IMPROVEMENT OF SUBGRADE BY RBI GRADE 81 AND FLY ASH

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Abstract- *Road infrastructure in India is developing at very fast pace. A good pavement is needed for the safe, comfortable and economical movement of traffic. If the local available soil has no adequate strength, either soil from other site is to be used or the available soil has to be stabilized. So, that it's engineering performance, such as strength, stiffness, compressibility, permeability, workability and sensitivity of local available soils can be improved. Soil can be stabilized with RBI Grade 81 and then can be used in sub grade and also as sub base and base layers. This will help to cut down the construction cost by selecting local available materials.*

The objective of present work is to study the effect of RBI Grade 81 at 2%, 3% and 4% along with fly ash 3%, 6% and 9% to determine the optimum value of CBR and DCPT at different percentage and to also find out the optimum combination. So that the design pavement based on natural soil and modified soil can be compared and cost comparison could be done.

Key Words: RBI Grade 81, Fly ash, CBR, DCPT.

1. INTRODUCTION

In developing countries like India the biggest handicap to provide a complete net work of road system is the limited finances available to build road by the conventional methods. Therefore there is a need to resort to one of the suitable methods of low cost road construction to meet the growing needs of the road traffic. The construction cost can be considerably decreased by selecting local materials including local soils for the construction of the lower layers of the pavement such as the sub-base course. Soil stabilization is the alteration of the property of a locally available soil to improve its engineering performance, such as strength, stiffness, compressibility, permeability, workability, and sensitivity. The several reasons for using stabilization are poor sub grade conditions, borderline base materials, construction of superior bases, moisture control, dust control and salvaging old roads. The uses of stabilization are economical road construction, upgrading of road, maintenance of unpaved roads, rehabilitation of failed roads, construction of roads, parking areas, air strips, and mass fills. Soils could be stabilized by mechanical, chemical, electrical, or thermal means. Chemical stabilization includes the addition of RBI Grade 81, cement, lime, asphalt, chemical compounds, or a combination of those.

RBI Grade 81(Road Building International Grade 81) is a unique and innovative product that was developed for the stabilization of a wide spectrum of soils in an efficient, least- cost manner. RBI Grade 81 is an environmentally friendly, inorganic, hydration activated powder based stabilizer that reacts with soil particles to create layers that are interconnected through a complex inter particle framework. RBI Grade 81 is a combination of naturally occurring compounds. Road can be opened to traffic within 24 hours of final compaction. It provides a dust free surface. If the nature of the soil changes for different depths, most of the methods for stabilization cannot be used. RBI Grade 81 has a wide range of response spectrum. Response spectrum is the range of soils for which a particular stabilizer can be used.

2. LITERATURE REVIEW

Several authors have reported the use of RBI-81 in many several soils such as Black Cotton soil, Red soil, Lateritic soil Kaolinite soil to investigate the effect of using a new stabilization product and to modify engineering properties of soil.

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Anitha.K.R, R.Ashalatha, Arvee.Sujil, Johnson [1] 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 RB1-81 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.

K.V. Madurwar, P.P. Dahale, A.N.Burile [2] made an attempt to modify engineering properties of black cotton soil by using RBI-81 and sodium silicate. After then Atterberg's 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. Addition suggests its stability as good stabilizer to improve performance of soft soil. They also came to the conclusion that free swell index decreases as RBI - 81 increased and its goes on increased by increase in sodium silicate.

B.M.Patil, K.A.Patil [3] deals with the improvement in various properties of sub grade soil by using soil stabilizer and locally available poor materials. Where they carried out the standard proctor test on treated and untreated soil sample and value of MDD and OMC were find out. The soil was treated with moorum and RBI 81 with different proportions tested for soaked CBR value, MDD and OMC which resulted for mix of soil: RBI Grade 81 in the proportion of 100:0, 98:2, 96:4 the soaked CBR values are found to be 2.56%, 4.89%, and 8.79% and for mix of soil: moorum: RBI Grade 81 in the proportion of 100:0:0, 90:10:0, 80:20:0, the soaked CBR values are found to be 2.56%, 2.41% and 2.84% and for mix of soil: moorum: RBI Grade 81, the proportion of 78:20:2, 76:20:4 the soaked CBR values are found to be 4.56%, 14.76% respectively. This indicates that the CBR value of sub grade soil can be improved by using moorum with RBI Grade 81and cost of construction can be reduced to certain extent.

Tejinder Singh, Navjot Riar [4] studies about the effect of stabilizer RB1-81 in the stabilization of soil with the help of Atterberg's limit, Standard Proctor test & CBR test to find out the strengthening of soil and for the analysis of cost difference between conventional method and cost of making pavement for soil with +2% RB1-81. During this experiment wet sieve analysis was done for determining practical size distribution. Liquid limit and plastic limit tests were also conducted to study the effect of RBI -81on index property of soil. CBR specimens were also prepared with different percentage of RBI-81 i.e. (0%, 2%, 4%, 6% & 8%) with water content of 1% + OMC. After the experiment the conclusion was made that the highly plastic soil can be stabilized with RB1-81 and can be considered as stabilized sub base. During this experiment it has also be seen that the CBR increased with addition of RB1-81. 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

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very effective stabilizer. It has also been observed that 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.

