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Advancement of CBR Values of Expansive Soil Due to Inclusion of Rubber Strips

Harish Chand Giri[1]
Aryan Institute of Engineering & Technology, Bhubaneswar, Odisha

Deepika Priyadarshini Palai[2]
NM Institute of Engineering and Technology, Bhubaneswar, Odisha

Bipash Mohanty[3]
Capital Engineering College, Bhubaneswar, Odisha

Swapna Bijayini Mohanty[4]
Raajdhani Engineering College, Bhubaneswar, Odisha

Abstract

The issue with expansive soils has been recorded from one side of the planet to the other. Numerous establishments related issues are additionally seen in and around India. Due to elective expanding and shrinkage of expansive soils, delicately stacked structural designing constructions like private structures, asphalts and trench linings are seriously harmed. Numerous imaginative establishment methods have been conceived as an answer for the issue of expansive soils. The major among them is to give support layers. In this review, the impact of elastic strips as support on the strength properties of expansive soil was considered.

Index terms: *CBR, swelling, shrinkage properties, MDD, OMC, rubber strips*

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1. INTRODUCTION

Expansive soils, popularly known as black cotton soils in India, exhibit alternate shrinkage and swelling with the advent of summer and monsoon respectively .The mineralogical composition of these clays, which contain montmorillonite is responsible for this behavior. In the present work, a study was made to reinforce the black cotton soil, collected from Amalapuram with the different combination of rubber strips. Unconfined compression tests and CBR tests are carried out for all the mixes. The amount of rubber strips in the mixes varied from 0 to 6 %. It has been observed that the strength was enormously increased with the addition of particular percentage of rubber strips.

2. OBJECTIVES OF THE STUDY

The objective of the present experimental study to evaluate the performance of expansive soil mixed with different percentages of rubber strips with reference to the strength properties.

3. MATERIALS USED

Clay

The expansive soil used for the study has been collected at a depth of 1.2m below the ground level from Amalapuram, East

Godavari district. The property of the soil assessed based on relevant IS code provisions are given in table.1

Table1: Properties of expansive soil

PROPERTY	VALUE
Sand (%) Silt (%) Clay (%)	11 38 51
Atterberg Limits Liquid Limit (%) Plastic Limit (%) Plasticity Index (%) IS Classification	 94 36 58 CH
Specific Gravity	2.65
Compacting Properties: MDD (g/cm^3) OMC (%)	 1.33 35.4%
Differential Swell (%)	100
Soaked CBR (%)	2.1
Tri-Axial Parameters Cohesion (kN/m2) Angle of Internal Friction (^{0})	 93.00 3

Rubber Strips

The rubber strips were collected from MARUTI Re-trading Company, Kakinada.

4. LABORATORY EXPERIMENTATION

The laboratory studies were carried out on the samples of expansive soil alone and also on the expansive soil mixed with rubber strips.

Liquid Limit

The liquid limit test was conducted on expansive soil, expansive soil with rubber strips, using Casagrande's liquid limit apparatus as per the procedures laid down in IS: 2720 part 4 (1970).

4. 4 Plastic Limit

The plastic limit test was conducted on expansive soil, expansive soil with rubber strips as per the specifications lay down in IS: 2720 part 4 (1970).

4. 5 Shrinkage Limit

This test was also conducted on expansive soil, expansive soil with rubber strips
As per IS: 2720 part 4 (1972).

4. 6 Free Swell Index

This test is performed by pouring slowly 10 grams of dry soil, 10 grams of soil with rubber strips, in two different 100 cc glass jars filled with distilled water. The swollen volume of expansive soil as well as expansive soil with rubber strips are recorded as per IS 2720 part 40(1985).

4. 7 Proctor's Standard Compaction Test

Preparation of soil sample for proctor's compaction test was done as per IS: 2720 part-6 (1974).

