Soil Stabilization using Road Building International (RBI) Grade 81

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Abstract: We consider Soil as the basic foundation for various civil engineering structures. It is necessarily important to resist the loads without failure. In some places, soil may be weak which cannot resist the oncoming loads. In such cases, soil stabilization is needed. Soil stabilization can be defined as changing the soil properties by chemical or physical practice, in order to enhance the engineering quality of the soil. The main objectives of the stabilization of soil are to increase the bearing capacity of the soil, its resistance to weathering process and soil permeability. The long-term performance of any construction project depends on the soundness of the underlying soils. Unstable soils can create significant problems for pavements or structures, Therefore soil stabilization techniques are necessary to ensure the good stability of soil so that it can successfully sustain the load of the superstructure especially in case of soil which are highly active, also it saves a lot of time and millions of money when compared to the method of cutting out and replacing the unstable soil. This study deals with the complete analysis of the improvement of soil properties and its stabilization using RBI Grade 81. In this study 'RBI Grade 81' is mixed with soil to investigate the relative strength gain in terms of bearing capacity and compaction. The effect 'RBI Grade 81' on the geotechnical characteristics was investigated by conducting 'standard proctor compaction tests'. The test were performed as per Indian Standard specifications.

Keywords: Soil stabilization, RBI Grade 81, geotechnical characteristics, Proctor test, CBR test.

I. INTRODUCTION

Black cotton soil also known as expansive soil is predominantly clay soil that leads to noticeable changes in volume and strength due to change in moisture content. Due to increase and decrease in moisture content, the soil gets expand the pressure increases and subgrade of the structure losses its strength, load carrying capacity, fissures, deformation and undulation thereby pavement failing process starts. All these process decrease the life span of pavement. If the stability of the local soil is not adequate for pavement construction, the engineering properties are enhanced by adopting various soil stabilization techniques. Thus the principle of soil stabilized road construction involves the effective utilization of local soils and other appropriate stabilizing agents. RBI Grade-81(Road Building International) is an odourless beige powder that is composed of a number of naturally occurring compounds. It improves the structural properties of a wide range of soils. It is particularly effective with silty-clayey soil with low geo-mechanical qualities and it works by hydration reaction. 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. Black cotton soil stabilized with RBI Grade-81 for different proportions i.e. 2% 4% 6% and 8 % stabilizer and

Laboratory experiments are performed to evaluate the effectiveness of the stabilizer in stabilizing the soil.

- Expansive soil deposits are problematic for the engineering structures.
- Different types of damages in the form of cracking, undulations differential settlement etc are experienced by road ,buildings, irrigation canal, sewer line etc.
- So to overcome this damages to the structure its Engineering properties are to be improved.
- In this project we are trying to improve the soil by using stabilization material, by using RBI GRADE 81 with different curing days
- On the basis of UCS value the soil is to be defined for different percentage of RBI GRADE 81.
- The RBI Grade 81is an inorganic soil stabilizer and pavement material. Some characteristic of RBI Grade 81 is given in the following.

I. Patented worldwide including India
II. Cementitious powder
III. Non-toxic
IV. Non inflameable

II. LITERATURE REVIEW

1. **K.V.madurwar, P.P.Dahal, A.N.Burile**:-from International Journal of Innovative Research in Science, Engineering and Technology Research on Comparative Study of Black Cotton Soil Stabilization with RBI Grade 81 and Sodium Silicate.

2. **Alchemist technology limited New Delhi:-** They work on pavement construction for various types of road in INDIA, by using RBI GRADE 81 soil stabilizer. They found that the RBI product is eco-friendly and easy for design of roads.

3. **RAASTA (2008):-**conducted the laboratory studies on black cotton soil by using RBI GRADE 81 stabilizer then it was concluded that low percentages about 1-2% of stabilizer is effective to improve the properties of black cotton soil.

4. **Prof.S.S.Razvi, Jayant, A.Patil** ,International Journal of Innovative Research in Advanced Engineering (IJIRAE),conducted test using RBI GRADE 81 on black cotton soil compare the values obtained before using stabilizer and after using stabilizer as RBI GRADE 81.In this study they found that engineering properties of soil is going to improve such as atterbergs limits, MDD and OMC etc.

5. **S N L Taib, S Striprabu, (2016)**Investigation on Strength Development in RBI Grade 81 Stabilized Serian Soil with Microstructural Considerations

6. **Anitha.K.Ret. al. (2009)** have performed test on "Effects of RBI- 81 on Different Types of Subgrade Soil". From the test results it is observed that substantial reduction in plasticity index for soil with RBI Grade 81 viz 42 percent for kaolinite, 4 percent for red soil and 116 percent for laterite. Soaked CBR value increased for all three soils with RBI. OMC increased and MDD decreased with addition of RBI Grade 81 for red soil and kaolinite.

7. **C.E.G.Justo and Krishnamurthy (2008)** have conducted a study on"laboratory studies on properties of soils treated with Rbi – 81 stabiliser", However there is an increase in the values of plastic limit and therefore a reduction in Plasticity Index (PI). About 35 to 40 % reductions in plasticity index values have been observed with the addition of 6 % stabilize.. The soaked CBR value of stabilized soils after 7-days curing showed significant increase in all the soils,even with 2% stabilizer content.

