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To Study the Effect of Use of Geosynthetics Fibres in Sub grade Soil

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INTRODUCTION

Reinforcements and separation are the two functions of Geosynthetics in which pavement system is used in geogrids. The apertures are used in the products of geogrids. These products are mostly in large size and due to this, they are not used for getting separation of different materials. Gradation has the main function to separate two different materials. Still, in theoretically geogrids can also give some separation methods, but in a limited amount. In pavements, geogrids used separation method which is a secondary function or we can say it is used for some separation of different materials and in reinforcement, geogrids used the primary function in pavements and geogrid used to improve the mechanical properties of engineering like M25 Grade Concrete. The reinforcement mechanisms associated with geogrids.

- In civil engineering, geotextile is used to build civil projects, system as well as structure with using earth, soil, rock as well as other materials which are basically related to geotechnical materials.
- To produce sheets, geomembrane function is used because it is basically an impermeable membrane and used like liners as well as cut off the sheets.
- A polymeric structure like geogrid which is also a bidirectional/ unidirectional is used to produce sheets. It is consist of a network that is fundamentally interconnected with others and also linked by bonding, extrusion. As compare with constituents, geogrids have a large opening. Because of this property, it is used in transportation, hydraulic or in some geotechnical applications.
- Polymer structure like geonet is used to form sheets. It has a regular network which is basically connected by the overlapping of ribs and these ribs have a commonly large opening as compared to the constituents.
- To produce strips or sheets geocomposite product is used as it is an assembled polymeric product. Geocomposite is basically consisted of one geosynthetics components and used it is also used in transformational applications.
- Sheets are produced by a polymer structure like geometry. It has a non-regular network of tapes, fibers, tapes and another material and this network is connected as mechanically with each other and it also has a large opening as compare with its constituents.

LITERATURE REVIEW

- **Chamara P. G Jayalath (2018)** Research is about to investigate the effect of geogrid as a sub grade reinforcement. Geogrids are used in weak sub grades. And by using geogrids as reinforcement can reduce the rutting depth. Composite geogrid reinforcement at the boundary of the "sub grade-base layer" was prepared in a steel box with length, width and height of 1m, 1m and 1.2m. The 500mm thick sub grade was prepared to achieve a CBR value of less than 3% and then a 200mm granular layer was compacted on top of the sub grade to achieve 91% of its maximum dry density. At 50 mm rutting, an approximate CBR of 5 can be achieved by using composite-geogrid-reinforced sub grade. He concluded that vertical stress applied to the sub grade is also reduced from 25 percent to 30 percent by using geogrid as sub grade reinforcement.

- **D. A ogundare (2018)** the research is about to utilization of geotextile for soil stabilization. Stabilization means to improve the load bearing capacity and engineering properties of soil'ssub grade.CBR tests performed without "non-woven geotextiles" with the non-woven geotextiles at depths of H/4 from the top and base surfaces of the soil. He performed CPR test on the sample and also he performed the test by addinggeotextile as reinforcement in sub grade soil and he found that the CBR value increases. That means the strength of sub grade soil is increased. As compared to traditional soil, Geotextile reinforced soils gives good performance under dynamic loadings.

- **Sangeetha and Naveen Kumar (2018)** study the effect of geosynthetics in the stabilization of sub grade soil. Nowadays the bearing capacity of the soil is not too good to meet the increasing population demands. The CBRvalue of the reinforced laterite soil was obtained as 1.23% after reinforcingit with Geonet it was found to increase by 1.4% and withgeomembrane it was 4.70%. The performance of the road depends upon the property of sub grade. So he uses geogrid material in sub grade soil and checks the CBR results and he found that soil strength will be increased by reinforcement. Strength of

soil increases when he put geomembrane at h/4 height that result in higher CBR values.

- **Parveen and Ajay (2017)** study are to use of geosynthetic material to improve soil properties. By using the material we found that it is cost effective and makes soil durable. It is 25 – 45 % cost effective than ordinary treatment. Nowadays with the use of geosynthetic material they increase the soil strength. There is an increase in the value of cohesion as a percentage of geosynthetic material increase upto2% but after that, there is a decrease in the value of cohesion. The CBR values of black cotton soil without any kind of reinforcement is 2.55%. The angle of internal fraction decreases with increase in the content of geosynthetic material. The CBR value increase with the use of reinforcement and dry density decrease.

AIM AND OBJECTIVES

To find the availability of various geosynthetics products is the key research work of this thesis and also to calculate the efficiency of geotextile in the construction of road and its maintenance. This research has some aims and objectives as mention below:

A. In the country, geosynthetics availability is classified by this research.
B. The objective of this thesis is to create design Pavement thickness which is based on
C. Increase the Service Life of Road
D. The aim is to raise the efficiency/ load capacity/strength of the road.
E. In order to conclude the constituent substance utilized in producing the geotextile, among the geosynthetic substances.
F. In order to add the geotextile in certain gathered up soil materials as well as evaluate results.

