SOIL STABILIZATION USING WASTE COTTON FABRICS OR CLOTHES AND SYNTHETIC FABRICS OR CLOTHES

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❖ **ABSTRACT :-**

Soil stabilization is defined as a technique to improve the engineering characteristics of soil. For a reinforcing the soil or stabilization the soil be can use the fabrics or waste clothes (Cotton and synthetic fabrics). The main aim of paper is to improve the bearing capacity of the soil with the help of cotton fabrics and synthetic fabrics (or Cotton clothes and Synthetic clothes) and evaluate the effects of waste clothes on bearing strength of the soil. For a 1.5 and 2 percentage of cotton clothes and synthetic clothe, Proctor Compaction test and CBR test was carried out. Optimum water content, maximum dry density and CBR values are calculated for a 1.5% and 2%of cotton clothes and synthetic clothes.

Key words: Cotton fabrics and Synthetic fabrics, OMC, MDD, Liquid limit, Plastic limit and Bearing capacity.

1) INTRODUCTON :-

Natural soil has a low bearing capacity so we need to improve the bearing capacity of the natural soil. Some soils are not suitable for construction work so these soils are stabilized to achieve the required properties needed for the construction work. Various researches are carried out on soil stabilization techniques and it is emerging as a popular and cost effective method to improve soil properties.

Soil reinforced with the help of waste cotton clothes and synthetic clothes. Soil reinforced with clothes behaves as a composite material in which clothes improve the strength of soil. The use of clothes in the soil is similar to the behaviour of plant roots which contributes to the stability of the soil by addition of the strength to the near surface soils in which the effective stress is low. Some laboratory test results have led to positive conclusions proving the potential use of waste clothes for reinforcing the soil mass. The primary purpose of reinforcing the soil is to improve its bearing capacity.

Here in this study soil stabilization has been done with the help of randomly distributed cotton Clothes and Synthetic clothes. The objective of this study is to focus on improvement of the bearing capacity of the soil.

2) OBJECTIVE: - The main objective this work is to improve the bearing capacity of the natural soil or weak soil with the help of waste cotton fabrics or clothes and synthetic fabrics or clothes. It's a cost effective technique and eco-friendly also. The main aim of this study is to utilize the waste fabrics clothes as a soil stabilizing material or a reinforcing material.

3) METHODOLOGY

❖ Material used

1) Cotton fabrics or clothes & Synthetic fabrics clothes :-

These fabrics are biodegradable and environmentally friendly. It has a high tensile strength as compare to natural fibres. Therefore, cotton fabrics or clothes and synthetic fabrics or clothes are use in soil stabilization as reinforcement. Cotton clothes and Synthetic clothes are the waste which comes from the stitching shops and the clothes industries where the clothes like shirts, paints, Kurta, Sharee etc. are stitch.

2) Soil sample :-

Soil sample is collected near the CME building in LNCT Bhopal.

Soil sample are compacted at their respective maximum dry density (MDD) and optimum moisture content (OMC), corresponding to the modify proctor compaction test.

The percentage of waste fabrics used for reinforcement in soil sample is 1.5% and 2% of soil sample by weight.

4) DETAILS OF LABORATORY STUDIES :-

The Atterberg limits for the soil sample were carried out by performing the laboratory tests. The particle size distribution is determined by the wet sieve analysis; the liquid limit test was carried out by Casagrande's tool at 25 blows. Plastic limit for soil sample is determined by rolling out soil till its diameter reaches approximately 3 mm and it was repeated until soil crumbles. Plasticity index was also calculated with the help of liquid limit and plastic limit.

Table No. : - 1

Atterberg Limits of Soil Sample:-

PROPERTIES	SOIL SAMPLE
Liquid Limit (LL) At 25 Blows	48.94 %
Plastic LIMIT (PL)	30.34 %
Plasticity Index	18.60 %

5) MODIFIED PROCTOR TEST:-

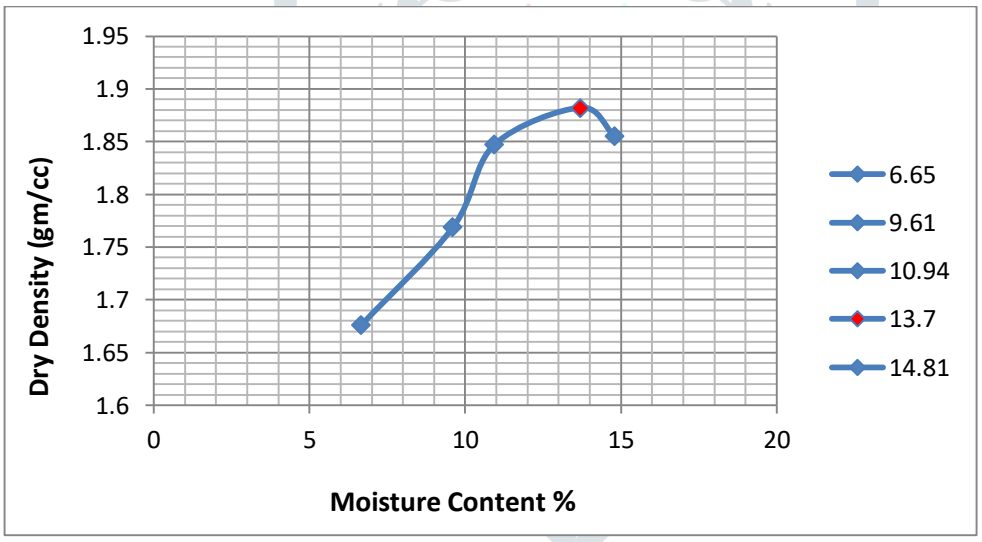
This test was performed to obtain a maximum dry density (MDD) of the soil sample and optimum moisture content (OMC) of the soil. To perform this test we need a cylindrical metal mould, detachable base plate, collar and hammer (4.89 kg). Compaction process helped in increase the bulk density by driving out the air from the voids. The maximum dry density is achieved when the soil is compacted at relatively high moisture content or optimum moisture content. The graph is plot between the water content and dry density. From this curve the OMC (optimum moisture content) and MDD (maximum dry density) were obtained.

