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Stabilization of Black Cotton Soil Using Waste Foundry Sand & RBI Grade 81

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Abstract: *Black Cotton soil is having abandoned in quantity & everywhere in Maharashtra, when any type of structure is constructed in black cotton soil the foundation of structure is very important, and it must be strong to support the entire structure. For the construction of road the sub-grade should be capable to withstand against the forces occurs due to the vehicles and also holds the pavement material by creating proper bonding. Black cotton soils are inorganic clays of medium to high compressibility and form a major soil group in India. They are characterized by high shrinkage and swelling properties so increase the stability of black cotton soil is important. This paper presents the experimental study undertaken to increase the stabilization properties of black cotton soil using Foundry sand and RBI Grade 81.*

Keywords: *Black cotton soil , CBR test , Foundry Sand , RBI Grade 81, Soil Stabilization*

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I. Introduction

One of the challenges faced by civil engineers is the design of foundation for sites having expansive Soils. Most economical and effective method for stabilizing expansive soils is using admixtures that present change in volume. Many problems arise from the industrial development. One of them is the proper and effective disposal of its waste. Generally, industrial waste causes many serious environment problems. So utilization of industrial waste in construction industry is the best way to dispose it .Using industrial waste in construction industry is beneficial in many ways such as disposal of waste saving biodiversities, increasing soil properties like strength, reduce permeability etc. preserve the natural soil and making economical structures. If these materials can be suitably utilized in highway construction, the pollution and disposal problems may be partly reduced. In the absence of other outlets, these solid wastes have occupied several acres of land around plants throughout the country. Keeping in mind the need for bulk use of these solid wastes in India, it was thought expedient to test these materials and to develop specifications to enhance the use of these industrial wastes in road making, in which higher economic returns may be possible.

II. Materials used

2.1 Black Cotton Soil

In Marathawada region BC soil is having abandoned in quantity & everywhere in Maharashtra. Soil for experimentation analysis was collected from Harsool, Jalgaon Road, Aurangabad. Soil was crushed and uniform in nature For the construction of road the subgrade should be capable to withstand against the forces occurs due to the vehicles and also holds the pavement material by creating proper bonding. Black cotton soils are inorganic clays of medium to high compressibility and form a major soil group in India. They are characterized by high shrinkage and swelling properties. This Black cotton soils occurs mostly in the central and western parts and covers approximately 20% of the total area of India. Because of its high swelling and shrinkage characteristics, the Black cotton soil (BC soil) has been a challenge to the highway engineers. The Black cotton soil is very hard when dry, but loses its strength completely when in wet condition. It is observed that on drying, the black cotton soil develops cracks of varying depth. As a result of wetting and drying process, vertical movement takes place in the soil mass. All these movements lead to failure of pavement, in the form of settlement, heavy depression, cracking and unevenness.

2.2 Foundry sand

Foundry sand is basically fine aggregate. It can be used in many of the same ways as natural or manufactured sands. This includes many civil engineering applications such as embankments, flowable fill, hot mix asphalt (HMA) and Portland cement concrete (PCC). Foundry sands have also been used extensively agriculturally as topsoil. Currently, approximately 500,000 to 700,000 tons of foundry sand is used annually in engineering applications. The largest volume of foundry sand is used in geotechnical applications, such as

embankments, site development fills and road bases. For experimentation waste foundry sand was collected from P. P. Metal Industry, MIDC Chikhalthana, CIDCO, Aurangabad, India.

