

# Study on use of Red Mud with RBI Grade 81 in Black Cotton Soil to Enhancing the Properties of Sub Grade & Base Layer of Re Wall and Semi Rigid Pavement

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## ABSTRACT

- Soil is very important in civil engineering constructions. The poor engineering properties of the local soils may present many difficulties for construction and therefore need to improve their engineering properties. Stabilization techniques can be used to improve the properties of soil.
- Soil stabilization improves various engineering properties e.g. bearing capacity, compressibility, strength, and various other properties of soil. In this study the impact of Red Mud to improve the strength of soil.
- An effective stabilizer i.e. RBI Grade-81 (polymer) used as a chemical additive and can also be used in sub grade, sub base and base layer.
- The industrial waste like Fly Ash, Stone Dust, Red Mud etc. can be used with RBI Grade-81 as stabilizer to reduce the cost.
- The strength has been compared on the basis of CBR for virgin soil and soil with red mud with RBI grade un-soaked and soaked conditions.
- The result implies that when sub-grade is reinforced with Red mud & RBI grade-81 its CBR increases as for virgin soil and it increases for un-soaked & soaked condition.
- Red Mud & RBI grade-81 has a good potential to reduce the cost of pavement layers if weak sub-grade is encountered on the alignment.

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## INTRODUCTION

Soil is basic and important element in Civil Engineering field. Stability of every structure depends on the type and characteristics of foundation which in turn depends on the type of soil. Many problems erupt if expansive soil, Natural soil is to be used in foundation, because of its shrinkage and swelling properties. There are many methods to make natural soil stable for various constructions. Natural soil is comfortable for road work, compared to other types of soil.

## LITERATURE REVIEW

**"Feasibility Study on the Use of RBI Grade-81 Cementation Material in Road Construction, year 2007"** by Central Road Research Institute (CRRI) New Delhi,

In the study four type of soil classified as gravelly, sandy, silty and clayey are combined with different dosage of RBI Grade-81 varying from 2% to 12% to test for CBR, UCS and Durability. The test were conducted as per prevailing IS and ASTM codes. The CBR of gravelly soil improved from 30% to 234% at dosage of 6%, in case of silty soil the improvement at 6% RBI Grade-81 increased to 268% from 8%. The Clay and sand CBR improved from respective 4% and 22% to 129% and 79% at 12% RBI Grade-81. Gravel and silt soils sample also passed the durability test at 6 and 4%

respectively, this dosage is recommended for construction of sub base and base.

**"Laboratory Studies on Properties of Soil Treated with RBI Grade-81 Stabilizer" Done at RASTA, Center for Road Technology, under Prof. C.E.G Justo[2008].** The involved four different kind of soils namely, black cotton, red loamy, silty sand and gravelly soil. The study involved plasticity characteristics, CBR and UCS. The black cotton soil showed an improvement of 47% at 4 % when tested for PI. CBR increased by 1100% at 6% RBI Grade-81 and the UCS value raised by 353% with 4% RBI Grade-81. Similar and even better trends are observed with other three types of soils.

## Objective

- The experimental work is to find the increase in strength of the natural soil by using of red mud with RBI grade by enhancing the property of sub grade & base layer of re wall with semi-rigid pavement.

## Methodology

There are various test performed in laboratory as per IS code standards like:

- Grain Size Distribution
- Liquid Limit
- Plastic Limit
- Plasticity Index

- Specific Gravity
- Optimum Moisture Content (OMC)
- Maximum Dry Density (MDD)
- California Bearing Ratio (CBR)

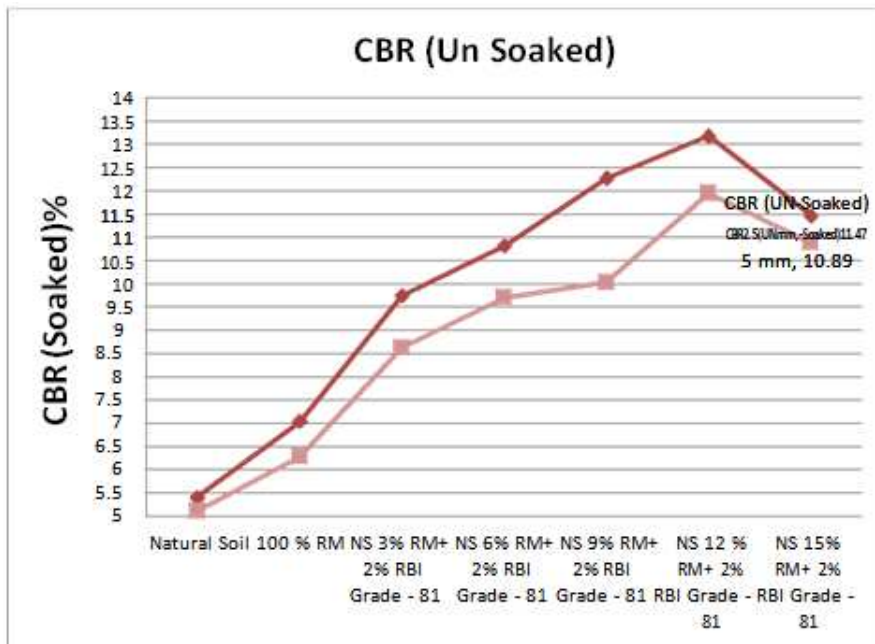
**Table-01 Tests conducted for Prepared Samples**

