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Effect Of Geotextiles On Cbr Values Of Soft Soil.

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Abstract

Geotextiles have been successfully used for reinforcement of soils to improve the CBR value of soil. In this paper the geotextile layers are used to develop pseudo-confining effect to increase CBR value of soft clay soils. Laboratory California bearing ratio (CBR) tests were performed to investigate the load-penetration behaviour of unreinforced and reinforced soft clay soils with geotextile layers. In this studies placing two layers of geotextile at top 1/5th height within soil sample. As soft clay soil used having only cohesion (Ø=0) the increase pseudo-confining effect is due to binding force by cohesion property of soil that increased the CBR value. To further increase the CBR value of soft clay by increasing pseudo- confining effect, 1/5th layer is provided with non plastic sand layer (Ø soil) with and without geotextile layers. The result of these tests shows that, CBR value of soft soils increases as pseudo-confining effect increases.

Keywords: *CBR, Geotextile, pseudo-confining effect Soft clay soil, reinforced soft soil,*

Introduction

Reinforce soil is the one of the geotechnical ground improvement strategy has been utilized from ancestors time and it is additionally drilled in our collective of animals. A portion of the landmarks in our history likewise give us the verification that soil reinforce is being utilized over hundreds of years. To rehearse it in field, numerous reinforce materials are accessible for the reinforcement of weak soft soil, well known these days are the geosynthetics.

Agreeable execution of road relies upon the sub level soil condition. In the event that the sub level soil comprise of delicate soils, quality and strength of road asphalt lessens. Strengthening soil is one of the a powerful and dependable method for improving quality and dependability of soils. Subsequently Geo manufactures are frequently used to improving the CBR of feeble/weak sub grade soil for paved and unpaved roads. Which Reduces the profundity of miss happening (grooves), Improved load bearing limit and frost up hurl Extend the administration life and diminish the expense of by and large development. A few specialists have indicated the advantages of geotextile in pave and un-pave road over weak sub soil level to improve their presentation. Increase in strength of subgrade soft soil, that is to increase the CBR values when reinforced with geo synthetics depends on the properties and type of geo synthetics, depth and number of reinforcement layers [1].The strength and stiffness of soil increases with different types of geosynthetic reinforcement is known concluded by [2] [3] and[4]. For low-volume roads with relatively thin pavement sections, correctly selected geotextiles gives benefits for separating the sub grade and base course minimizing pumping, filtering infiltrated/ground water, and stabilized the road [5].

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Objective

- Laboratory test was conducted to determine strength and deformation by using Geo textile layer as reinforcement in Soft Clay Soil
- To evaluate CBR value of Unreinforced Soft Clay Soil , reinforced by 2 layer of Geo textile layer in top 1/5 of layer
- To evaluate CBR value of Unreinforced Soft Clay Soil with top layer replaced by Non Plastic Soil, reinforced by 2 layer of Geo textile layer in top 1/5 of layer.
- To evaluate CBR value of above cases by compacting statically with 833kg (1/3 of Equivalent static load) and 5000 kg (Twice the Equivalent static load).

Materials used a.Soil

The soil utilized for the tests are typically accessible soft soil
and non plastic soil obtained from REVA University, Bangalore. By conducting grain size analysis and Atterberg limit tests as per IS : 2720. The soil is classified as low plasticity clay (CI) and silty sand (SM) . In fig 1 shows the particle size distribution curve of soft soil. laboratory determined engineering properties of soft soil in are shown in table 1.

