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GEOTEXTILE CAN BE WORTH THEIR COST IN PAVEMENT

MAYURA YEOLE[1], DR.J.R.PATIL[2]

[1]*Assistant Prof.at Indira College of Engineering & Management*
[2]*Principal of Dr.D.Y.Patil Institute & Technology*

Abstract— Geotextiles have been successfully used for reinforcement of soils to improve the bearing capacity. In this study geotextile as a tensional material have been used for reinforcement of granular soils. Laboratory California Bearing Ratio (CBR) tests were performed to investigate the load-penetration behavior of reinforced soils with geotextile. Samples of granular soil are selected and tested without reinforcement. Then CBR tests were performed by placing geotextile in one or two layers at various depths in soil sample. The effect of the number of geotextile on the increase in bearing capacity of reinforced granular soil is discussed.

***Keywords* —** CBR, Geotextile, permeability, reinforcement, subbase.

I. INTRODUCTION

Engineers are continually faced with maintaining and developing pavement infrastructure with limited financial resources. Traditional pavement design and construction practices require high-quality materials for fulfillment of construction standards. In many areas of the world, quality materials are unavailable or in short supply. Due to these constraints, engineers are often forced to seek alternative designs using substandard materials, commercial construction aids, and innovative design practices. One category of commercial construction aids is geosynthetics (Naeini and Mirzakhanlari 2003). Geosynthetics include a large variety of products composed of polymers and are designed to enhance geotechnical and transportation projects. Geosynthetics perform at least one of five functions: separation, reinforcement, filtration, drainage, and containment. One category of geosynthetics in particular, geogrids, has gained increasing acceptance in road construction. Extensive research programs have been conducted by the U.S. Army Engineer Research and Development Center (ERDC) and non-military agencies to develop design and construction guidance for the inclusion of geogrids in pavement systems. (Fannin & Sigurdsson, 1996).

In this paper laboratory CBR tests have been performed on granular soils with and without geotextile. The results of test have been discussed.

II. CBR TEST

The test is done in a standard manner to compare the strengths of different subgrade materials, and to use these figures as a means of designing the road pavement required for a particular strength of subgrade. The stronger the subgrade (the higher the CBR reading) the less thick it is necessary to design and construct the road pavement, which gives a considerable cost saving. Conversely if CBR testing indicates the subgrade is weak (a low CBR reading) it requires to construct a suitable thicker road pavement to spread the wheel load over a greater area of the weak subgrade in order that the weak subgrade material is not deformed, causing the road pavement to fail. The standard CBR test was selected, so that a comparative analysis between the current test and previous test results without the use of geosynthetic can be interpreted. In the present study CBR tests were conducted on soils with and without geotextile.

III. EXPERIMENTAL STUDY

The necessary details of the materials used, experimental set-up, tests conducted and the experimental procedures have been presented as follows.

III.1 Specification of CBR Mould

The specification of CBR mould used is given in Table 1.

Table 1: Specification of CBR Mould

Mould	152.4 x 180.8 mm (inside diameter x height)
Collar	50.8 mm height, fits both ends of mould
Base plate	Perforated
Construction	All steel, plated

III.2 Materials

Soil samples was used; and the soils consisted of granular materials. Other characteristics were determined in the laboratory. The Optimum moisture content (OMC) is 13.5 %.The maximum dry density (MDD) is 1.92 gm/cc. The geotextile used was 0.8 mm thick. For these tests all the depths are considered randomly.

III.3 Test Programme

The soil was compacted in mould in five layers. Each of the layers was compacted by 55 blows of a 24.7 N rammer dropped from a distance of 305 mm. One CBR test has been performed without geotextile. A nonwoven geotextile sheet produced from polypropylene raw material was placed in mould in one or two layers as given in Table 2.

Table 2: CBR tests with Geotextiles

Sr. No.	Layer	Depth in mm from top
1	1	25
2	1	50
3	1	100
4	2	25 & 75
5	2	50 & 75
6	2	50 & 100

IV. RESULTS AND DISCUSSIONS

The CBR tests have been conducted on soil sample as close to the optimum moisture content (OMC). After the CBR test, the CBR values were obtained and plotted. A curve of penetration vs. load on piston was plotted for un-reinforced and reinforced samples with geotextile.