S. No.	Material	Tests conducted
1	Natural Soil	Grain size Analysis- (mechanical Method), Specific Gravity Consistency Indices (L.L. , P.L. , P.I.) Compaction Test (Light Compaction) CBR Test (Soaked & Un-soaked)
2	Natural soil + 3 % Red Mud+ 2% RBI Grade-81	
3	Natural soil + 6 % Red Mud+ 2% RBI Grade-81	
4	Natural soil + 9% Red Mud+ 2% RBI Grade-81	
5	Natural soil +12% Red Mud+ 2% RBI Grade-81	
6	Natural soil + 15 % Red Mud+ 2% RBI Grade-81	
7	Natural soil + 18 % Red Mud+ 2% RBI Grade-81	

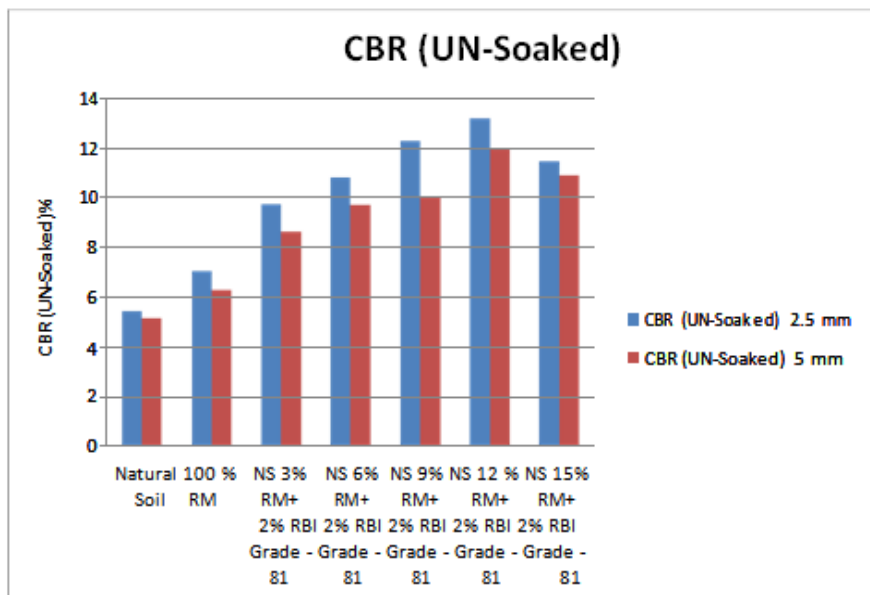
**RESULT**

**CBR Test for Natural Soil with varying percentages of Red Mud**

California Bearing Ratio (CBR) tests were executed out to determine CBR Value for sub-grade soil and for soil that may be stabilized with altered percentages of Red Mud, California Bearing Ratio (CBR) Unsoaked and Soaked tests were executed on Natural Soil (B.C Soil) first by mixing with altered percentage of Red Mud to stabilize Natural soil and then altered percent of Red Mud at which maximum CBR is gained is chosen for further experimental work.