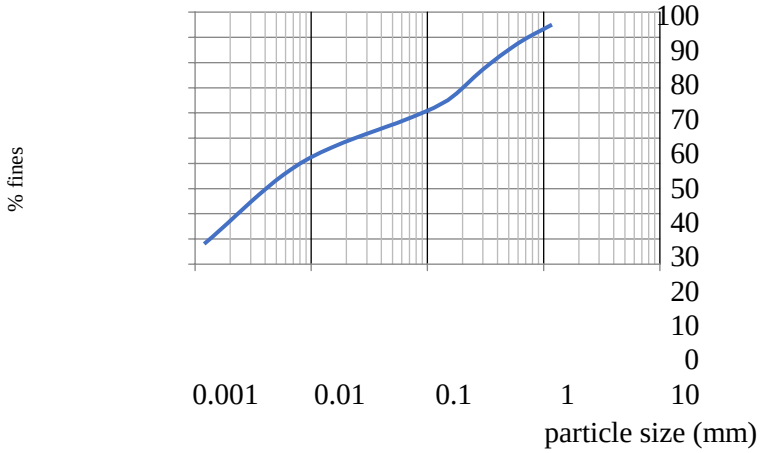

Figure 1: Particle size distribution of soft soil

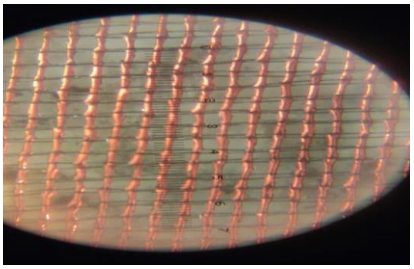

Figure 2: Microscopic view of woven/weaved threads

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Table 1b: properties of geotextile

Geosynthetic	Description	Value	Unit
geo textile layer	Mass per unit area	40	g/m^2
	materia l size	150×150	mm

Table 1a: Engineering properties of soft soil

Sl no	Details	Soft Clay Soil	Non plastic soil
1	% Gravel	0	0
2	% Sand	41.5	78.9
3	% Silt and clay	58.5	22.1
4	Liquid limit	38.8	NP
5	Plastic limit	26	NP
6	Plasticity index	12.8	NP
7	Soil Classification	CI	SM
8	MDD in gm/cc	1.50	1.89
9	OMC in %	15	6
10	CBR Value In %	0.88	8.35

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Methodology

The standard proctor test were conducted

to determine

b. Geo textile layer.

Woven Geotextile layer manufactured from polyester or polypropylene (which are polymers obtained by condensation polymerization of carboxylic acid and diol or by propylene). synthetic fibres are weaved to textiles, as shown in **fig 2**, geotextile are more flexible, low biodegradation susceptible, high permeable to liquid flow. These are suitable for applications involving the functions of separation, filtration and stabilisation. It has excellent resistance to biological and chemical environments normally found in soils and it is stable against short-term exposure to ultraviolet radiation. which is low cost and soft. maximum dry density (MDD) and optimum moisture content (OMC) as per IS : 2720 (part 7) 1980. Results shows MDD of 1.50 gm/cm^3 and OMC of 15 gm/cm^3.

Un-soaked California bearing ratio test was conducted on soft soil without reinforcement and with two layer of geo textile layer reinforcement as per IS: 2720 (part 16) 1973.

To know the pseudo confining effect and strength of geo textile reinforced soft soil , the two layer of geo textile layer was placed at top 1/5th height with in soil sample and by providing non plastic sand layer at 1/5th layer with and without two layer or geo textile. By Two different loads of static compaction effort.

Equivalent static load required to achieve standard compaction maximum density is 2500kg.

- In this study compaction is carried out statically by two loads. (1/3rd of static equivalent load and twice the static equivalent load)
- 833kgs and 5000 kgs

Purpose of using static load compaction

- This can be applied easily by using compression testing machine.
- Static compaction does not disturb or cause damage the placed geo textile materials, because of the gradual movement of piston.

Cylindrical mould is replaced by 15*15 concrete cube mould A cylinder mould has two circular faces without edges or vertices .where as cube mould is having 4 faces with 4 corners with a angle 90º are adopted for test, as geometry of pavement structure are similar to cube. Hence, geotextile material can be placed easily in mould trimmed to square

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shape slightly lesser to mould dimension. By knowing maximum dry density (MDD) and optimum moisture content (OMC) the required dry weight of soil to mould volume is known and water is added to soft soil mixed well,

Case 1 : Soft Soil is filled in mould by 5 layers without reinforcement and by providing 2 layer geo textile layer as reinforcement at top 1/5th layer each layer compacted statically as shown in **fig 3**
Case 2 : soft soil is filled in a mould by 4 layers with placing non plastic sand layer at 1/5th layer without and with reinforcement as shown in **fig 4**
Study on Both the case were conducted at two different types of static compaction load.The position of placed geo synthetic layer as shown in cross
section model **fig 5**. Surcharge load were placed to stimulate the road construction thickness effect over test specimen. Load applied to the soil at rate 1.25mm/min. Load readings are noted at penetration of 0.5mm to 12.5 mm.

