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STRENGTHENING OF SUB-GRADE SOIL USING GEOSYNTHETICS

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Abstract: *Roads are arteries of a city and an increase in population increases traffic . Heavy traffic demands strong, smooth, durable and well maintained road pavement and hence healthy and strengthened road network is essential for socioeconomic development of a country. Reinforcement of road pavement using various materials are in practice, geosynthetics being popular among them. Geosynthetics are synthetic products used to stabilize terrain. These include Geotextiles, Geogrid, Geonet, Geofoam, Geomembrane, Geocells etc. Geosynthetic play a significant role in modern pavement design and maintain techniques. The focus of this project is on better understanding of natural and artificial geotextiles for strengthening of sub grade soil. This project gives effect of reinforcement of Geotextiles on subgrade soil.*

Key Words: **Geosynthetics , Subgrade, Reinforcement**;

1.INTRODUCTION

Roads are arteries of a city and thus they constitute an integral part of a city. Lowermost layer of a pavement is called subgrade and it usually consist of soil present at the site. Roads often have to be constructed across this weak and compressible soil. Whenever a road needs to be built on such soil with low CBR value, settlement may take place during or after construction, with serious consequence in the lifespan of the road. It is therefore a common practice to distribute the traffic loads in order to decrease the stress on the soil sub-grade. This is generally done by placing a reinforcement layer.

Use of Geo-synthetics serves as a solution to these problems. Geo-synthetics increase the strength of sub-grade soil and modify some of its properties so that strength and lifespan of the road is increased. The project provides an overview of the current Geo-synthetics technologies and highlights the function that geo-textiles perform in enhancing the performance and extending the service life of paved road.

1.1 SUBGRADE SOIL

Subgrade is the lowermost layer of a pavement and it usually consist of soil already present at site. This compacted subgrade may be the in-situ soil or a layer of selected material. Subgrades are commonly compacted before the construction of pavement. The load-bearing strength of subgrade is measured by California Bearing Ratio (CBR) test. The long-term interaction between a fine soil subgrade and granular layer, under dynamic loads, is likely to cause pumping erosion of the soil subgrade and penetration of the granular particle in to the soil subgrade, giving rise to permanent deflections and eventually to failure. These problems can be avoided by reinforcing with other materials like geotextiles, geogrid,geonet etc..

1.2 GEOSYNTHETICS

Geosynthetics are synthetic products used to stabilize terrain. They are generally polymeric products used to solve civil engineering problems. This includes eight main product categories: geotextiles, geogrids, geonets, geomembranes, geosynthetic clay liners, geofoam, geocells and geocomposites. The growth in their use worldwide for transportation application has been nothing short of phenomenal. It consists of natural and artificial product that is used along with soil in geo-technical and civil engineering constructions. Natural products are coir, jute, hemp etc. The most common use of geo-synthetics is in road construction. Geosynthetics increase the strength of subgrade soil and modify some of its properties so that the strength and lifespan of the road is increased. Main functions of geosynthetic are Filtration, Separation, Drainage, Barrier, Reinforcement, Protection etc.

2.REINFORCEMENT

The concept of reinforcing poor soil has continued until the present day. Soil is strong in compression but weak in tension. Reinforcement which has high tensile strength could be effective in counteracting materials which are weak in tension. Reinforcement in subgrade is done by introduction of a geotextile, geogrid or geocomposite which are good in tension into a soil which is good in compression.

REINFORCING MATERIALS

- GEOCOMPOSITE
- GEOGRID
- GEOTEXTILES
    - NON WOVEN GEOTEXTILES
    - HOT BOUND-NON WOVEN GEOTEXTILES
    - NON WOVEN GEOTEXTILES TYPE-1(GEO BAG)
    - NATURAL GEOTEXTILES (COIR)

3. METHODOLOGY

Soil collected from a site near Cochin, Kerala was used for the studies .Basic laboratory tests such as standard proctor test, California Bearing Ratio test(CBR), Unconfined Compression test, particle size determination, Direct shear test and Permeability test were conducted on the collected

sample to determine index and engineering properties of soil. Five different geotextiles were used for the present investigation, as shown in figure 1.To quantify the improvement in engineering properties of soil by placement of geotextile, tests were conducted on reinforced soil. Result then compared with result from basic soil.

CBR test were conducted with single layer and double layer reinforcement. The material is provided at one third and two third depth of the mould such that it is about one and half times the diameter of the plunger.

Direct shear test were conducted by single layer of reinforcement at middle of the mould perpendicular to the direction of shear. A 4X4 size layer is provide at the middle of 6X6 mould. The test were done with all geosynthetics. . Every tests were conducted at OMC.

Table -1: comparison of test result

MATERIALS USED	CBR VALUE FOR 1LAYER (%)	CBR VALUE FOR 2 LAYERS (%)	ANGLE OF INTERNAL FRICTION(degree)
GEO COMPOSITE	4.86	4.89	41.42
NONWOVEN GEOTEXTILE	3.7	4.23	42.87
GEO BAG	2.77	3.99	39.8
COIR	3.1	4.1	23.9
HOT BOUND GEOTEXTILE	3.698	6.18	19.3

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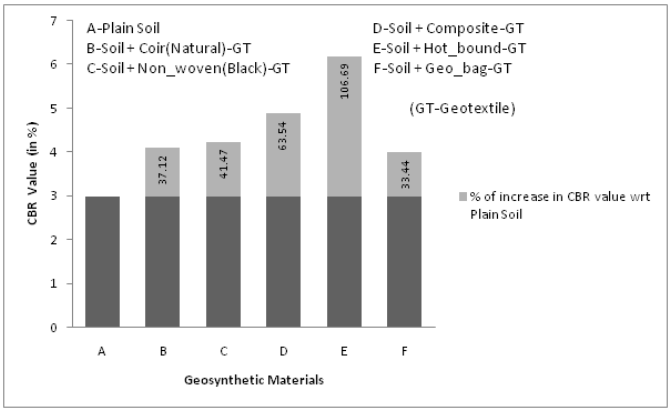

Chart -1: CBR variation of reinforcement

Fig -1: Reinforcement materials

4. RESULTS

The percentage increase in cbr value for each of the material was different .The highest percentage increase was for hot bound GT with a value of 106.69%.Then the value decreases for composite GT, nonwoven GT,natural(coir)GT and geobag with values 63.54%,41.47%,37.12%and33.44% respectively.

5. CONCLUSIONS

When soil reinforced with geosynthetics it become stronger and stiffer than soil without reinforcement.

Placing of geotextile material in soil improves bearing capacity and load carrying capacity of soil and thus increase service life of pavement. Experimental studies show increase in subgrade strength which support the theoretical studies carried out. Geosynthetics when used in pavements perform various functions like reinforcement, separation, drainage and filtration.

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