Influence of Geotextile on Flexural Strength of Beam and CBR Value of Soil

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***Abstract* – This Geotextile is a new material which is used around the soil by applying the tension resistant elements in the form of sheets, strips and nets. There are various loads are acting on the foundation. If the soil is loose than its increase the foundation cost, to overcome this problem different layers of geotextile are applied between the different layers of soil. Using the different types of woven geotextile perform the CBR (California Bearing Ratio) test by applying at different depths and calculate the loads and penetration and on from these values calculate the CBR value of soil and behalf of this we can find out capacity improvement ratio of the soil, and design the rigid pavement. Geotextile is also applied in various lengths and in different proportions in cube and cylinders and perform compression and split tension test. It is applied as the layer around three sides of beam to sustain the flexural load and perform flexural test and take out the results.**

***Index Terms* - Geotextile, CBR, Flexural strength test, Rigid pavement.**

I. INTRODUCTION

Many researchers have made attempts to use the geotextile material as a reinforcement which quit is successful and increasing. This geotextile is placed in the soil mass to decrease the tensile strain which is caused due to boundary forces and gravity. The strength can be improved by dappling in the direction of tensile strain, as same way as the reinforced concrete. It has different characteristics which are suitable for construction of different structures. It contains prefabricated elements which are easily placed, stored, transported and assembled. These type of technique suitable for the poor sub-soil conditions. After applying geotextile soil can be flexible and withstand large differential settlement without distress. Generally geotextiles are very cheap compared to other and can be adopted to great advantage for construction. Geotextile fibers can also use now a days with concrete to know the effect of its presence on the various properties of the concrete. Generally their proportion are taken as the percentage weight of the cement. Geotextile material can also be used as a layer with the concrete and its effect can be measured by the testing of the concrete.

II. LITERATURE REVIEW

Tara Sen & H.N. Jagannatha Reddy [8] have presented in their paper that Jute textile reinforced polymer composite system was developed and it's tensile, flexural behaviour was characterised and compared with that of carbon textile (CFRP) and glass textile (GFRP) reinforced polymer composite. In the present work the efficacy of jute textile reinforced polymer composite (JFRP) as compared to CFRP and GFRP for the flexural strengthening of reinforced concrete beams was compared by carrying out bending test on reinforced concrete beams in three groups of fourteen beams. The work carries out the study of failure modes, flexural strengthening effect on ultimate load and load deflection behaviour as well as the deflection ductility study of RC beams bonded externally with JFRP, CFRP and GFRP, wrapped in U configuration in single layer, along the entire length of the beam in full wrapping and strip wrapping technique. The results depicted that JFRP, CFRP and GFRP, strengthening improved the ultimate flexural strength of the RC beams with full wrapping technique and by strip wrapping technique. JFRP strengthening displayed highest deformability index and proved that jute textile FRP material has huge potential as a structural strengthening material.

Vikrant S. Vairagade and Kavita S. Kene have [9] done laboratory experiment, cube and cylindrical specimens have been designed with metallic and non-metallic groups of fibers. In metallic fibers, steel fibers of hook end with 50, 60 aspect ratio and crimped round (copper coated) of 52.85 aspect ratio containing 0% and 0.5% volume fraction were used without adding admixtures. In synthetic fibers category, fibrillated polypropylene fibers of 15 mm, 20 mm and 24 mm cut length at 0.4% by weight of cement were used without adding admixtures. Total 63 specimens were casted and tested for the work. Comparing the results of fiber reinforced concrete with plain concrete, this paper validated the positive effect of steel fibers with different aspect ratios and fibrillated polypropylene fibers with different cut length in compression and splitting strength improvement of specimen at 7 and 28 days, analysed the sensitivity of different fibers to concrete with different strength.

S. Siva Gowri Prasad, Suresh Kumar & Ramesh Surisetty [1] In this study, samples of fly ash compacted to its maximum dry density at the finest moisture content is organized without and with Geotextile layers in the CBR mould. Geotextile sheets equal to the plan dimensions of CBR mould is placed in distinct preparations of 1st , 2nd , 3rd and 4th layers at different locations (i.e. at different embedment ratio, z/d) in the CBR mould. Subsequent to each arrangement of Geotextile, the CBR values are evaluated in the laboratory and compared with the results of CBR values earlier than including geotextiles.

Liaqat A. Qureshi M. Ilyas Sheikh and Tahir Sultan [10] have used cocktail fibers which is mixture of steel and polypropylene, used in different proportion and cast cubes & beam and done compressive test and flexural test.

M.M. Kamal, M.A. Safan, Z.A. Etman and R.A. Salama [11] have used steel and polypropylene fibers in different proportions in a beam with reinforcement and with only web reinforcement and done a tension and flexural test.