4. 8 Unconfined Compressive Strength

The unconfined compressive strength tests are conducted on expansive soil as well as expansive soil with rubber strips as per IS 2720part 10 (1973). All the samples are prepared by static compaction using split mould at optimum moisture content and maximum dry density to maintain same initial dry density and water content. The test was conducted under a constant strain rate of 1.5mm/min. The proving ring reading is noted for 50 divisions, and loading was continued until 3 (or) more readings are decreasing (or) constant (or) strain 20% has been reached. The samples of expansive soil and additive mixes were cured for 4 days, 7days and 28days, and at the end of each curing period, three samples for each mix were tested.

4. 9 California Bearing Ratio Test

The California Bearing Ratio tests are conducted on expansive soil, expansive soil with rubber strips as per IS 2720 part 16 (1979). The tests were conducted under a constant strain rate of 1.25mm/min. The proving ring reading is noted for 50 divisions, and loading was continued until 3 (or) more readings are decreasing (or) constant. The samples were tested in both soaked and un-soaked conditions. The tests were conducted at time intervals of curing for 4days, 7days and 14 days at optimum moisture content.

5. RESULTS AND DISCUSSION

Effect of Rubber Strips on Expansive Soil Properties

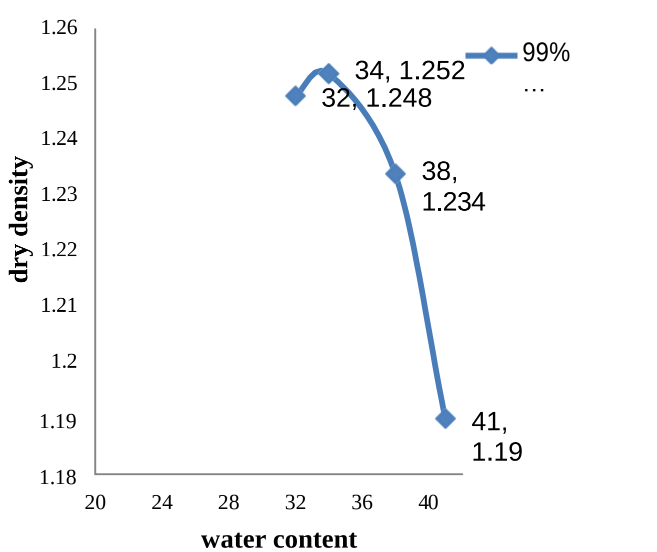

Figure 1: water content Vs dry density

The influence of addition of rubber strips on the engineering properties and CBR values of expansive soil are given in table 2. The CBR value of soil with rubber strips has been increasing upto 5% of addition of rubber and thereby decreased.

Table 2: Effect of different percentages of rubber strips on the engineering properties and CBR values of expansive soil

% of Rubber Strips	% of soil	OMC (%)	MDD g/cc	CBR (%)	
				Unsoaked	Soaked
1	99	37.0	1.252	2.87	2.20
2	98	36.0	1.230	2.91	2.30
3	97	37.0	1.260	4.48	2.45
4	96	41.5	1.200	4.71	2.73
5	**95**	**39.5**	**1.200**	**4.72**	**3.94**
6	94	37.0	1.220	4.65	2.78