**Figure5.10 Variation in Un Soaked CBR Value of Natural Soil and Natural soil + varying %age of Red Mud with 2% RBI**



**Figure 5.11 Bar Chart Un Soaked CBR Value of Natural Soil and Natural soil + varying %age of Red Mud with 2% RBI**

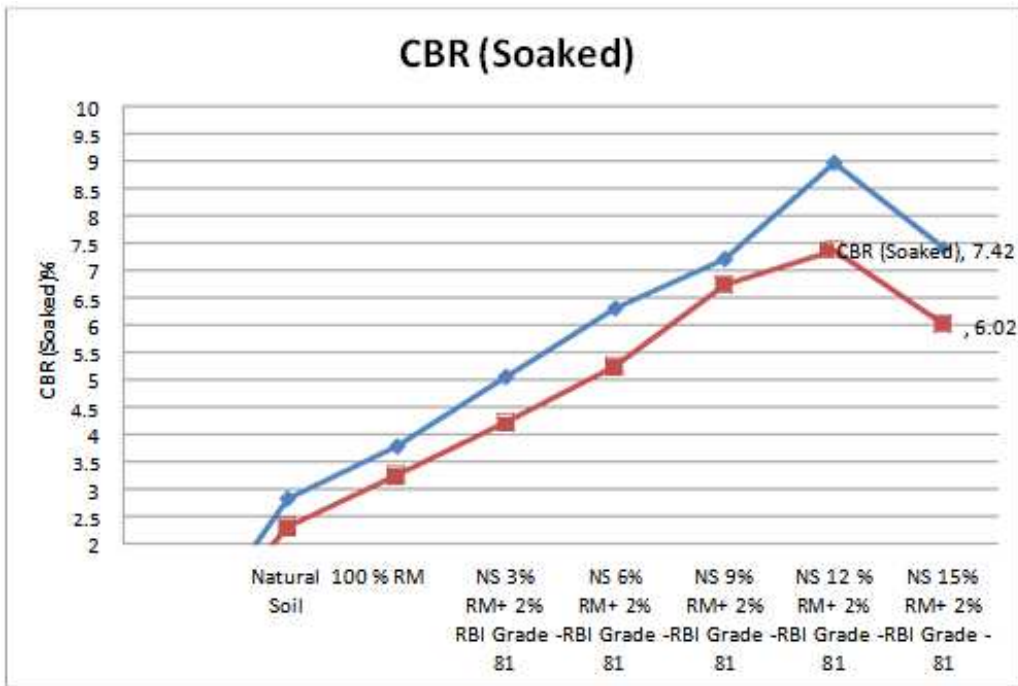


Figure 5.12 Variation in Soaked CBR Value of Natural Soil and Natural soil + varying %age of Red Mud with 2% RBI

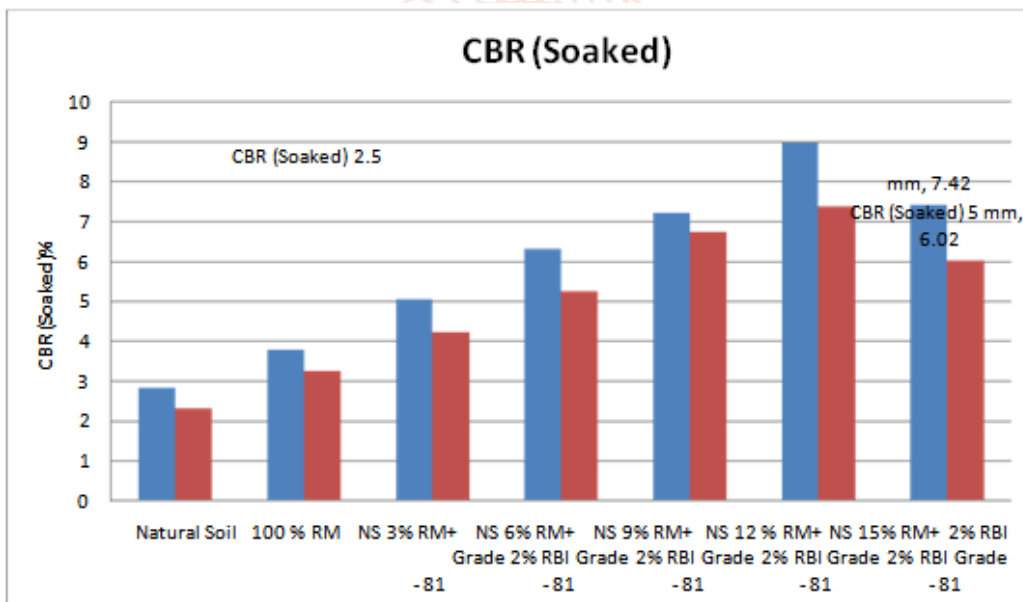


Figure 5.13 Bar Chart Soaked CBR Value of Natural Soil and Natural soil + varying %age of Red Mud with 2% RBI