Table No.:- 2

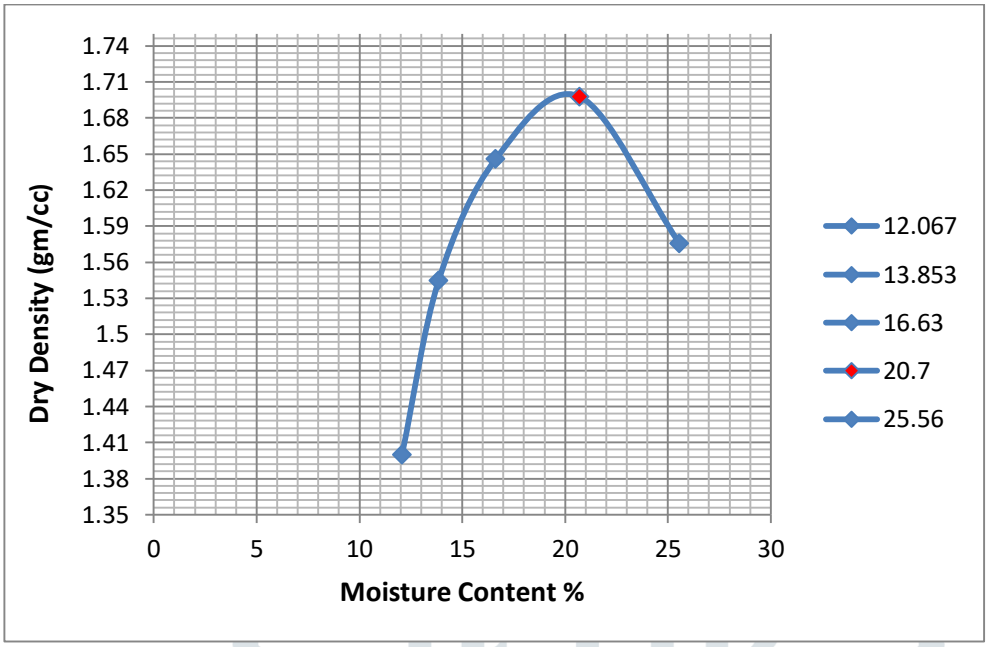
Results which is obtain from Modified Proctor Test –

SOIL SAMPLE	FABRICS CLOTHES CONTENT (%)	OPTIMUM MOISTURE CONTENT (%)	MAXIMUM DRY DENSITY (gm/cc)
Normal soil sample	0	13.70	1.882
Soil sample + Cotton clothes	1.5	17.89	1.755
	2	18.04	1.670
Soil sample + Synthetic clothes	1.5	16.44	1.777
	2	13.67	1.769