Figure 3 : Placing Geo textile in 1/5th layer of soft soil layers

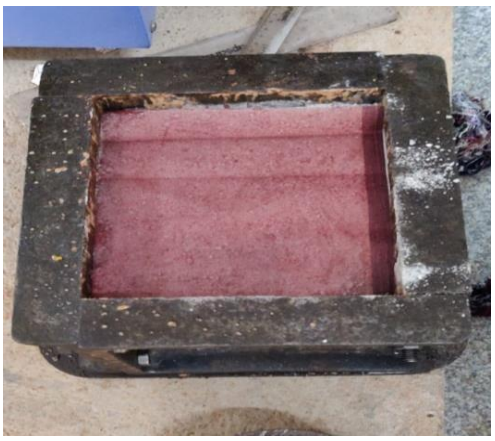

Figure 4 : Placing Geotextiles in top 1/5th layer of non plastic soil layer.

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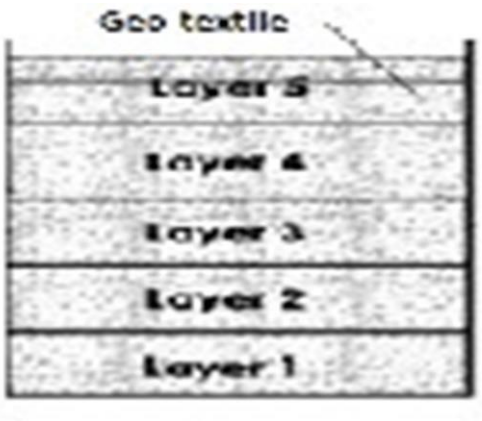

Figure 5: Schematic representation of test specimen with reinforcement by Geo textile at top $1/5^{th}$ layer.

Table 2: CBR values at 833kg of static compaction

Types	2.5 mm penetration	CBR (%)	5mm penetration	CBR (%)
Soft soil	2.75	0.88	4	0.85
Softsoil+2 Geo textile	3.6	1.15	6.5	1.39
Soft soil + non plastic soil.	6	1.92	8.5	1.81
Soft soil+ plastic soil+2layer geotextile	5.25	1.68	9	1.92

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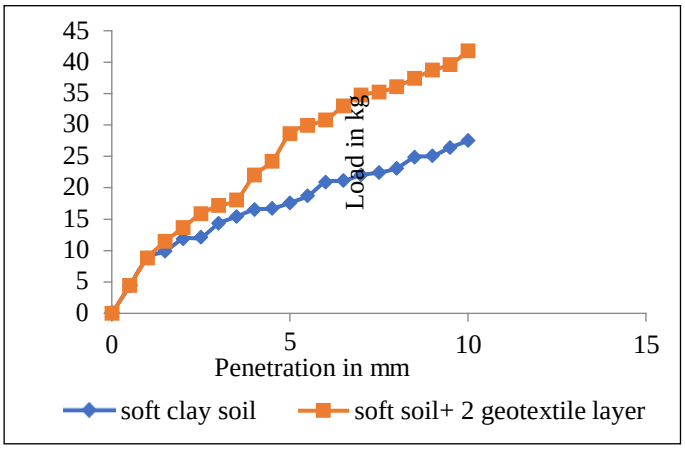
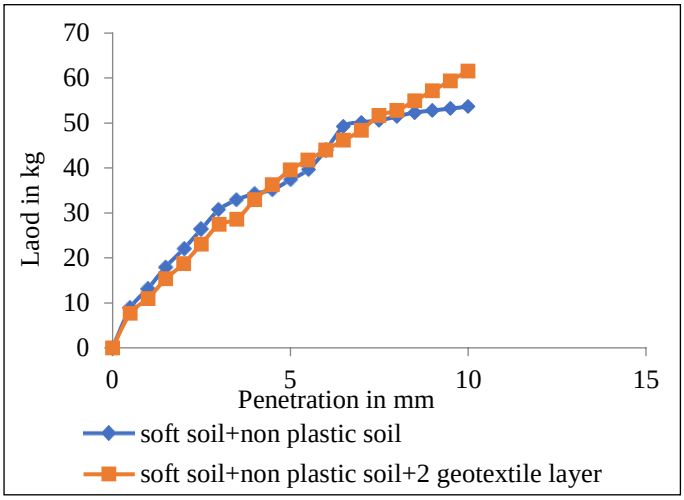


Figure 6 : Load v/s Penetration curve at 833 kg compaction.



