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Use of Moorum in Subgrade Soil & Pavement Sub-Base

Sumit[1], Paramjeet Malik[2]

1Postgraduate Student Department of Civil Engineering, Sat Priya Group of Institution, Rohtak – 124001
2Asst. Professor, Department of Civil Engineering, Sat Priya Group of Institution, Rohtak, Haryana

ABSTRACT

The life of road depends on strength of the subgrade soil and traffic density. The subgrade soil is not uniform throughout the alignment of the road. Generally the poor subgrade soil having soaked California Bearing Ratio (CBR) value less than 2% is replaced by good quality subgrade material. This paper deals with the improvement in various properties of subgrade soil by using soil stabilizer and locally available poor materials. The additive like RBI Grade 81is used to improve the properties of subgrade soil. The cost of construction of road increases, if only RBI Grade 81 is used as a stabilizer. The CBR value of subgrade soil can be improved by using moorum with RBI Grade 81 and cost of construction can be reduced to certain extent. From CBR test, it is found that the soaked CBR value of soil is improved by 476.56% i.e. 2.56% to 14.76% by stabilizing soil with 20% moorum and 4% RBI Grade 81. The various mixes of soil: moorum: RBI Grade 81 for the different proportions were tested for maximum dry density (MDD), optimum moisture content (OMC) and soaked CBR value.

1. 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] 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 applications.

2. MATERIALS USED

2.1 Soil

The soil sample is collected from Lasur station to Amantpur wadi road located in Aurangabad district of Maharashtra state,India. The various properties of soil were tested and are given in table 1.

Table1: Basic Properties of soil

Properties of soil	Value	Properties of soil	Value
Specific gravity	2.26	CBR %	2.56
Liquid limit %	62.00	UCS N/mm^2	0.35
Plastic limit %	33.25	Gravel % (4.75 to 80.0 mm)	04.96
Plastic index %	28.75	Sand % (0.075 to 4.75 mm)	12.89
Dry density gm/cm^3	1.43	Silt and clay % (below 0.075 mm)	82.15
OMC %	25.80		

2.2 Moorum

The weathered rock fragments which are gravely and non plastic in nature is locally called as moorum. The granular moorum is collected from Amantpur wadi 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%	1.78
2	Optimum moisture content %	10.21
3	Soaked CBR %	8.14