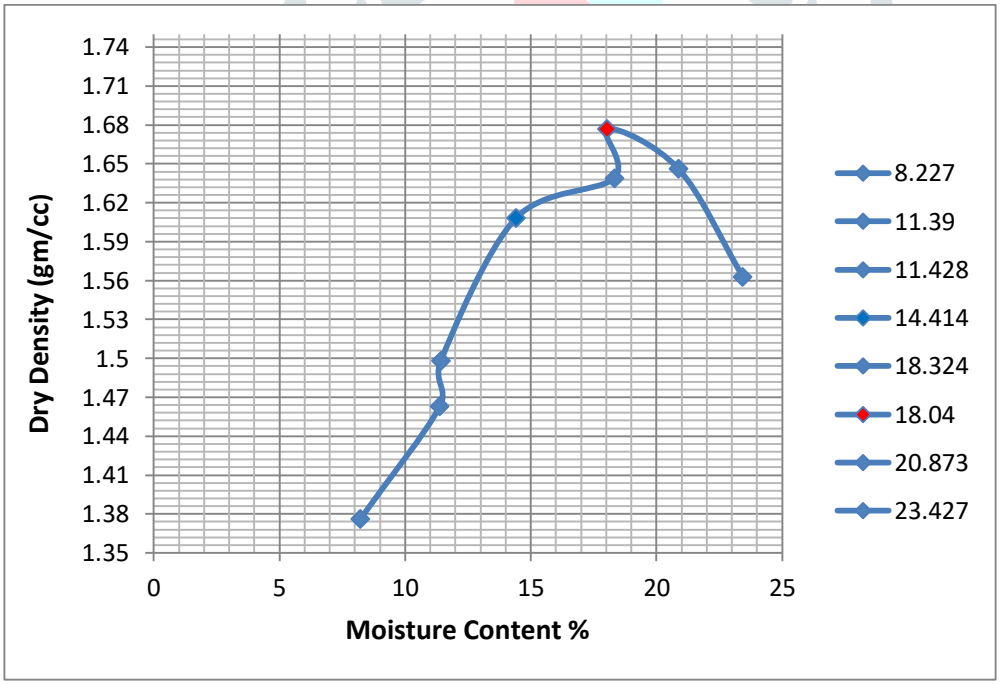
1. **Black cotton soil sample :-**



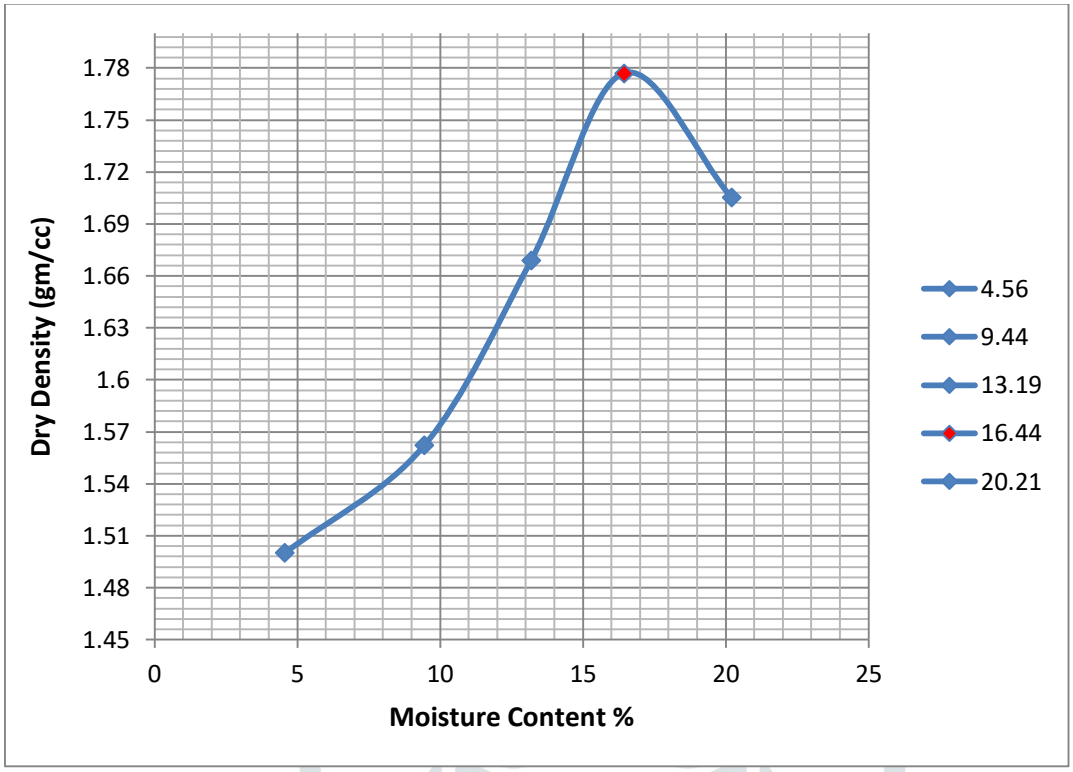
2. Black cotton soil + 1.5 % Cotton fabrics or cloths:-



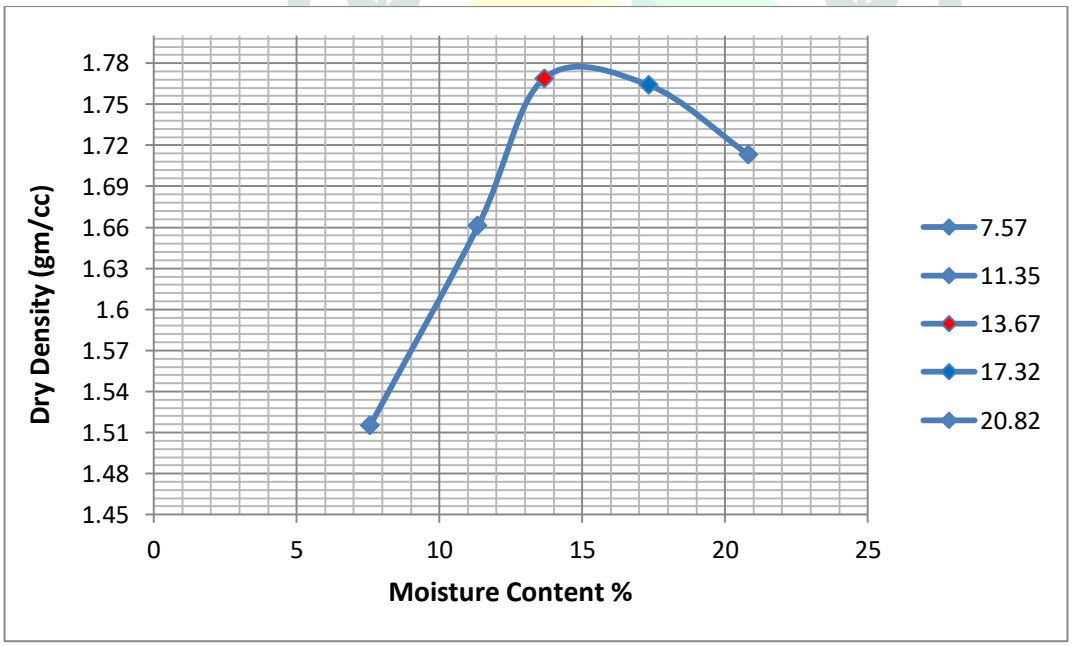
3. Black cotton soil + 2 % Cotton fabrics cloths :-