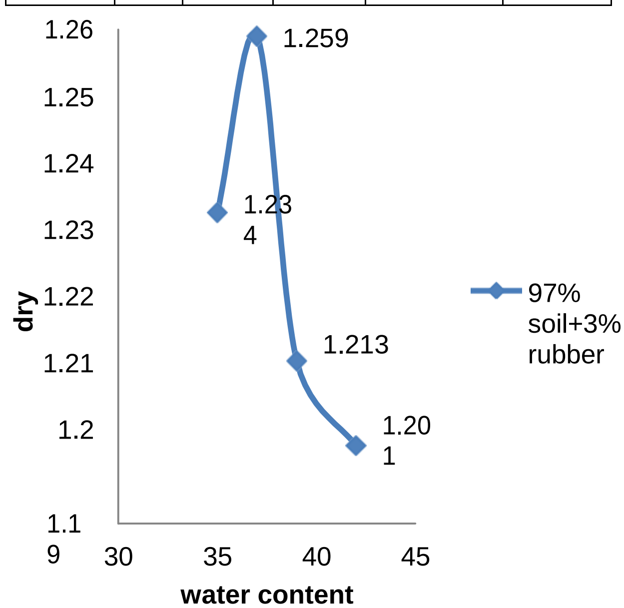

Figure3: water content Vs dry density

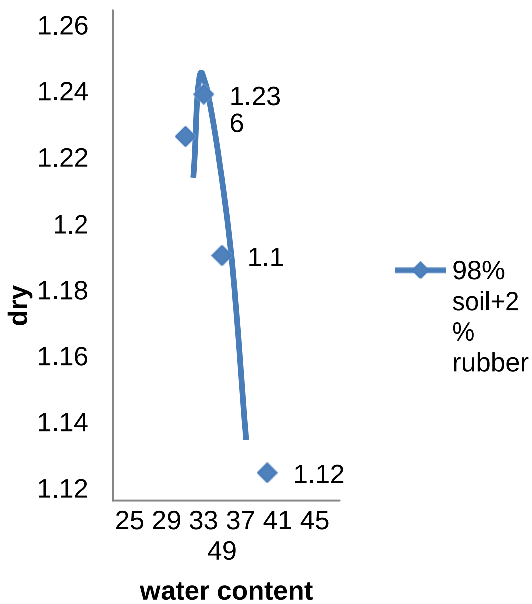

Figure 2: water content Vs dry density

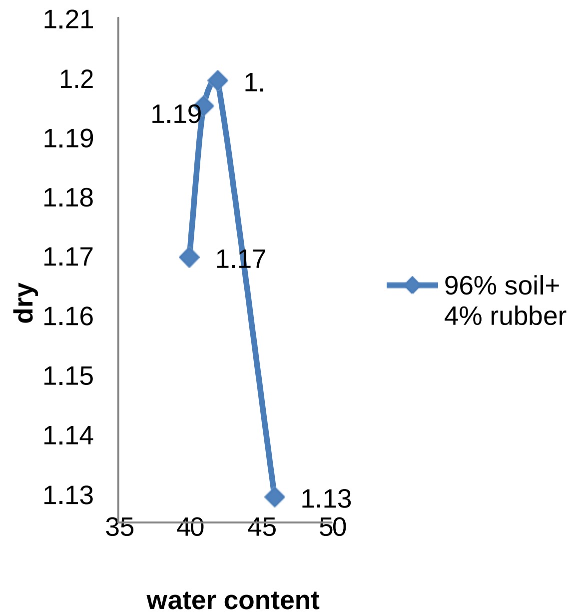

Figure 4: water content Vs dry density

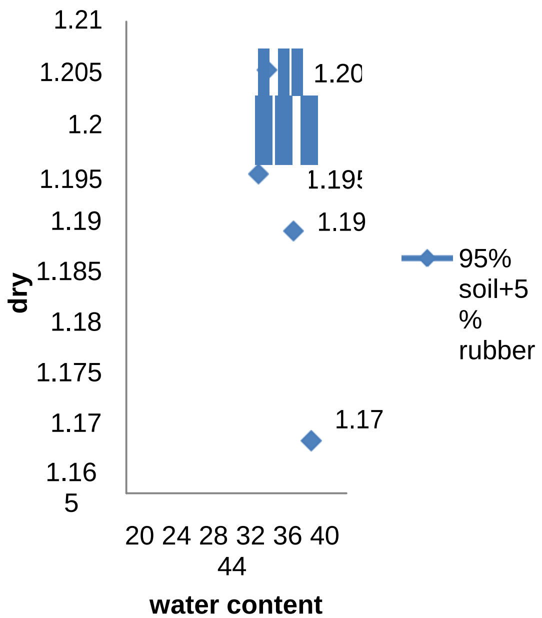