IV.1 Tests on Soil Sample

Several CBR tests were performed on soil sample. The CBR test results and load-penetration curve on soil sample with and without geotextile are presented in Table 3 and from Figure 1 to Figure 7.

Table 3: CBR test results for Soil sample with and without geotextiles

Geotextile position in mm from top	CBR Test No.			Avg. CBR	% Increase in CBR
	1	2	3		
No geotextile	11.1	11.3	11.1	11.17	Nil
25	14.5	14	14.9	14.47	29.55
50	11.5	11.4	11.7	11.53	3.28
100	11.5	11.3	11.7	11.50	2.99
25 & 75	15.2	15.9	15.2	15.43	38.21
50 & 75	13.7	14	13.5	13.73	22.99
50 & 100	11.3	12	11.8	11.70	4.78

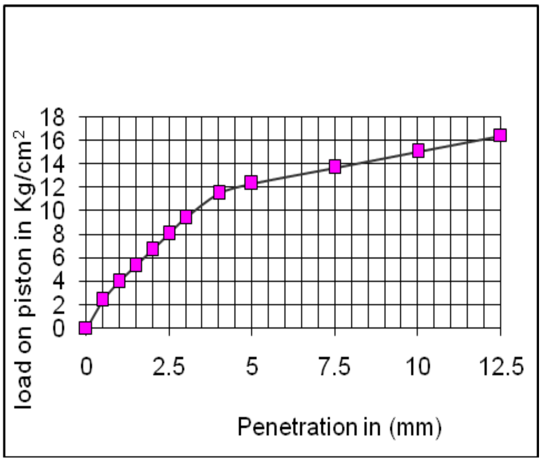

Fig.1: CBR test without geotextile

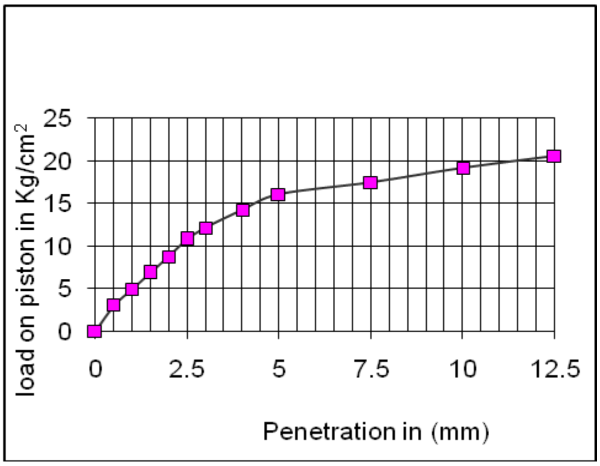

Fig.2: CBR test - geotextile at 25 mm from top

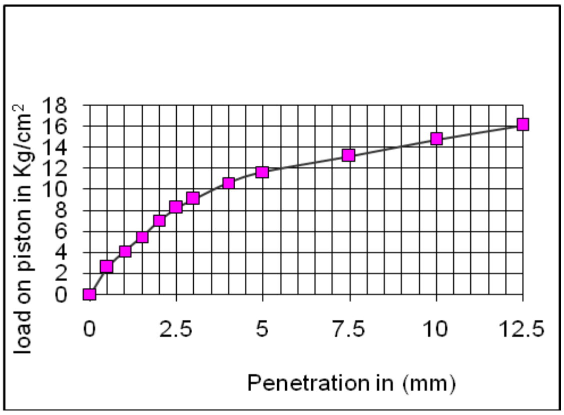

Fig.3: CBR test - geotextile at 50 mm from top

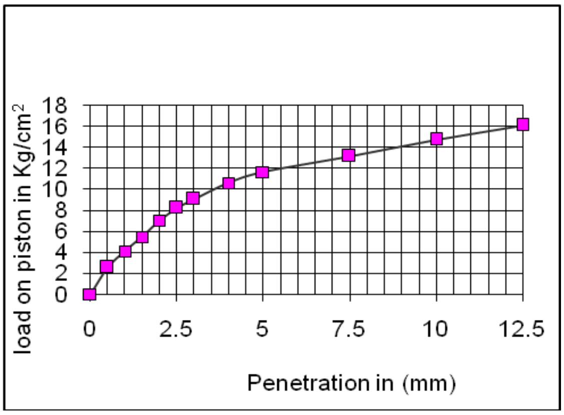

Fig.4: CBR test - geotextile at 100 mm from top

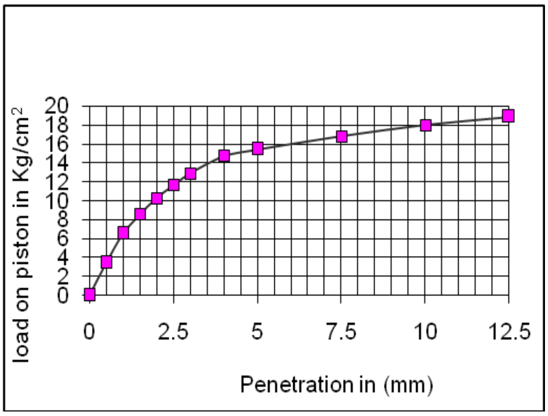

Fig.5: CBR test - geotextile at 25 mm & 75 mm from top

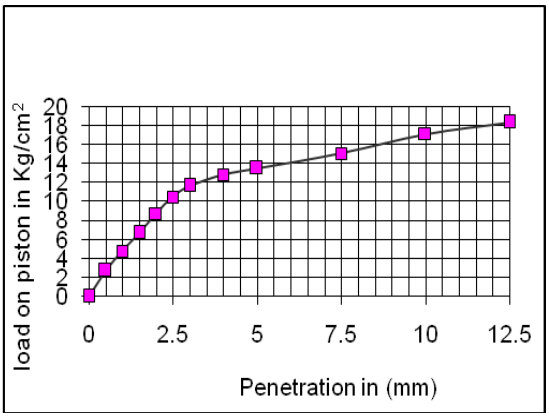