4. Black cotton soil + 1.5 % Synthetic fabrics or cloths :-



5. Black cotton soil + 2 % Synthetic fabrics or cloths :-



6) CALIFORNIA BEARING RATIO TEST (CBR) :-

This test is performed to determine the bearing capacity of the soil. The California bearing ratio test is the penetration test meant for the evaluation of subgrade strength of the pavements. The results obtained by these tests are used with the empirical curves to determine the thickness of the pavements and its component layers. This is the most widely used method for design of flexible pavement.

In this study we performed the soaked CBR on the soil samples and calculate the soaked CBR value after 96 hours.

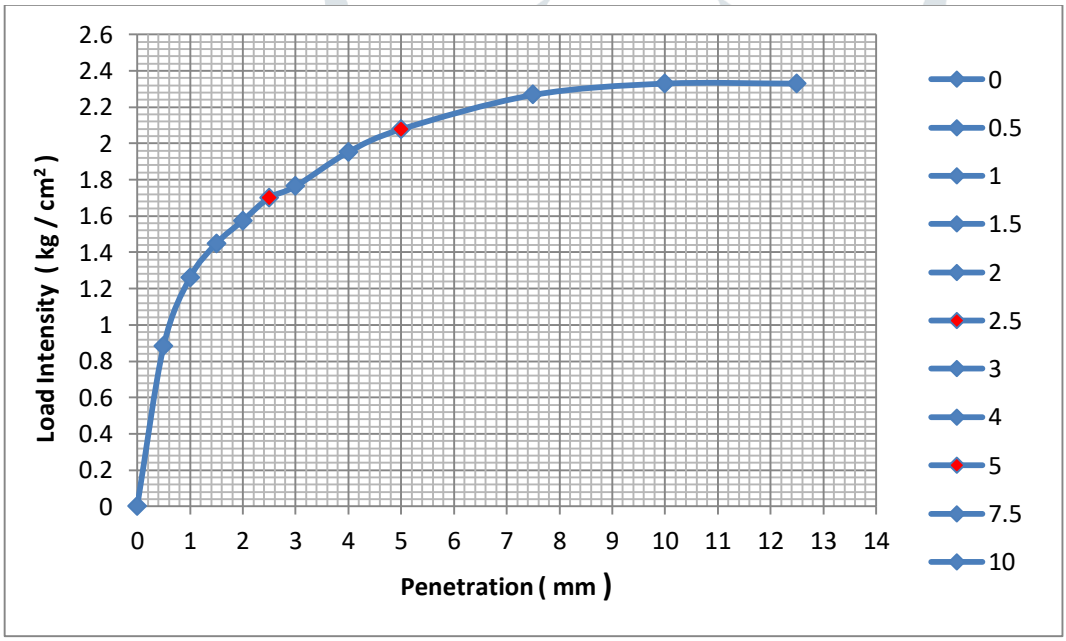
Table No. : - 3

Results which are obtain from soaked CBR test which is performed after the 96 hours.

SOIL SAMPLE	FABRIC PERCENTAGE (%)	CBR VALUE At 2.5 mm Penetration (%)	CBR VALUE At 5.0 mm Penetration (%)
Normal soil sample	0	2.43	1.98
Soil sample + Cotton clothes	1.5	1.62	1.44
	2	1.15	1.02
Soil sample + Synthetic clothes	1.5	4.36	4.08
	2	5.67	5.19