Figure 5: water content Vs dry density

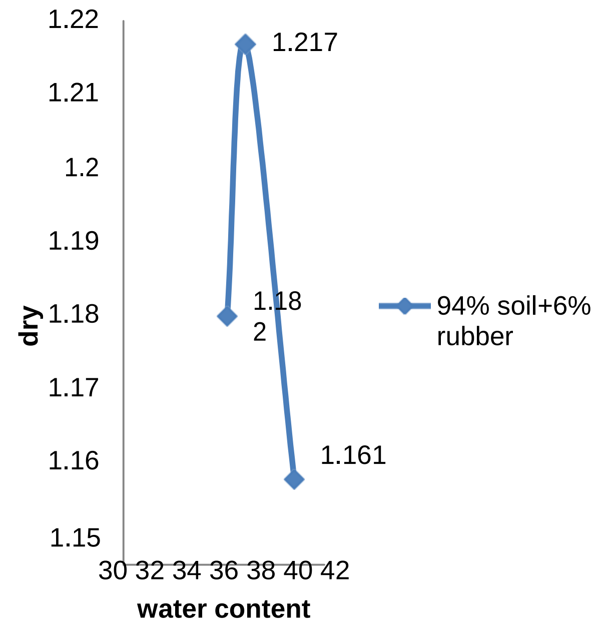

Figure 6: water content Vs dry density

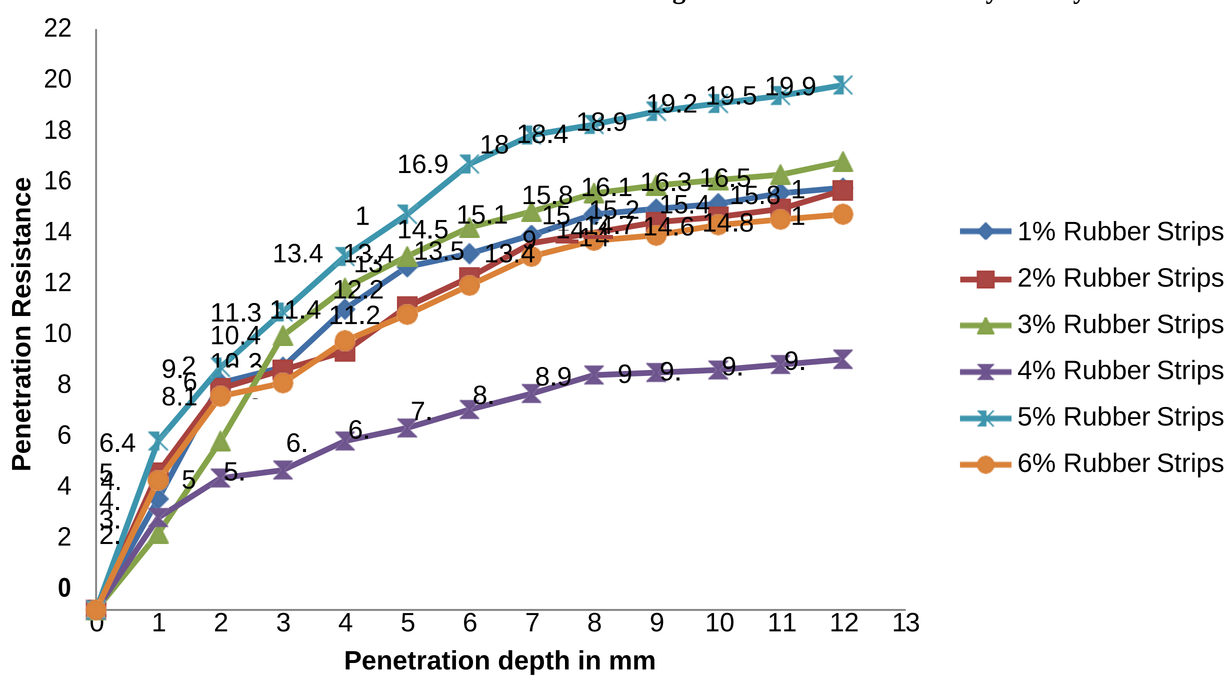

Figure7: Influence of various % of Rubber strips on Unsoaked CBR values of expansive soil