RESEARCH METHODOLOGY

SAMPLE COLLECTION

The materials that were used for this investigation are clayey, organic and lateritic soils. For the laboratory tests, three soil samples were collected. Organic soil and clayey soil were gotten from Delhi-Sirsa Highway. The materials were gotten in polythene to prevent loss of moisture to the atmosphere. The analysis was carried out in order to ascertain the physical and engineering properties of the samples."

LABORATORY TEST

Tests implemented or performed on natural clayey, organic and lateritic soils collected for this project include particle size distribution, Moisture content, Grain Size analysis, Atterberg limits and CBR test in order to evaluate their Geotechnical properties

GRAIN SIZE DISTRIBUTION

IS: 2720 (Part 4) – 1985 – Method of test for soil (Part 4- Grain size analysis)

AIM:

To determine the effective size and the uniformity coefficient of a given sample of soil and to classify.

Equipment for Particle Size Distribution:

Set of fine sieves, 2mm, 1mm, 600 micron, 425, 212, 150, and 75 micron.

Set of coarse sieves, 100mm, 80mm, 40mm, 10mm, and4.75mm.

Weighing balance with an accuracy of 0.1% of the mass of the sample.

Soil Atterberg Limits

Plastic limit, shrinkage limit and liquid limit are the Atterberg limits and used to calculate the critical water contents of a fine-grained soil.

The test was carried out on natural soil samples in order to classify into standard groups and these limits include liquid, plastic and shrinkage limits. Some useful information obtained from knowledge of these limits are:

- It enables to identify and classify the soil.
- Shear strength of soil can be inferred from these properties.
- Results of the liquid limit can be useful in the assessment of the settlement of soil

Plastic limit

When soil is very dry in plastic or has less water is called as the plastic limit of soil. In this method soils, the moisture level is so minimum that it will be easy to convert soil into threads of 3mm by using the palm of hands. The soil thread at plastic limit crumbles under the rolling action. At this stage, in the plastic limit of soil moisture was added again and the average value of the moisture content was taken.

The plastic index is defined as the difference between the value of plastic and liquid. This is a measure of how much water a soil can absorb before dissolving into a solution. The higher the value, the more plastic and weak the material is. Plastic soil containing clay has a PI of 10 to 50 or more.

California Bearing Ratio Test (CBR)

OBJECTIVE:

To determine the CBR of soil in Remoulded/ undisturbed condition.

Soil Sample–

The larger products which might be replaced with an equal amount of materials that have passes 19mm sieve. If the size of soil particles are found more than 19mm then this process was not accessible. The specimen might be compacted that are dynamically or statically.

I. Compaction by StaticMethod

The volume of mold is calculated by the given examples and the wet soil mass which required moisture content to provide the density. Water is mixed with soil to provide water content in a desirable manner.

II. Compaction by Dynamic Method

4.5 kg or 5.5 kg preventative sample of granular soil is mix with water for the compaction of dynamic. In case the soil is usually to be compressed with the highest dried out density on the best optimum water content-driven around accordance with major compaction or gentle compaction, the actual mass of soil needed would be to be shot. The spacer disc is placed with the starting plate along with a disc of rough filtration system paper positioned about the roof of the spacer disc. The soil water combination is compressed in the mold inside accordance with the techniques specified for gentle compaction check or maybe major compaction check.

EXPERIMENTAL WORK
GRAIN SIZE DISTRIBUTION
Sample Weight: 1000 Grams

Table- Grain Size Distribution Data

IS Sieve No (mm)	Wt. of Soil Retained in Grams	%Wt. Retained	Cumulative %Wt. retained	% Finer
4.75	81.80	8.18	8.18	91.84
2.36	65.51	6.55	14.73	85.85
1.18	260.39	26.42	40.83	59.52
0.6	390.00	39.00	79.73	20.62
0.425	0.22	0.86	79.33	20.73
0.3	4.68	0.68	80.83	19.41
0.15	136.46	13.68	93.73	6.15
0.075	34.63	3.48	97.42	2.73
Pan	26.83	2.62	100.42	0.00

Percentage Fines (Size Less than 75μ) < 5%

The test was carried out on natural soil samples in order to classify into standard groups and these limits include liquid, plastic and shrinkage limits. Some useful information obtained from knowledge of these limits are:

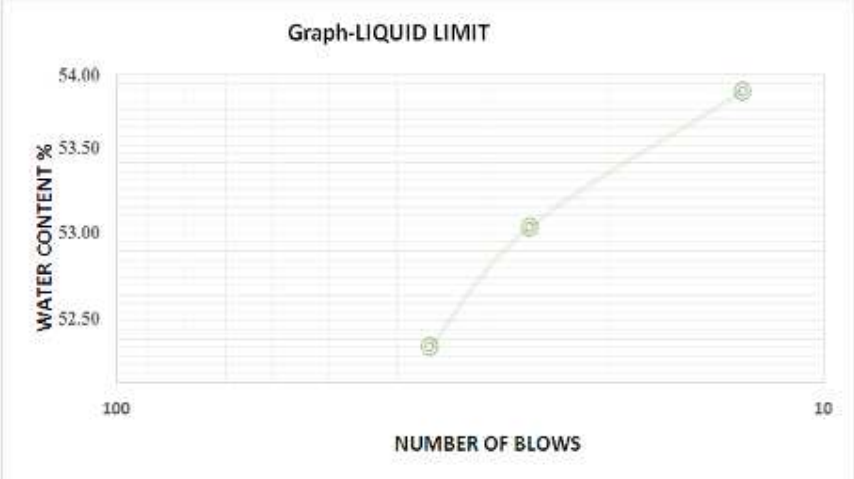
- It enables to identify and classify the soil.
- Shear strength of soil can be inferred from these properties.
- Results of the liquid limit can be useful in the assessment of the settlement of soil

ATTERBERG LIMITS

I. LIQUID LIMIT

Table-Liquid Limit Data of Soil Sample

SL. NO	DESCRIPTION	I	II	III
1	Number of Blows	13	26	36
2	Container Number	1	2	3
3	The weight of container + Wet Soil in grams	10.26	11.26	8.26
4	The weight of container +Dry Soil in grams	6.51	7.73	5.73
5	The weight of Water in grams	3.62	3.84	2.26
6	The weight of Dry Soil in grams	6.83	7.84	5.51
7	Water Content (wL) in Percentages	53.82	52.83	50.26



Liquid Limit wL= 51.84 PLASTIC LIMIT

Table-Plastic Limit Data of soil Sample

SL.NO	DESCRIPTION	I	II
1	Container Number	1	2
2	The weight of container + Wet Soil in grams	2.2	1.16
3	The weight of container +Dry Soil in grams	1.76	0.88
4	The weight of Water in grams	0.32	0.17
5	The weight of Dry Soil in grams	1.75	0.95
6	Water Content (wP) in Percentages	18.65	18.57
7	**Average Plastic Limit WP**	**18.72**	

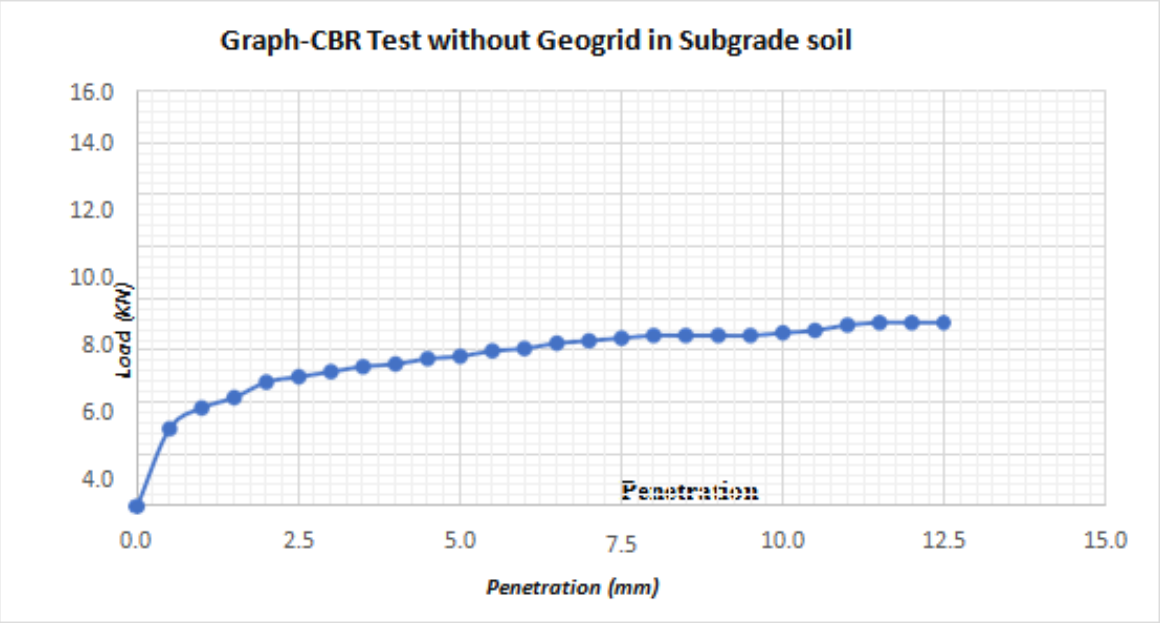
Plasticity index IP: Liquid Limit – Plastic Limit: 31.85 IP>18 High Plastic Soil