1) CBR of black cotton soil :- Area of plunger = 19.625 cm^2

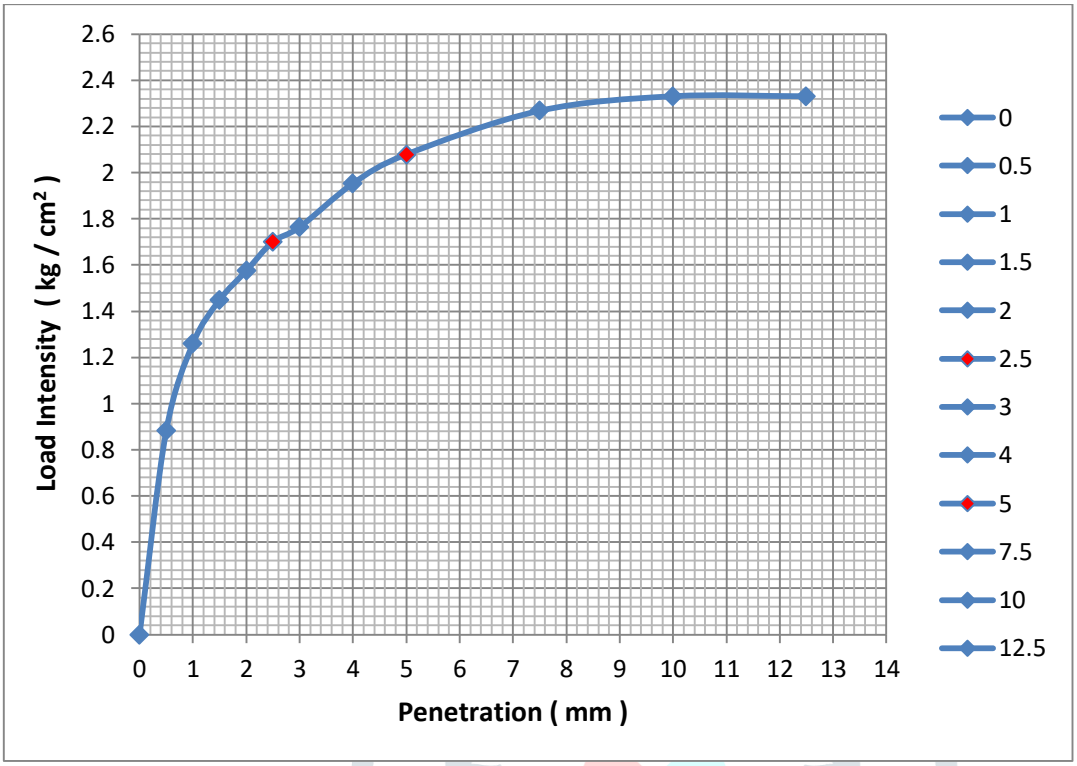
One division value = 2.4736



2) CBR of black cotton soil + 1.5 % Cotton fabrics or clothes :-

Area of plunger = 19.625 cm^2

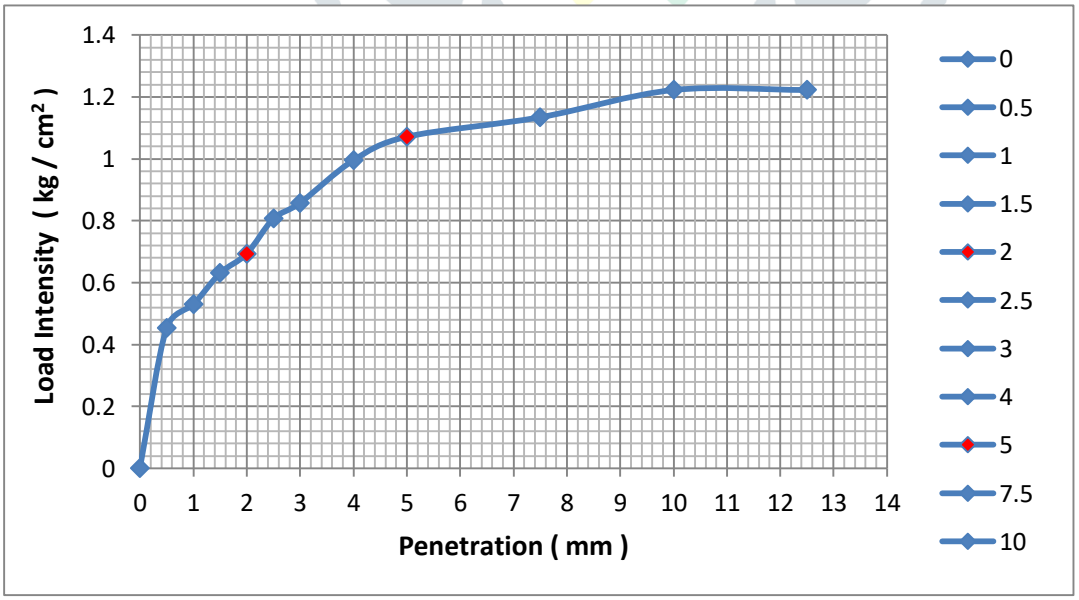
One division value = 2.4736