III. EXPERIMENTAL WORK

There are three type of geotextile and they are applied in three different layers which are 1st -2nd, 2nd -3rd, and all three layers in the CBR mould at the depth of 4.5 cm, 9 cm, and 13.5 cm from the top. It can also use with concrete, to know the effect we perform some tests. We cut the geotextile in the 45 mm and 35 mm length and applied it in the different proportion of 0.5%, 0.8% and 1.1% of the weight of the cement and cast the cube and cylinders and perform the compression test and split tensile test. We also used the three types of geotextile as a layer around the three sides of the beam whose thickness is taken from the results of the CBR test and perform the flexural strength test and take out the necessary results. The casting and the testing of the cube, cylinder and beam are shown below in the figure.

Fig 1: Casting of cube

Fig 2: Casting of cylinder

Fig 3: Casting of beam

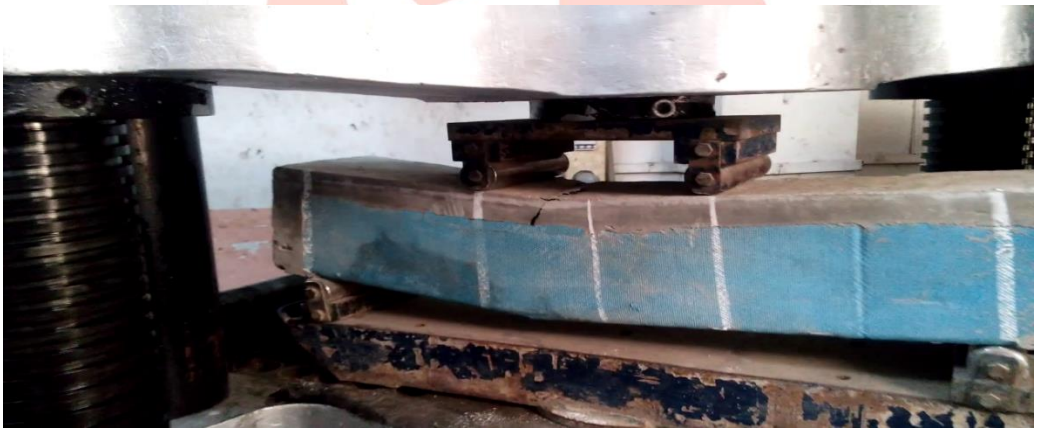

Fig 4: Testing of beam

IV. TABLES

Table 1 Properties of Woven Geotextiles

Sr.	Design-parameter	HTSF-W3225	HTSF-W3020	HTSF-W3020A
1	E.O.S. (mm)	>0.15 <0.875	>0.15 <0.825	>0.15 <0.70
2	Specific gravity	0.91	0.91	0.91
3	Thickness in mm	0.6	0.7	0.8
4	Breaking Strength kN	>60	>80	>100
5	% Elongation at B.S.	<25	<30	<28
6	Grab strength test (ASTM- D-1682) kN	>1.8	>1.9	>2.2
7	%in Elongation at G.T (ASTM- D-1682)	<30	<30	<28
8	Tear Strength (ASTM- D-1682) kN	>0.50	>0.55	>0.6
9	Water permeability	>10	>22	>20
10	G.S.M.	>240	>300	>380

Table 2 Results of CBR test

Type of Geotextile	Name	CBR value	
		Unsoaked	Soaked
	Normal	2.33	1.89
HTFS-W3225	1st & 2nd	2.35	2.11
	2nd & 3rd	3.1	2.5
	All three	5.24	4.89
HTFS-W3020	1st & 2nd	4.41	4.03
	2nd & 3rd	5.8	4.65
	All three	7.17	6.58
HTFS-W3020A	1st & 2nd	8.2	7.6
	2nd & 3rd	8.9	8.3
	All three	10.8	10.01

Table 3 28 days compressive strength of cubes

		Length of geotextile		
Weight (N)	Type	45mm	35mm	Weight (N)
88.4	Normal	24.19 N/mm^2		
86.6	0.50%	26.50 N/mm^2	24.85 N/mm^2	87.2
88.0	0.80%	22.51 N/mm^2	21.94 N/mm^2	89.5
88.25	1.10%	20.32 N/mm^2	19.18 N/mm^2	87.6

Table 4 28 days split tensile strength of cylinders

		Length of geotextile		
weight (N)	type	45mm	35mm	weight (N)
131.4	normal	2.54 N/mm^2		
128.7	0.50%	2.61 N/mm^2	2.53 N/mm^2	130.6
131.1	0.80%	2.45 N/mm^2	2.37 N/mm^2	129.2
129.3	1.10%	2.25 N/mm^2	2.17 N/mm^2	132.5

Table 5 Result of flexure test of beam

Flexure strength test			
Type of beam	Load (N)	a (mm)	f_{cr} (N/mm^2)
Normal	37000	193 from right	6.35
with 60 kN	40000	185 from right	6.58
with 80 kN	42000	223 from right	8.72
with 100 kN	45000	201 from left	9.33

V. Conclusion

From the above results we conclude that the CBR value is increasing from 2.33 to 10.8. The compressive strength of cube and split tensile strength of cylinder is also increasing while the proportion of the geotextile is 0.5%. The flexure strength of the beam is also increasing compared to the normal sample of the beam.

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