2.3 Road Built International Grade 81 (RBI 81)

RBI Grade 81 is a powder that is composed of a number of naturally occurring compounds. It is an odorless beige powder. The pH of saturated paste is 12.5. It improves the structural properties of a wide range of soils. It is particularly effective with silty-clayey soil with low geo-mechanical qualities. RBI Grade 81 works by hydration reaction. Pore space is filled by a crystalline growth. An irreversible inter-particle matrix is formed. Through the addition of low dosages of RBI Grade 81 the volume stability of the soil is increased significantly. The reaction of RBI Grade 81 with soil particles produces as an inter-particle matrix that binds soil particles together into a rigid mass. 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.RBI Grade 81 is insoluble in water, non UV degradable, inert and chemically stable. It forms a dust free surface and is simple to apply and hardens fast. It is durable and permanent. It is environmental friendly and aesthetically pleasing. Strength of soil treated with RBI Grade 81 increases with age. It gains strength till about one year after application to soil. Permeability of soil mass decreases with addition of RBI Grade81 as they reduces pore spaces. For experimentation RBI Grade 81 was collected from Alchemist Technology Ltd, Building No.23, Nehru House, New Delhi, India.

III. California Bearing Ratio Test (CBR Test)

This is a penetration test developed by the California division of highways as a method for evaluating the stability of sub grade and other flexible pavements materials. The CBR test may be conducted in laboratory on a prepared specimen in a mould or in situ in the field. Briefly the test consists of causing a cylindrical plunger of 50mm diameter to penetrate a pavement component material at a rate 1.25mm/min. The loads for 2.5mm and 5mm are recorded. This load is expressed as a percentage of a standard value at a respective deformation level to obtain CBR value.

$$\text{CBR\%} = \frac{\text{load sustained by the specimen at 2.5 or 5.0 mm penetration}}{\text{load sustained by standard aggregate at the corresponding penetration level}}$$

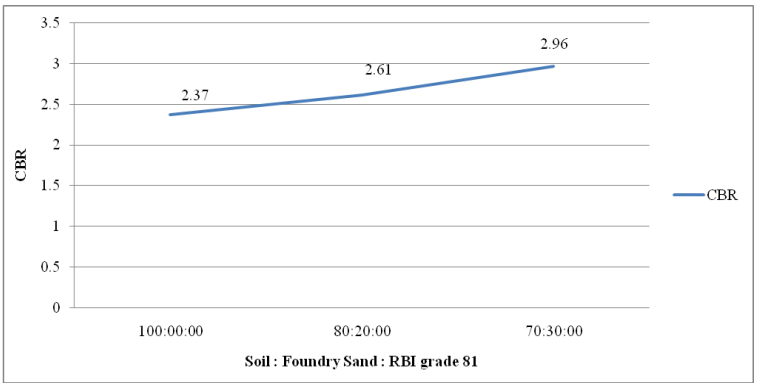
IV. Observations and Results

Table 1: Basic Properties of Black Cotton Soil

Sr. No.	Properties Of Black Cotton Soil	Value
1	Specific Gravity	2.083
2	Liquid Limit	60.50%
3	Plastic Limit	41.44%
4	Natural Moisture Content	11.20%
5	Optimum Moisture Content	29.00%

Table 2: Effect of Foundry Sand and RBI Grade 81 on CBR Value of Black Cotton Soil

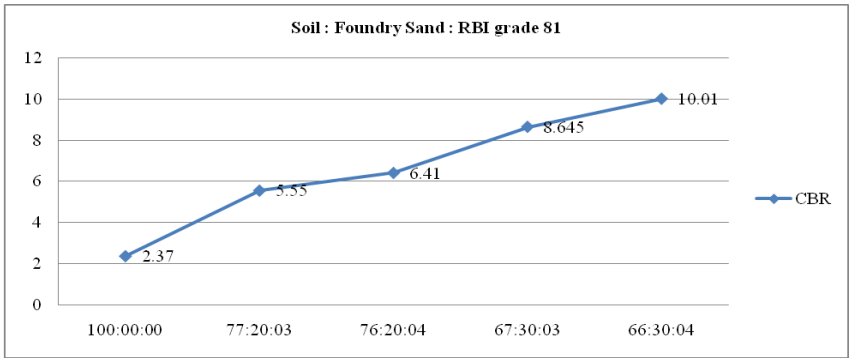
Proportion	CBR
100:00:00	2.37
80:20:00	2.61
70:30:00	2.96



Graph No.1: Effect of Foundry Sand and RBI Grade 81 on CBR Value of Black Cotton Soil