3) CBR of black cotton soil + 2 % Cotton fabrics or clothes :-

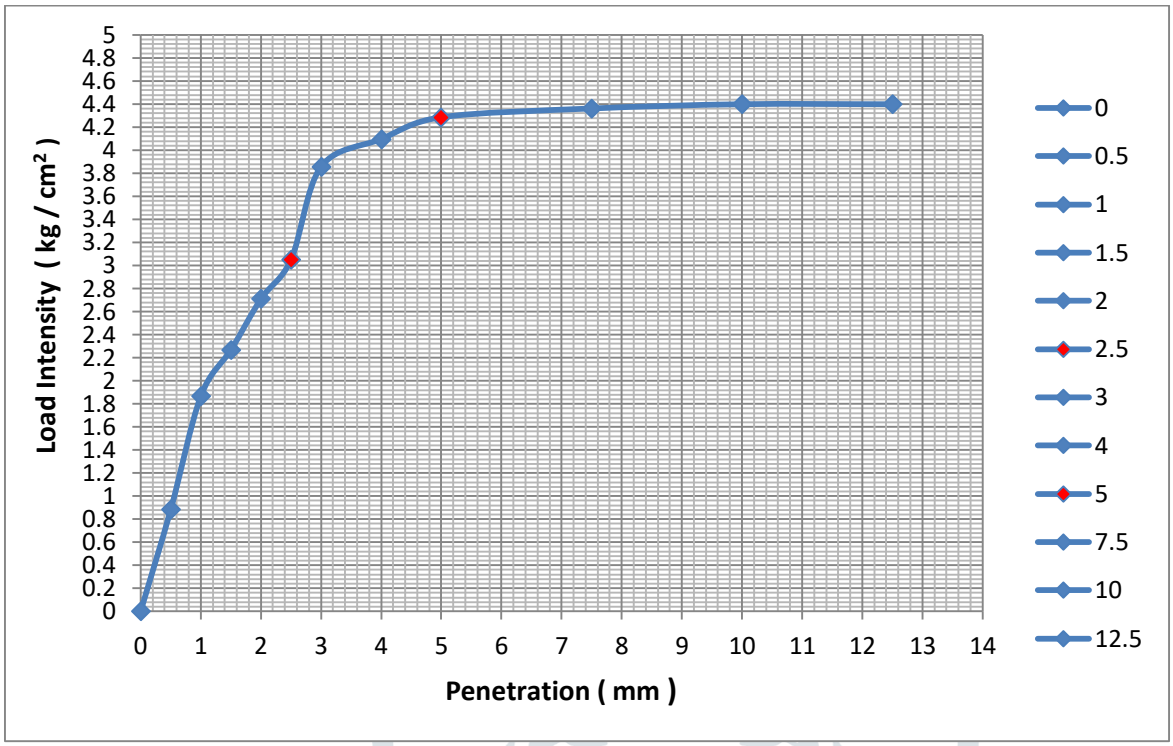
Area of plunger = 19.625 $cm^{2.}$

One division value = 2.4736



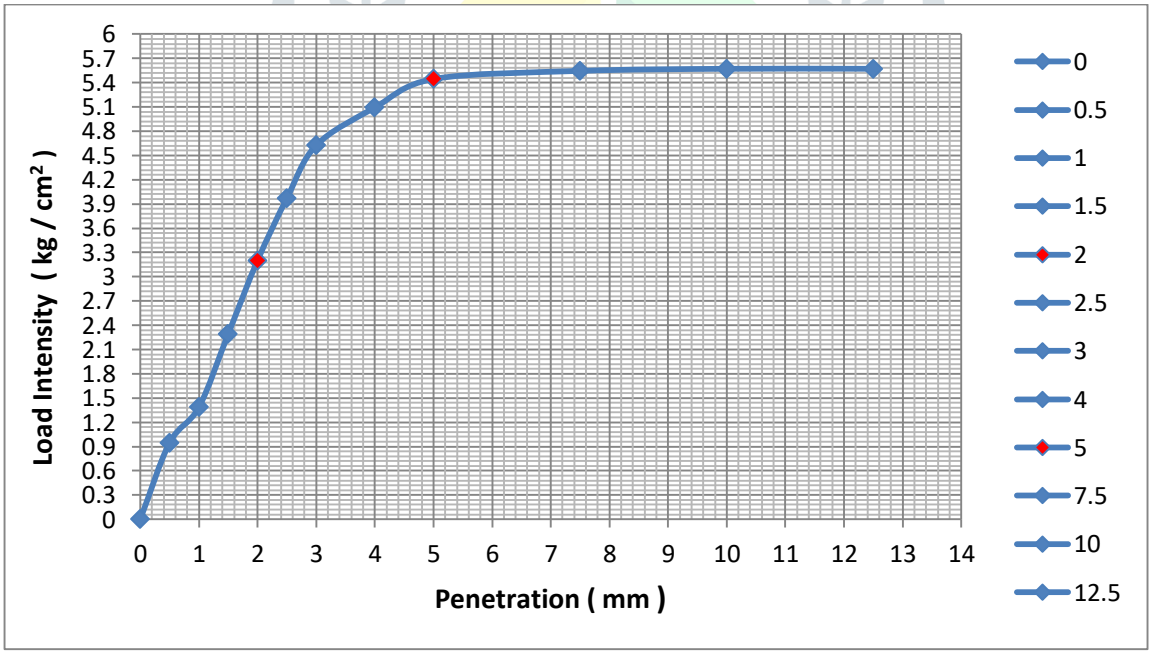
4) CBR of black cotton soil + 1.5 % Synthetic fabrics clothes :-