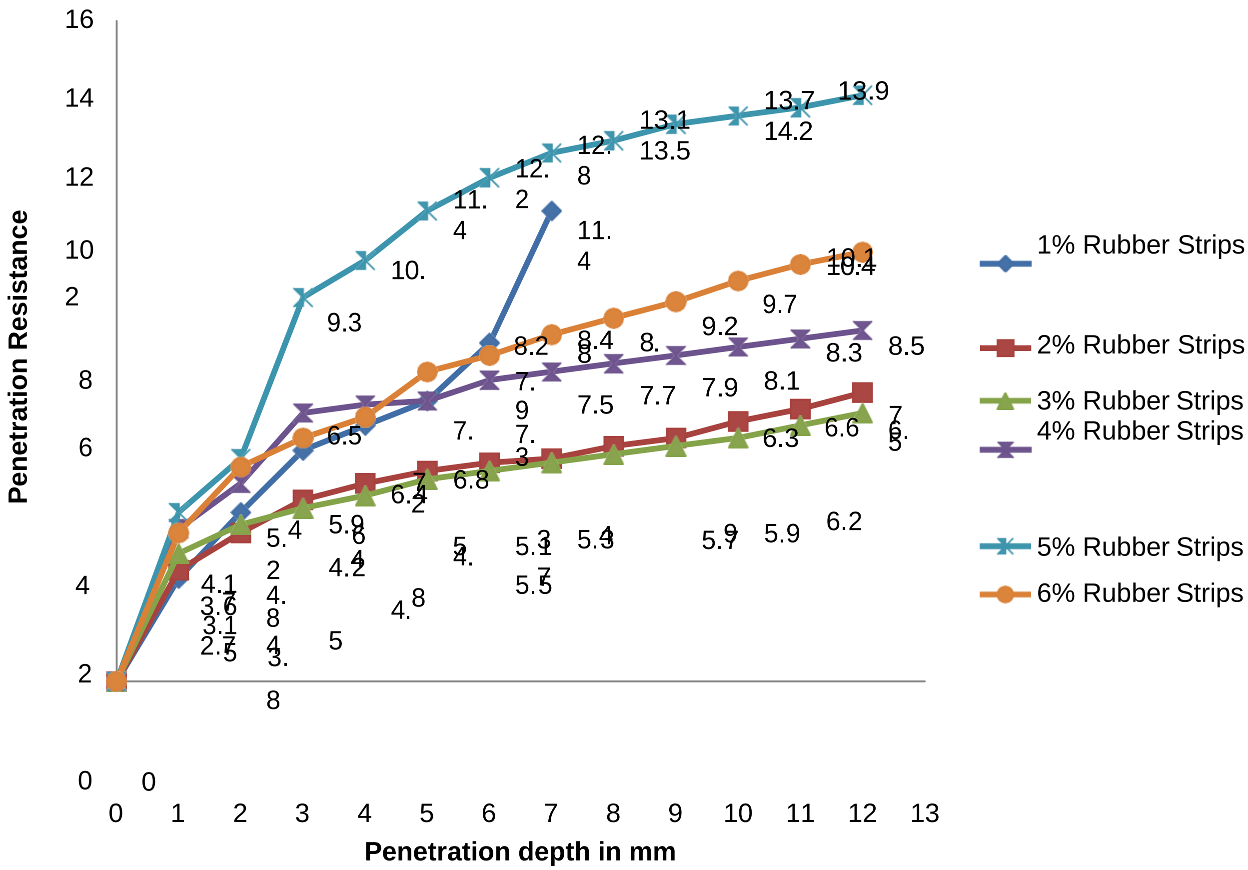

Figure8: Influence of various % of Rubber strips on soaked CBR values of expansive soil

6. CONCLUSIONS

The following conclusions were drawn based on the laboratory test results.

1. Soil used in this investigation may be classified as "CH" group as per IS classification indicating that it is a clay of high compressibility .The free swell index of the soil is equal to 100% which indicates high degree of expansion.

2. In case of soil-rubber strip mixes, the CBR value has been increased with increase in percentage of rubber strips up to an optimum percentage of rubber strips and there after the CBR value has been decreased with further increase in percentage of rubber strips.

3. It is observed that the CBR value of the expansive soil has been increased by 88% with addition of 5% Rubber strips as an optimum.

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