8. **K.V. Madurwar** (2013) have performed test on "Comparative Study of Black Cotton Soil Stabilization with RBI Grade 81 and Sodium Silicate". Liquid limit decreases as the admixture content increases whereas reverse trend observed with plastic limit as it increases with the increase of admixture, results in net reduction of plasticity index. Unconfined Compressive strength, CBR (soaked) values increase with increase in RBI 81 addition suggest its suitability as good stabilizer to improve performance.

9. **B.M.Patil and K.A.Patil (2013)** have performed test on "Effect of Fly ash and Rbi grade 81 on Swelling Characteristics of Clayey Soil". This paper deals with stabilization of clayey soil by using fly ash and RBI Grade 81 to improve the geotechnical properties of soil. The results show that, the LL, MDD, OMC and DFS index of clayey soil improved considerably. The LL of untreated soil is 67% and it reduces to 46% for mix of soil: fly ash: RBI Grade 81 for 76:20:04 proportion. The DFS of untreated soil is 65% and it reduces to 40% for addition of fly ash and RBI Grade 81.

10. **Lekha B.M. and A.U. Ravi Shankar (2014)** have conducted a study on "Laboratory Performance of RBI 81 Stabilized Soil for Pavements". The collected soil samples were treated with RBI 81 in various mix ratios. 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.

11. **Er. Tejinder Singh and Er.Navjot Riar (2013)** have conducted a study on "Strengthening Of Subgrade by Using RBI Grade-81 A Case Study". In this study shows that 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.

III. OBJECTIVES

1. To evaluate the effect of RBI-81 on the basic properties of Bearing Capacity soil.

2. To understand the effect of RBI-81 on the unconfined compressive strength of the Bearing Capacity soil.

3. To compare RBI GRADE 81 on the basis of cost, suitability, and time required to execute the work.

4. To study the compaction characteristics of native soil and soil stabilized with RBI Grade -81 under varying dosages.

5. To study the mineralogical characteristics of untreated and treated soils through X-ray diffraction method.

6. To evaluate the changes in strength characteristics of treated and untreated soil specimens by California

7. Bearing ratio test (CBR) with varied dosages of RBI Grade -81.

8. Construction time and cost reduction

9. Drastically increases the strength

10. Stabilization water proofs the soil.

11. Treated layer are water resistant

12. Reduces thickness, use of transport, and earth moving machinery substantially.

13. Longer durability which reduces maintenance

IV. METHODOLOGY

- For the test on black cotton soil, the sample is carried.
- Stabilizer RBI GRADE 81.
- Test on soil like atterbergs limits. Sieve analysis,MDD and OMC values are compared before and after addition of RBI GRADE 81

1. Plastic Limit :-

   This test is done to determine the plastic limit of soil as per IS: 2720 (Part 5) – 1985.The plastic limit of fine-grained soil is the water content of the soil below which it ceases to be plastic. It begins to crumble when rolled into threads of 3mm dia.

Fig.1 PLASTIC LIMIT

2. Liquid Limit :-

   This test is done to determine the liquid limit of soil as per IS: 2720 (Part 5) – 1985. The liquid limit of fine-grained soil is the water content at which soil behaves practically like a liquid, but has small shear strength. It's flow closes the groove in just 25 blows in Casagrande's liquid limit device.

Fig.2 LIQUID LIMIT

3. Modified proctor test: -

   To determine moisture content and dry density relationship using heavy compaction or modified compaction method as per IS-2720-Part-8.

Fig.3 MODIFIED PROCTOR TEST

4. CBR test in progress:-

   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 (CBR Test) is

a penetration test developed by California State Highway Department (U.S.A.) for evaluating the bearing capacity of subgrade soil for design of flexible pavement.Tests are carried out on natural or compacted soils in water soaked or un-soaked conditions and the results so obtained are compared with the curves of standard test to have an idea of the soil strength of the subgrade soil.

Fig.4 CBR TEST

5. Liquid limit test in progress by cone penetrometer apparatus :-

For determination of the liquid limit of soil using cone penetrometer.IS : 2720(Part 5)-1985

Fig.5 LIQUID LIMIT TEST IN PROGRESS BY CONE PENETROMETER APPARATUS

V. CONCLUSIONS:

i. The study of variations of different parameters liquid limit, plastic limit, plasticity index, shrinkage limit, maximum dry density, optimum moisture content, unconfined compressive strength and California bearing ratio with the addition of Dandeli fly ash.

ii. The each parameter of the study soil samples, there exists an optimum Dandeli fly ash percentage for mixing with the soil under consideration; at which the respective parameter attains its most desirable value from geotechnical point of view.

VII. Future Scope :

I. To improve the Engineering properties (Shear strength, permeability, bearing capacity, etc).

II. To decrease the plasticity index.

III. Reduction in time and cost of road construction using RBI grade 81 as a stabilizer.

IV. The criteria for improving the engineering properties of different soil types and granular materials, procedures for determining a design treatment level for each type of soil through laboratory analysis and recommend construction practices for incorporating the RBI GRADE-81with the soil is suggested. These criteria are applicable for all types of roads and airfields where a stabilized layer is proposed to be included in pavement crust.

VI. REFERENCE

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II. Satander Kumar and Anukul Saxena., “Soil and Aggregate Stabilization for Sustainable Pavement” NBM&CW, December 2010

III. 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

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