Table 3: Effect of Foundry Sand and RBI Grade 81 on CBR Value of Black Cotton Soil

Proportion	CBR
100:00:00	2.37
77:20:03	5.55
76:20:04	6.41
67:30:03	8.645
66:30:04	10.01



Graph No.2: Effect of Foundry Sand and RBI Grade 81 on CBR Value of Black Cotton Soil

V. Conclusion

Based on the result of Black Cotton Soil by using Foundry Sand and RBI grade 81 suitability of waste foundry sand with BC Soil for stabilizing for road sub-grade, sub-base, pavement etc. would be evaluate. From experimentation analysis it is concluded that-

1. Waste Foundry sand can be used successfully as a soil stabilizing material for road sub-grade, sub-base construction.
2. The results show that the maximum CBR value is 10.01% of proportion 66:30:04 (Soil: Foundry Sand: RBI grade 81).
3. The optimum percentage of Foundry Sand is 30%. As percentage of Foundry Sand increases above 30%, CBR value decreases, means the stability or strength of BC soil is decreases with further increase in percentage of foundry sand.
4. Due to RBI grade 81, the CBR value increases. But the use of higher percentage of RBI may be uneconomical because of its cost. Therefore here 4% RBI kept as optimum percentage to achieve economy.
5. Due to use of waste material like foundry sand disposal problem is resolved and also waste material is utilize to acquiring strength to the road sub-grade or sub-base.
6. Permeability is also reducing by using RBI in foundry sand and BC soil.

References

[1] Aboubeker N & Sidi Mohamed A.M (2004), "Stabilization of swelling soils using salts". International conference of geotechnical engineering.
[2] Al-Rawas A.A, A.W.hago., Hilal Al-Sarmi. (2005), "Effect of lime, cement and Sarooj (artificial pozzolana) on the swelling potential of an expansive soil from Oman". Environment, N40, pp.681-687.
[3] Al-Rawas AA, Taha R, Nelson JD, Beit Al-Shab T, Al- Siyabi H. (2002),"A comparative evaluation of various additives used in the stabilization of expansive soils", Geotechnical Testing Journal, GTJODJ, ASTM, 25(2):199–209.
[4] Bekkouche A, Azzouz F.Z, Aissa Mimoune S.M, (2007), "Salt Stabilization of expansive clays from Tlemcen région, Algeria", Col.9-11/02/2007, pp19-26.
[5] Bell FG, (1996), "Lime stabilization of clay minerals and soils". Engineering Geology 1996, 42:223–37.
[6] British Standard 1377, (1990)," Methods of test for soils for civil engineering purposes". London: British Standard Institution.
[7] Chen. F.H. (1988),"Foundations on expansive soil", Developments in Geotechnical Engineering, Vol. 54. Elsevier Publishing Co. Amsterdam, 464 pages.
[8] Gueddouda M.K, Lamara M, Aboubekr N, Goual I,(2007), "Characterization and stabilization of expansive soils, effect dune sand and salt association for swelling potential".
[9] Gueddouda M.K, Lamara M, Hachichi A, Goual I,(2006), " effect dune sand for swelling potential of clays swelling". COST. No.4, pp .15-22.
[10] Gueddouda M. K; Lamara M; Abou-bekr. N;Taibi.S,(2010), "Hydraulic behavior of dune sand –bentonite mixtures under confining stress". Geomechanics and Engineering, Vol. 2, No. 3, 213-227.
[11] Holtz W.G., & Gibbs H.J. (1956), "Engineering properties of expansive soils". Trans of ASCE, Vol.121, 1956, pp. 641-679.
[12] Ranganatham B.V & Satyanarayana B. (1965),"A rational method of preding swelling potential for compacted expansive clays". Proc of the 6th I.C.S.M.F.E. Montreal.1965.
[13] Sherwood PT.(1995)," Soil stabilization with cement and lime: state-of the art review". Transport Research Laboratory, London: Her Majesty's Stationery Office; 1995.153 p.

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