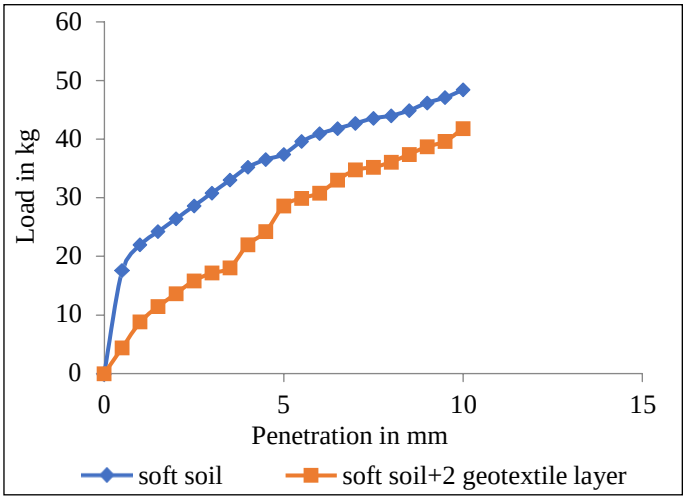


Figure 7 : Load v/s Penetration curve at 833 kg compaction.

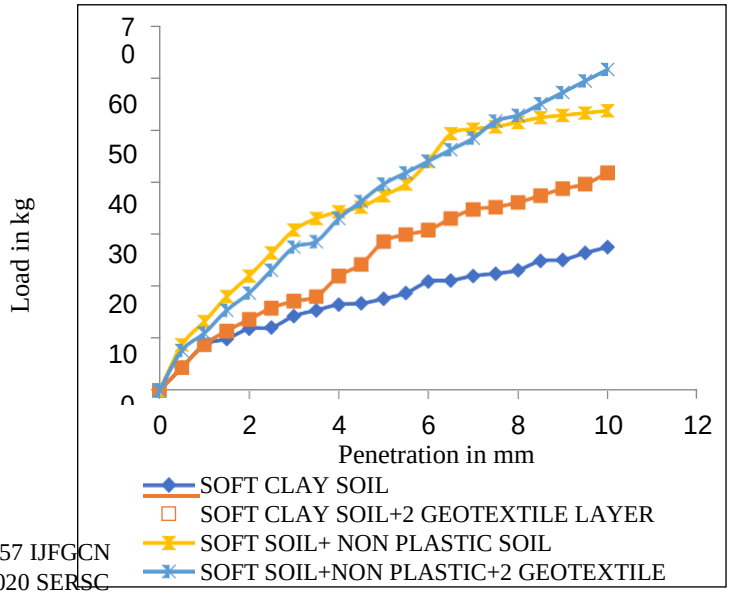


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Figure 8: Load v/s Penetration curve at 833 kg compaction.

Table 3: CBR values at 5000kg of static compaction

Types	2.5mm penetration	CBR (%)	5mm penetration	CBR (%)
Soft soil	6.5	2.08	8.5	1.81
Softsoil+2Geo textile layers	11	3.53	16	3.42
Soft soil +Non plastic soil	14	4.49	20	4.28
Soft soil+ Non plastic soil+2 geo textile layers	16.5	5.29	22	4.71