Fig.6: CBR test - geotextile at 50 mm & 75mm from top

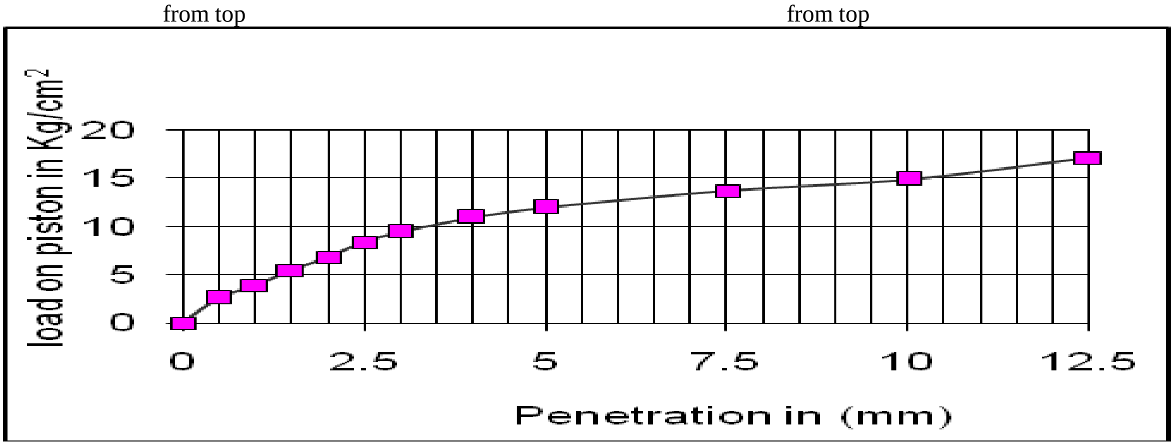

Fig.7: CBR test - geotextile at 50 mm and 100 mm from top

V. CONCLUSION

A series of CBR tests have been conducted to investigate the effect of geotextile on the bearing ratio of soils. The conclusions from the study are given below:

Placing of geotextile material in soil improves the CBR and therefore the strength of soils. It implies that geotextile reinforced soils in unpaved roads will perform better than unreinforced ones and increase load carrying capacity of soils. As compared with CBR value of soil without geotextile the maximum increase in CBR value is 38.21 %, when two layers of geotextiles have been placed at depths of 25 mm (~H/5) and 75 mm (~H/1.75) [H = height of soil sample in mould]. When one layer of geotextile has been placed at depth of 25 mm (~H/5), the increase in CBR value is 29.55 %. When two layers of geotextile have been placed at depths of 50 mm (~H/2.55) and 75 mm (~H/1.75), the increase in CBR value is 22.99 %.

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