3. EXPERIMENTATION

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

4. 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	26.67	8.79

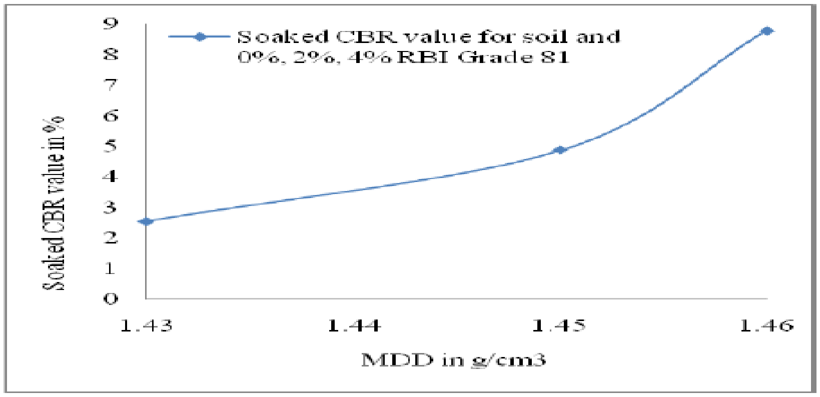

Fig.1. Effect of RBI Grade 81 on CBR and MDD of soil

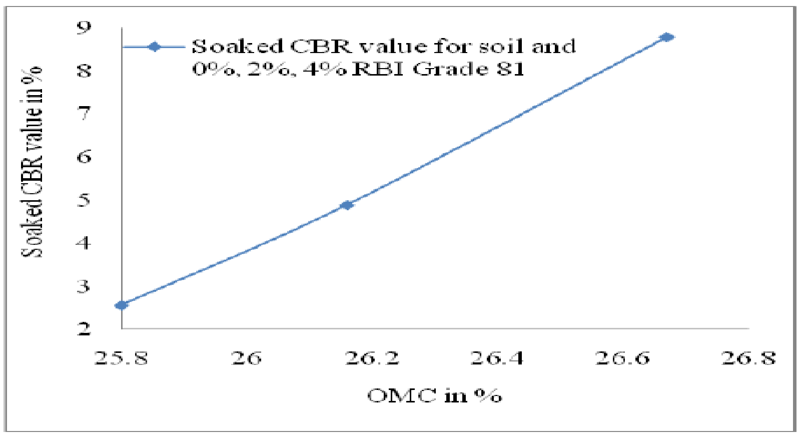

Fig.2. Effect of RBI Grade 81 on CBR and OMC of soil

From the table 3, it is observed that the MDD for mix of soil: RBI Grade 81 for proportion 98:2 is 1.45 g/cm3 and the OMC is 26.16%. Similarly the MDD for mix of soil: RBI Grade 81 for proportion 96:4 is 1.46 g/cm3 and the OMC is 26.67%. It is also observed that the MDD and OMC of mix soil: RBI Grade 81 for proportion 98:2 is less as compared to MDD and OMC of untreated soil.

4.2 Effect of Moorum on MDD and OMC of soil

The MDD and OMC of mix of soil: moorum for proportion of 100:00, 90:10, and 80:20 was found out and the results are given in table 4. The MDD for mix of soil: moorum for proportion 90:10 is 1.51 g/cm3 and OMC is 23.20 g/cm3. The results shows that the MDD of soil increases as the percentage of moorum increases. Also the OMC of soil reduces as the percentage of moorum increases in the soil.

Table 4: Effect of Moorum on MDD and OMC of Soil

Soil : Moorum:	MDD g/cm^3	OMC in %	Soaked CBR value
100:00	1.43	25.80	2.56
00:100	1.78	22.43	8.14
90:10	1.51	23.20	2.41
80:20	1.53	24.85	2.84

4.3 Effect of Moorum and RBI Grade 81 on MDD and OMC of soil

The maximum dry density of mix of soil:moorum: RBI Grade 81 for proportion of 100:0:0. 88:10:2, 78:20:2 was found out and the results are given in the table 5. The results shows that the MDD for mix of soil: moorum: RBI Grade 81 for proportion 88:10:2 is 1.61 g/cm3 and OMC is 24.76%. Similarly the MDD for mix of soil: moorum: RBI Grade 81 for proportion 78:20:2 is 1.64 g/cm3 and OMC is 26.44%. From the figure 3, it is also observed that the dry density of treated soil with moorum and RBI Grade 81 increases as compared to untreated soil. The MDD for mix of soil:moorum: RBI Grade 81for proportion of 100:0:0. 88:10:4, 78:20:4 was found out and the results are given in the table 5. The MDD for mix of soil: moorum: RBI Grade 81 for proportion 88:10:4 is 1.47 g/cm3 and OMC is 26.87%. Similarly the MDD for mix of soil: moorum: RBI Grade 81 for proportion 78:4:20 is 1.49 g/cm3 and OMC is 24.76%.The results shows that the dry density of treated soil with moorum and RBI Grade 81 increases as compared to untreated soil. Also the moisture content of treated soil with moorum and RBI Grade 81 is decreases as compare to untreated soil.