Figure 9 : Load v/s Penetration curve at 5000 kg compaction

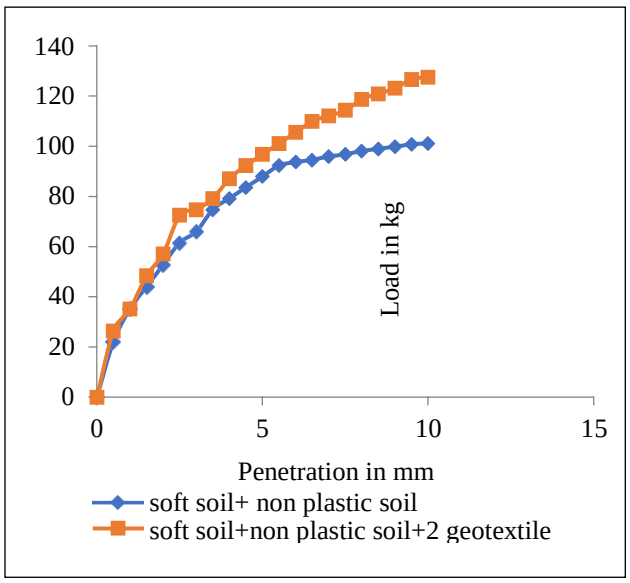

Figure 10 : Load v/s Penetration curve at 5000 kg compaction

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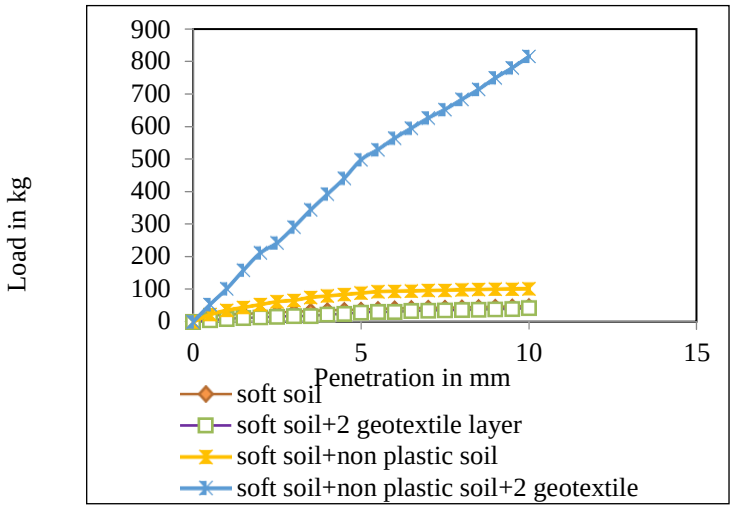

Figure 11 : Load v/s Penetration curve at 5000 kg compaction.

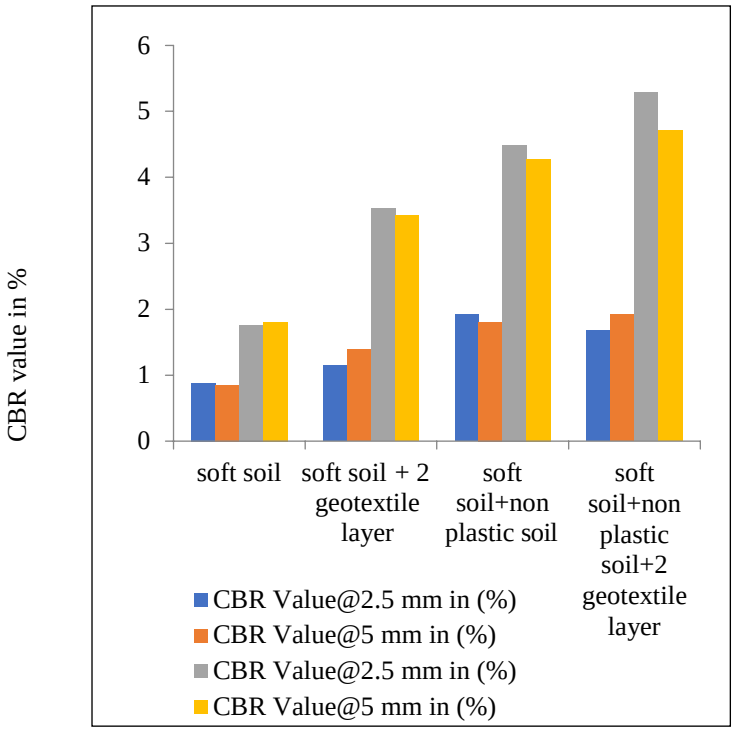

Figure 12 : Represents CBR value in % at compaction load of 833kg and 5000kg

4. By increase, initial compaction effort from 833 kg to 5000Kg further increases CBR Value in all the above cases.

5. By replacing top one layer (out of 5 layers of soft soil) with two Geo textile layer with Non Plastic Soil in sub grade soil, increase the CBR value by 410 % and reduces pavement thickness as

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per IRC 37. This is an economical and feasible solution for ground improvement.

Result and discussion :

- Soft Clay Soil, By providing Geo-textile layer as reinforcement in top 1/5th layer increase CBR Value 30.68% and 63.52% times .
- Soft Clay Soil, 5 layers replacing top one layer with non- plastic soil, shows increase in CBR value 118.18% and 112.94%. and By providing Geo-textile and Geo bag as reinforcement in top1/5th non plastic layer, shows further increase CBR Value 90.9 & 125.88%.
- By Increase initial compaction effort from 833 kg to 5000Kg further increases CBR Value in all the above cases as shown in the increment % bar chart.
- From economical view Geo textile used to reinforce soil are very cheaper cost material.
- Further we can improve the strength of the soil by using greater strength and stiffness geo textile material.

Conclusion:

From present study,

1. By proving Geo-textile as reinforcement in top 1/5th layer increase CBR Value of Soft Clay Soil
2. By replacing top one layer of Soft Clay Soil (out of 5layes) by Non Plastic Soil with providing Geo-textile as reinforcement in top 1/5th layer further increase CBR Value.
3. Due to confinement of geo textile gave better performance CBR value in soft soil and soft soil with non plastic soil layer.

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