Area of plunger = 19.625 cm^2
One division value = 2.4736

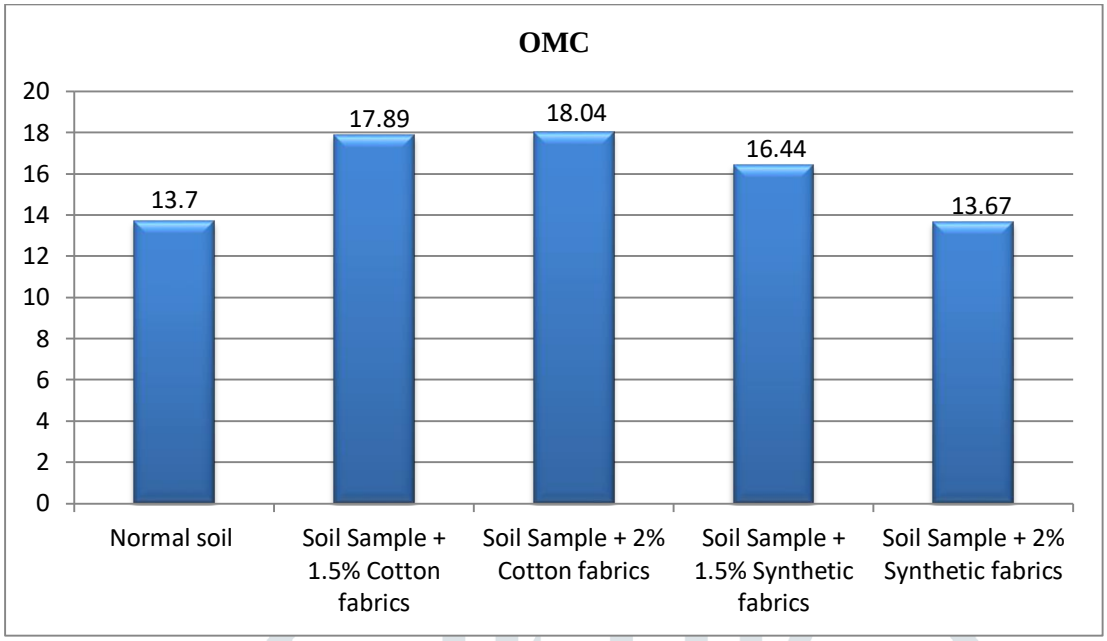


5) CBR of black cotton soil + 2 % Synthetic fabrics clothes :-

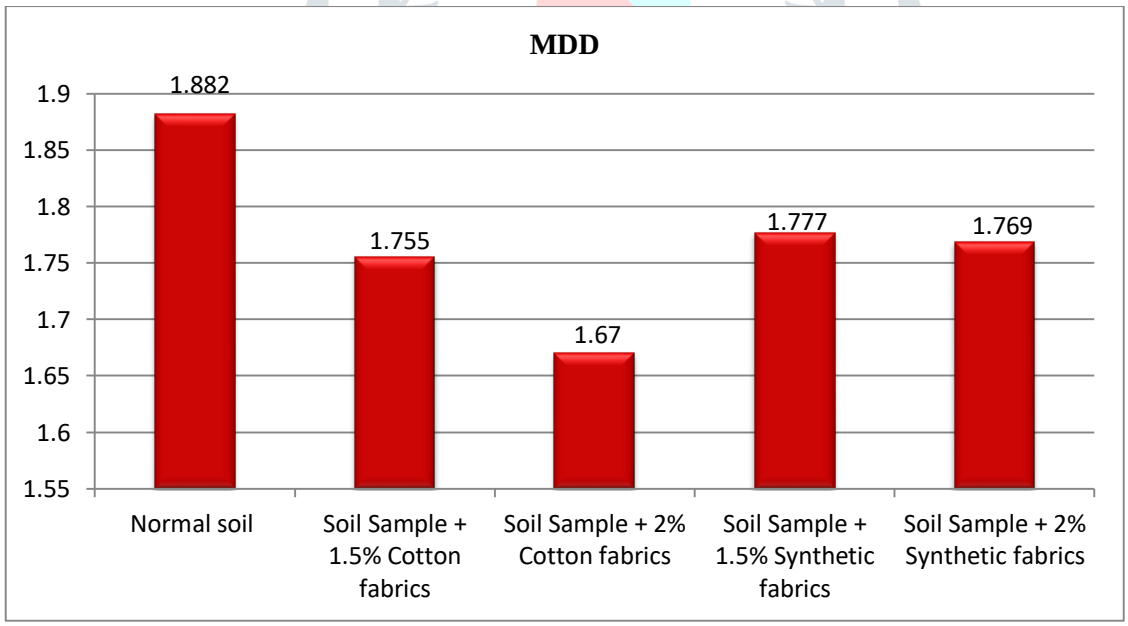
Area of plunger = 19.625 cm^2
One division value = 2.4736