Table 5: Effects of RBI Grade 81 and Moorum on MDD and OMC of soil

Soil : Moorum: RBI Grade 81	MDD g/cm^3	OMC in %	Soaked CBR value
88:10:2	1.61	24.76	3.4
86:10:4	1.47	26.82	10.23
78:20:2	1.64	26.44	4.56
76:20:4	1.49	24.76	14.76

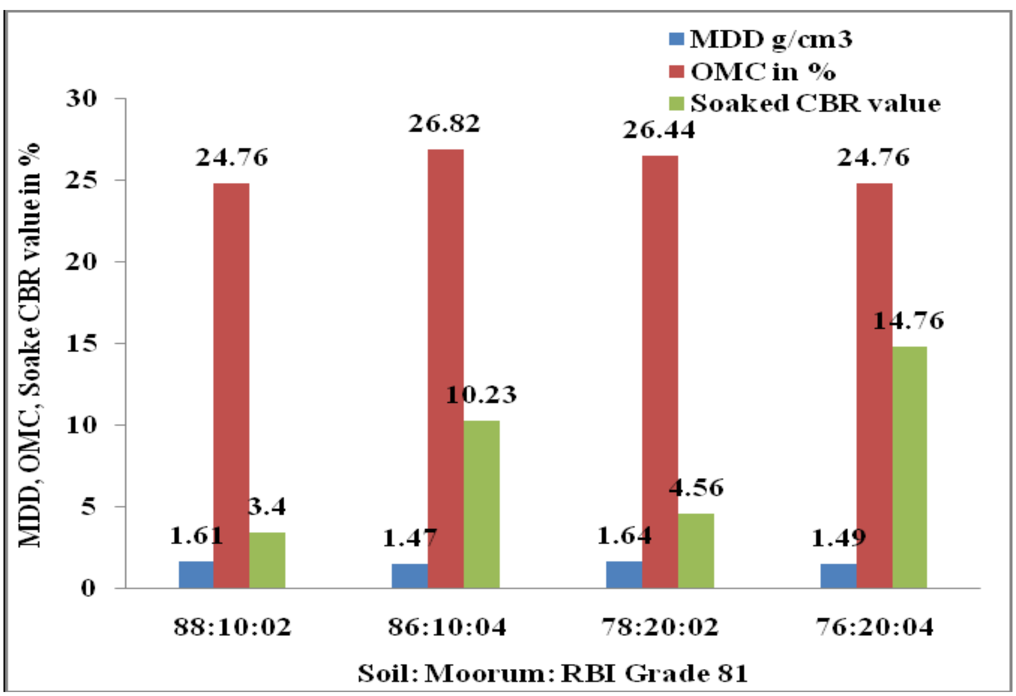

Fig.3. Effect of Moorum and RBI Grade 81 on MDD, OMC and CBR value of soil

4.4 Effect of Moorum and RBI Grade 81 on soaked CBR value of soil

The CBR test is conducted in the laboratory on soil, moorum and RBI Grade 81 for various proportions. The obtained results are given in table 6.The modified soil obtained by mixing soil: RBI Grade 81 in the proportion of 98:2 and 96:4. For these modified soil mixes the soaked CBR value were found to be 4.89% and 8.79%, respectively. Similarly by mixing of soil: moorum: RBI Grade 81 in the proportion of 90:10:0, 88:10:2 and 86:10:4, the soaked CBR value were found to be 2.41%, 3.40% and 7.95% respectively. The effect of moorum and RBI Grade 81 on CBR value of soil is as shown in figure

4. As per IRC-37-2001[8], the total pavement thickness to carry traffic of 2 msa, with CBR value of subgarde soil 2.56 % is 660mm. If the same soil treated with 2% RBI Grade 81, its CBR value increases to 4.89%. Hence the total pavement thickness to carry traffic of 2msa with 4.89% CBR is 520mm. Therefore the total thickness of pavement is reduced by 21%. If the poor subgrade is treated with 4% RBI Grade 81, the CBR value increased to 8.79%. Therefore the total pavement thickness is reduced to 390mm. If the poor subgrade soil is treated with 20% moorum, the CBR value increased to 2.84%. The total pavement thickness to carry traffic of 2msa with 20% moorum treated subgrade soil is 630mm. The poor subgrade soil treated with 20% moorum and 2% RBI Grade 81, the CBR value increased to 4.56% and the total pavement thickness to carry traffic of 2msa is 515mm. The poor subgrade soil, if treated with 20% moorum and 4% RBI Grade 81, the CBR value increased to 14.76% and the total pavement thickness reduced to 300.