CALIFORNIA BEARING RATIO

I. WITHOUT GEOGRID

Table- CBR Test Data Without Geogrid

SL No:	Penetration in mm (C1)	Proving Ring Readings (C2) KN	Proving Ring Readings in division (C3=C2*5)	Load in Kg C4=C4*0.915
1	0.0	0.0	0.0	0.0
2	0.5	2.74	14.35	12.64
3	1.0	2.63	18.57	16.75
4	1.5	3.52	20.68	18.86
5	2.0	3.56	23.79	21.35
6	2.5	4.36	24.97	21.57
7	4.0	4.74	26.57	24.68
8	5.0	4.85	28.46	25.35
9	7.5	5.4	31.35	28.86
10	10.0	5.83	32.48	31.68
11	12.5	6.72	34.96	31.46



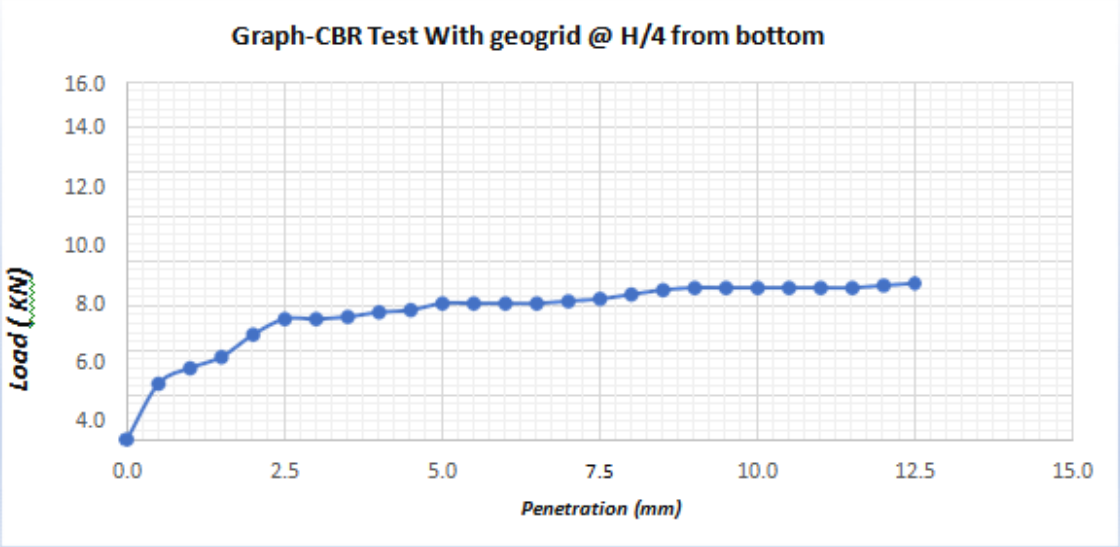
CBR @ 2.5 mm Penetration: 1.67, CBR @ 5.0 mmPenetration: 1.36

The test is then performed when we add geosynthetic material in sub grade soil

II. WITH GEOGRID AT H/4 FROM THE BOTTOM

Table-CBR Test Data with geogrid @ H/4 from bottom

SL No:	Penetration in mm (C1)	Proving Ring Readings (C2) KN	Proving Ring Readings in division (C3=C2*5)	Load in Kg C4=C4*0.915
1	0.0	0.0	0.0	0.0
2	0.5	2.4	11.48	10.34
3	1.0	2.2	15.57	15.43
4	1.5	4.7	15.45	15.46
5	2.0	3.7	22.75	20.75
6	2.5	4.4	26.56	**24.86**
7	4.0	5.7	28.74	26.59
8	5.0	5.9	29.49	**26.55**
9	7.5	5.3	30.36	27.84
10	10.0	5.8	33.25	32.39
11	12.5	6.0	34.14	31.29



CBR @ 2.5 mmPenetration: 1.79, CBR @ 5.0 mmPemetration: 1.27

CONCLUSION

1. The optimistic effects of geogrid reinforced sub grade courses can reasonably and ecologically be utilized to decrease aggregate size.
2. Geogrids application are investigated to sub grade material in this research as a form of reinforcement" to road construction.
3. The conclusion of this research is that the strength of poor soils can be increased by geo-grid and provides higher CBR values.
4. By this research, it is found that the strength of sub grades is supportively as well as significantly when geo grids depth is fixed.
5. It was observed that the highest sub grade strengthisachievedwhenitisplacedat3H/4 for a single layer although has a satisfactory resultant H/2andH/4respectively.
6. Geotextiles design which is based on sound engineering principles will provide long term relationship between the user and the organization.

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