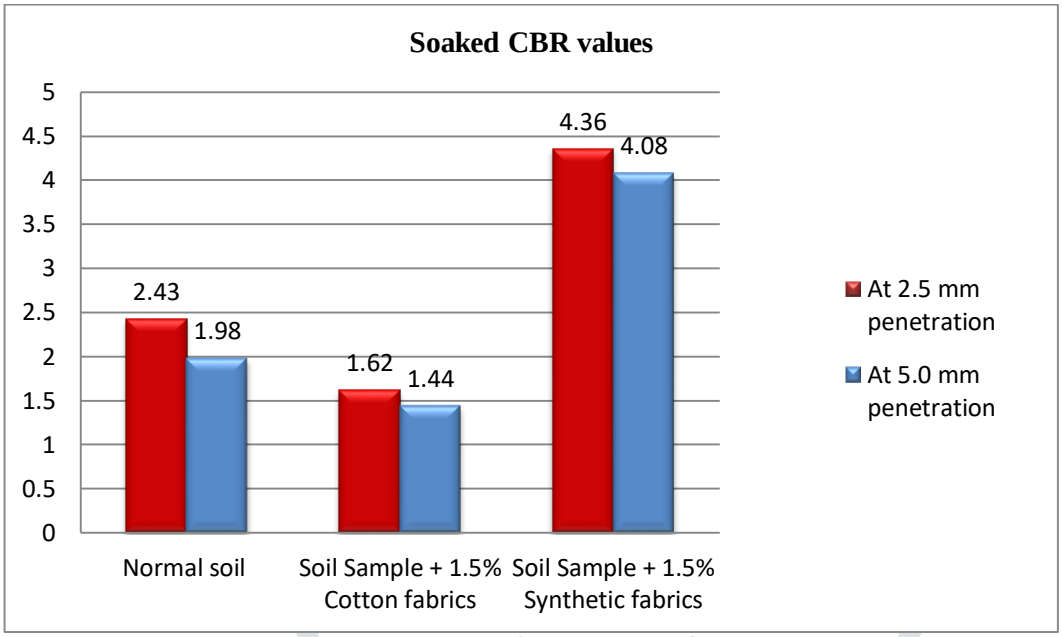
1) Comparison between Normal soil , Cotton fabrics or clothes mix in soil and Synthetic fabrics or clothes mix in soil for OMC :-



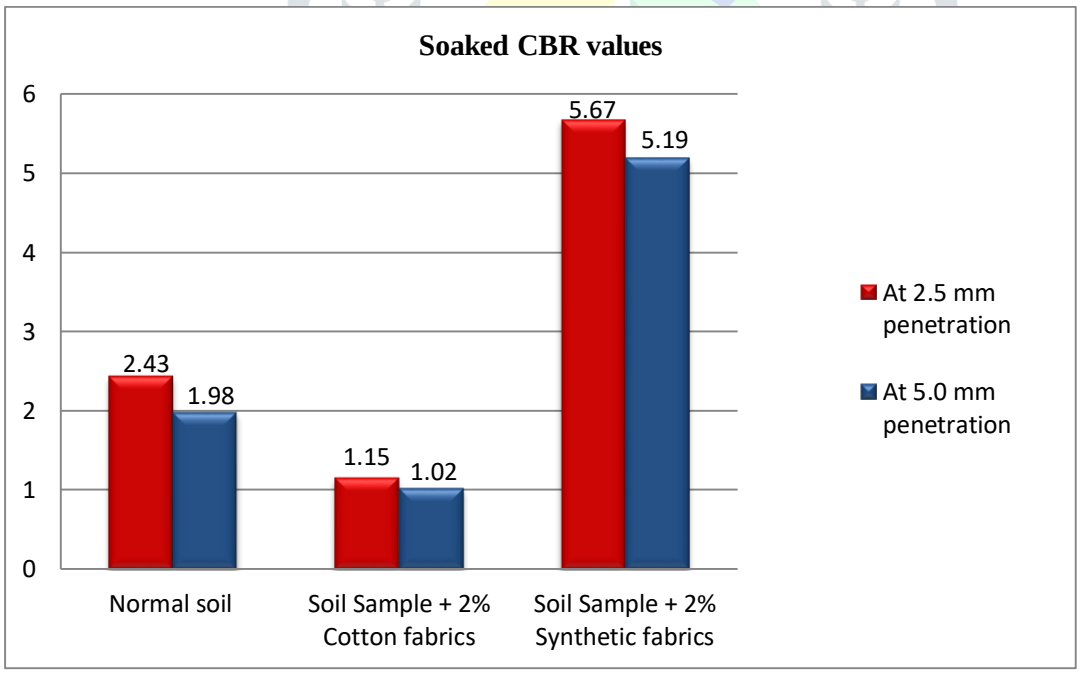
2) Comparison between Normal soil , Cotton fabrics or clothes mix in soil and Synthetic fabrics or clothes mix in soil for MDD :-



3) Comparison between Normal soil , 1.5 % Cotton Fabrics mix in soil and 1.5 % Synthetic Fabrics mix in soil for SOAKED CBR :-



4) Comparison between Normal soil , 2 % Cotton Fabrics mix in soil and 2 % Synthetic Fabrics mix in soil for SOAKED CBR :-



7) CONCLUSION:-

From the above experimental study we concluded that, we can stabilize the soil with the help of waste synthetic clothes or fabrics. Because the synthetic clothes are not absorb the more water or moisture content as compare to cotton clothes and synthetic clothes or fibre have a high tensile strength . The waste cotton clothes cannot be used as reinforcement in the soil stabilization projects, because it is absorb high moisture content and has a low tensile strength. In the experimental work we mix the synthetic clothes in the soil sample as 1.5 % and 2 % by weight. When we determine the OMC (Optimum moisture content)

and MDD (Maximum dry density) of the mix of synthetic fabrics and soil sample so we get a minimum value of OMC and maximum value of MDD at a 2 % mix of synthetic fabrics in the soil . At a 2 % mix of synthetic clothes in the soil sample we get a high soaked CBR value as compare to 1.5 % of mix. If we use this technique so we reduce the quantity of waste clothes and also reduce the cost of the soil stabilizing projects. We can also reduce the hazardous impact on the environmental after using waste clothes.

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