Table 6: Effects of RBI Grade 81 and Moorum on CBR Value of soil

Sr. No.	% of soil	% of RBI Grade 81	% Gravel (Moorum)	% of Soaked CBR	% increase in CBR
1	100	-	-	2.56	-
2	98	2	-	4.89	91.01
3	96	4	-	8.79	243.35
4	-	-	100	8.14	-
5	90	-	10	2.41	-
6	80	-	20	2.84	10.94
7	70	-	30	3.28	28.10
8	88	2	10	3.40	32.81
9	78	2	20	4.56	78.12
10	68	2	30	6.15	140.23
11	86	4	10	10.23	210.55
12	76	4	20	14.76	476.56
13	66	4	30	16.27	531.64

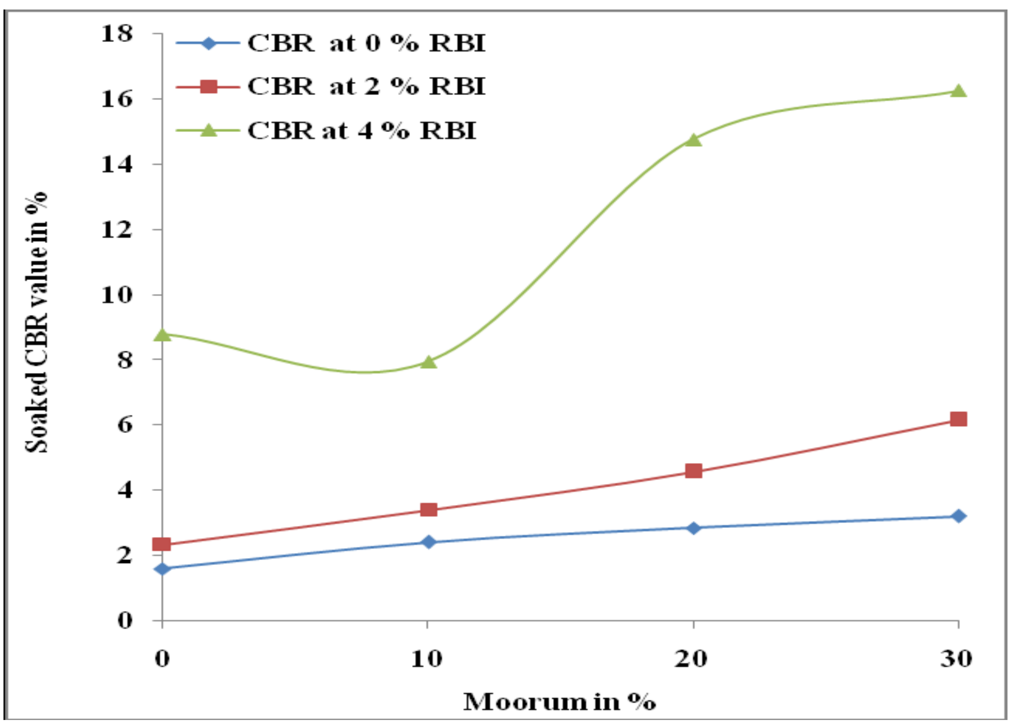

Fig.4. Effect of RBI Grade 81 and Moorum on CBR value of soil

The construction cost of the pavement initially more due to more cost of RBI Grade 81 but it reduces the maintenance cost by 20% to 30%. The important advantage of use of reduced amount of moorum is to save natural materials and protects the environment.

CONCLUSION

1. 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% respectively.
2. 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% respectively.
3. For mix of soil: moorum: RBI Grade 81 in the proportion of 88:10:2 and 86:10:4 the soaked CBR values are found to be 3.40%, 7.95% respectively.
4. 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.

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