B. M. Patil, K. A .Patil [5] deals with the effect of industrial waste and chemical additives on the CBR value of soil. The various industrial wastes like fly ash, pond ash and stone dust mixed in clayey soil with RBI Grade 81 as chemical additives in different proportions and its soaked CBR value determined in the laboratory. The CBR value of mix of soil and RBI Grade 81 for different proportions was determined. The RBI Grade 81 added in 2%, 4%, and 6% by weight of soil. The results show that the CBR value of treated soil with 2% RBI Grade increases by 91.01%.The CBR value of untreated soil is 2.56%. The CBR value of treated soil with 20% pond ash and 4% RBI Grade 81 is 12.74%. The percentage increase in CBR value is 397% than untreated soil. This indicates that the soaked CBR value of soil is increase slightly by addition of industrial wastes, when these wastes added with RBI Grade 81 the increase in CBR value is considerable. The RBI Grade 81 help to utilize locally available soil for road construction and therefore the cost of construction can be reduces.

Haricharan T.S, Vinay Kumar K.S, Durga Prashanth L, M.R.Archana, A.U.Ravishankar [6] 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 viz 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.

Mamta, Mallikarjun.Honna [7] modify the engineering properties of black cotton soil by using RB1-81. During this experiment the authors carried out tests like Atterberg's limit, CBR & UCS tests on the samples of soil and soil with stabilizer. 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 lateritic (red soil) and black cotton soil .Which resulted and concluded that CBR value for specimens increase more with curing as addition of optimum percentage of RB1-81 with 1% & 2% the result of CBR test on Black cotton Soil increases from 5.7% & 7% on un-soaked condition and 7% & 10% on 3 days soaked condition and in lateritic soil it increase from 11.4% & 12.3% on un-soaked condition and 13% & 15% on 3 days soaked condition. This concluded that RBI-81 is effective stabilizer from enhancement of geotechnical properties of lateritic & Black cotton Soil.

Ahmed. Naseem .A .K, R. M. Damgir [8] author figures out the effect of waste material like fly ash and natural soil stabilizer mixed with black cotton soil at different proportions on Liquid limit, plastic Limit, plasticity Index, Compaction Characteristics, California Bearing Ratio of an expansive soil. These expansive soils was mixed with fly ash from 0% to 30% at an increment of 10% after then RB1-81 has been mixed with black cotton soil from 0% to 6% at an increment of 2%. After then Liquid limit, plastic limit tests, standard proctor compaction test, UCS test, soaked CBR test were conducted. Which help them to get on the conclusion that the soaked CBR Value has increased from untreated black Cotton soil to treated with fly ash as well as with RBI Grade 81 also. Also the soaked CBR value

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increase with increase in RBI grade 81 addition suggest its suitability to improve performance of soft soil. It has also been found that there is increase in MDD and OMC of treated soil with RBI Grade 81 at 4% mix than untreated soil.

B.M.patil and K.A.patil [9] deals with stabilization of sub grade soil by using fly ash and RBI Grade 81. The various laboratory tests like California Bearing Ratio (CBR), standard Proctor, Unconfined Compressive Strength (UCS) and Differential Free Swell Index (DFS) were conducted in the laboratory on different mixes of soil, fly ash and RBI Grade 81. After conducting all the tests the author gets the result that the soaked CBR value of untreated soil is found to be 2.76%. For the sub grade soil treated with fly ash and RBI Grade 81, the CBR value is increased to 13.14% from 2.76% for proportion of 76:20:04. Also the soaked CBR value of soil: fly ash: RBI Grade 81 in the proportion of 76:20:04 increases by 376% as compared to untreated soil. Overall we get to study in this paper that the use of fly ash along with RBI Grade 81 significantly improves the geotechnical properties of soil.

3. DISCUSSION

Based on various researchers, it is observed that the engineering properties of soil can be improved by using RBI-81. This helps to use local available soil to be use in sub grade and also as sub base and base layer. It is also been observed that the geotechnical properties of soil has also been improved by using fly ash along with RBI-81.

4. CONCLUSION

Based on above literature review it could be concluded RBI Grade 81 is effective in stabilization of most types of soils. The increase in CBR value varies w.r.t type of soil. For some soils, the increment is large with small addition of the chemicals like fly ash, Sodium Silicate, pond ash, moorum and stone dust. Since RBI Grade 81 help to utilize locally available soil for road construction, therefore the cost of construction can be reduced by avoiding replacement of soil. The soaked CBR values increase with increase in RBI 81 addition suggest its suitability as good stabilizer to improve performance of soft soils. The use of fly ash along with RBI Grade 81 significantly improves the geotechnical properties of soil.

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BIOGRAPHY

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