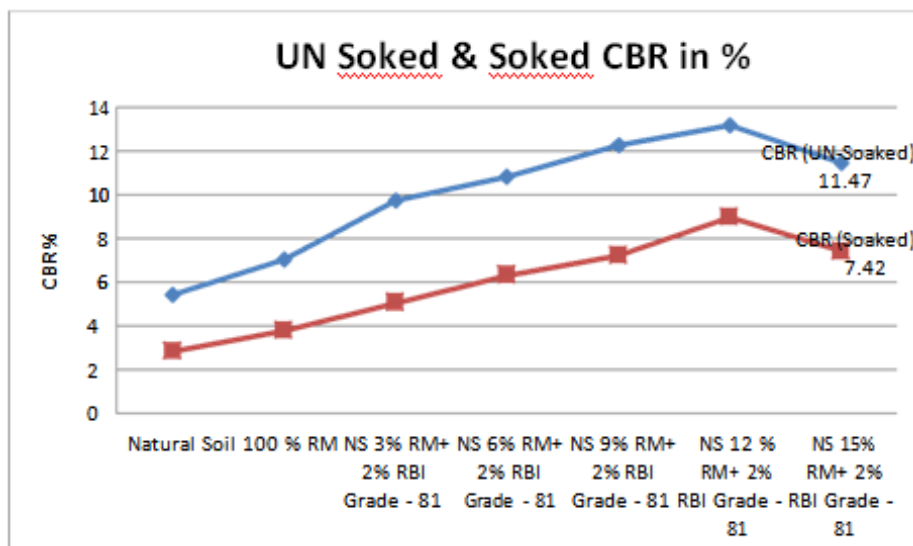
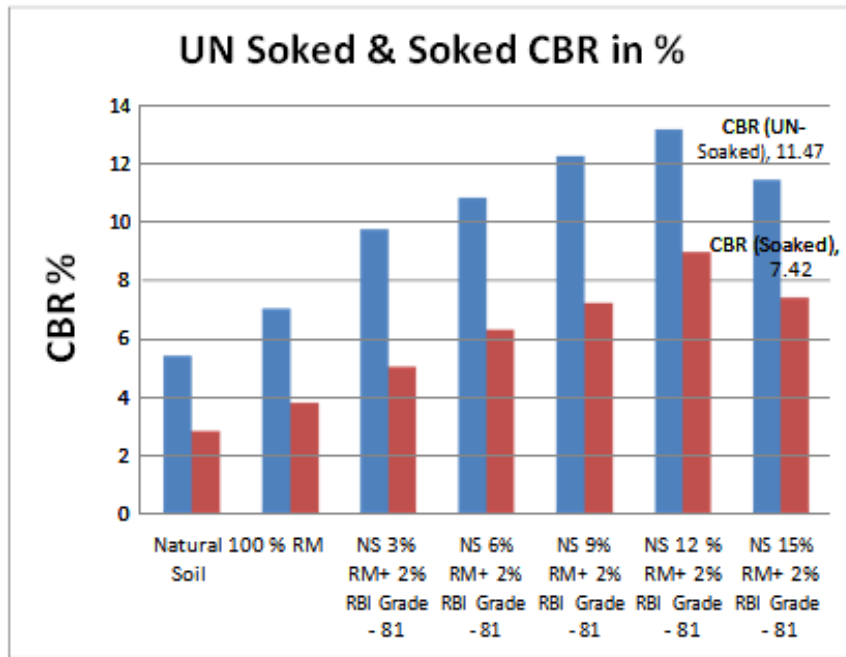


Figure 5.14 Comparison of Un Soaked & Soaked CBR of Natural Soil and Natural soil + varying %age of Red Mud with 2% RBI



**Figure 5.15 Bar Chart Comparison of Un Soaked & Soaked CBR of Natural Soil and Natural soil + varying %age of Red Mud with 2% RBI**

**CONCLUSION**

The Unsoaked CBR value of the raw soil is **5.42 %** and after mixing of Red Mud with RBI Grade-81 in the soil, there is remarkable change in CBR value from **5.42 to 13.19%**. when Red Mud is increased from 0 to 15% with 2% RBI Grade 81 is effective beyond also there is a decrease in CBR of soil from **13.19 to 11.47%** when Red Mud is increased from 15% to 18% The soaked CBR value of the raw soil is 2.53 % and after mixing of Red Mud with RBI Grade-81 in the soil, there is remarkable change in CBR value. increasing from **2.83 to 8.98%** when Red is increased from 0 to 16% with 2% RBI Grade-81 is effective beyond also there is a decrease in CBR of soil from **8.98 to 7.42%** when Red Mud is increased from 15% to 18%.

**Future Scope of work**

The suitability of using waste material like demolition waste, all types of slag, marble, granite, stone dust, fly ash, etc. to be stabilized with this RBI Grade-81 technology along with soil and used in road construction.

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