81 in various mix ratios. Subsequently, the treated soil samples were cured for different periods ranging from four hours to twenty eight days. Tests were also conducted to determine chemical composition of untreated and treated soils to understand the mechanism of stabilization. Soaked CBR test results indicate that the stabilizer used works well with cohesive soils (such as BC soils). Fatigue life test results indicate a high fatigue life for all treated soils when subjected to repeated loading (considering 1/3rd UCS strength values) as compared to the untreated soils.

III. MATERIALS AND METHODOLOGY

The materials used for this study was Clay soil and Silt soil collected from Deesa in Banaskatha district. They were all collected at depth of 1.5 m below the natural ground level. These soils were kept safe and dry in jute bags in the Geotechnical laboratory They were air dried for three days to allow partial elimination of natural water which may affect analysis, later sieve analysis has been done and laboratory experiments has been carried out, and the stabilizer RBI 81 has been collected from "Alchemist Technology Ltd from New Delhi

Initially the basic tests performed includes the preliminary tests (grain size analysis, natural moisture contents, specific gravity, and Atterberg's limits) as well as the engineering property tests California Bearing Ratio (CBR) Tests for

unstabilized soil as well as for stabilized soil carried out according to the procedures recommended in the relevant IS codes. For tests of specimens of stabilized soils, specimens prepared by thoroughly mixing the required quantity of soil and stabilizer (RBI 81 - 1%, 2%) in appropriate proportion in dry state and wet state to get a homogeneous and uniform mixture of soil and stabilizer.

The soil sample has been collected from the study area which shown in figure below

IV. EXPERIMENTATION

Grain size Analysis, Atterberg's limit and California Bearing Ratio (C.B.R.) tests has been carried out on the samples of soil and soil with stabilizers. RBI Grade 81 will be added to the soil in dry state in percentage (by weight) varying from 1% to 2% and the tests has been carried out for Clayey soil and silt soil. Clayey soil and silt soil are such that they represent a wide range of variation in their properties.

The Standard Proctor Test is carried out on the untreated soil samples as per IS: 2720-1980 (Part VII) and values of MDD and OMC were found out. The soil was treated with clayey soil and RBI Grade 81 for different proportions tested for soaked CBR value, MDD and OMC.

V. RESULTS AND DISCUSSION

Table-2: properties of Clay and Silt soil

Sl.no	Property	Clay soil	Silt soil
1	Specific gravity	2.4	2.5
2	Grain size distribution (%) Gravel Sand Silt clay	 21.6 21 20	 20.7 28.11 27.1
3	Consistency limit (%) Liquid limit Plastic limit	 30.2 16.77	 22.5 NP
4	IS soil classification	MH	CL
5	Maximum dry density(g/cc)	1.62	1.95
6	Optimum moisture content (%)	17.2	10
7	California bearing ratio (%)	3.06	2.92

Table -3: Increase value in basic properties of soil with RBI 81 mix

	Clay soil			Silt soil		
RBI-%	LL (%)	PL (%)	PI(%)	LL (%)	PL (%)	PI (%)
1	28	13.7	22.8	21.9	NP	8.5
2	25	11.37	23.8	18.6	NP	8.9

Table- 4: variation in California bearing ratio of soils with RBI-81 mix

Days	CBR(%) with varying RBI-81 for Clay soil		CBR(%) with varying RBI-81 for Silt soil	
	1%	2%	1%	2%
0 (unsoaked)	4.01	5.28	3.06	4.08

VI. CONCLUSIONS

1. Based on above results Liquid limit and plasticity index decreases with the addition of RBI Grade 81 with varying percentage (1%, 2%) for both soils which shows good effectiveness of RBI-81
2. From the above test results, it can be concluded that RBI-81 is effective stabilizer for enhancement of geotechnical properties of lateritic soil and BC soil.

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