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Effect of Geotextile on Unpaved Roads

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***Abstract*: Unpaved roads are usually used for low volume traffic and it serve as access roads for rural areas. The performance of the unpaved roads depends on properties of the sub-grade soil . The geotextiles are used in the sub-base to improve the performance of the soil. However, the use of geotextile is uneconomical but it increases the service life of the unpaved roads and avoids large deformation in the roads. The maintenance cost for this type of roads is somewhat low compared to the roads without geotextile . This study is carried out experimentally, utilising the CBR testing arrangement. The penetration relation of the sub grade-woven geotextile-gravel, sub grade-nonwoven geotextile-gravel and sub grade-gravel is evaluated using CBR test. This test shows that the performance of the unpaved road is improved with the inclusion of the geotextile.**

***Keywords*: CBR , Geotextile , sub grade**

I. INTRODUCTION

Pavement is a structure formed by natural soil on which other granular soils such as sub-base , base, asphaltic concrete and cement concrete are laid . The quality and stability is a major factor responsible for adequate performance and service of the road during its lifespan. The physical properties of the subgrade soil determine the total thickness requirement of the pavement structure, which it supports and the life of the structure in good condition.

During construction of roads on soil a certain bearing capacity of the subbase is required to prevent unnecessary differential settlements of road structure . For such soils inclusion of geotextile in the sub base increases the bearing strength and reduces the differential settlement.

II. MATERIALS

2.1 RED SOIL :

The red soil is a group of soil that develop in a warm, temperate, moist climate under deciduous or mixed forests and that have thin organic and organic mineral layers overlaying a yellowish-brown leached layer resting on an illuvial red layer. They are found in large tracts of Tamil Nadu, Karnataka , southern

Maharashtra and Andhra Pradesh. The Contents are given in the following table.

CHEMICALS	COMPOSITION
Non soluble	90.47 %
Iron	3.61%
Aluminium	2.92%
Organic matter	1.01%
Magnesium	0.70%
Lime	0.56%
Carbon-di-oxide	0.30%
Potash	0.24%
Phosphorus	0.09%
Nitrogen	0.08%

Table 1.Chemical properties of red soil.

2.2 GEOTEXTILE :

Geotextile and related products have many applications and currently support many civil engineering applications including roads , airfields , rail road's bank protection , coastal construction , silt fences etc. Geotextile were originally intended to be an alternative to granular soil in filter fabrics . Work began in the 1950s with geotextile used behind precast concrete seawalls,under precast concrete erosion . The applications of Geotextile are as follows.

- Seperation
- Filtration
- Erosion control
- Slope Stabilisation
- Strengthening of soil

II. EXPERIMENTAL PROCEDURE :

Once the preliminary tests are done aand checked for quality of materials , the main procedure is done . The main procedure is to find the CBR value of soil – gravel combination and compare the results with the soil-woven geotextile and soil-nonwoven geotextile . After testing the above combinations , the results are found and compared to find the combination in which there is more strength .

3.1 CBR TEST FOR SOIL – AGGREGATE:

The subgrade soil is taken and placed in the mould upto a height of 125mm at its maximum dry density found using its optimum moisture content . The soil is compacted well . Then the gravel is placed for the rest of the mould i.e)25mm . Then the mould is placed in the apparatus and CBR testing is done . The tests were carried with a 50mm plunger for soil-aggregate , soil- woven geotextile-aggregate and soil-nonwoven geotextile-aggregate separately . The CBR value is found by drawing the graph between the penetration in mm and the load in KN . The graph shows the variation in the strength of arrangement.

Now the experiment for soil – aggregate is done and the graph is as follows.

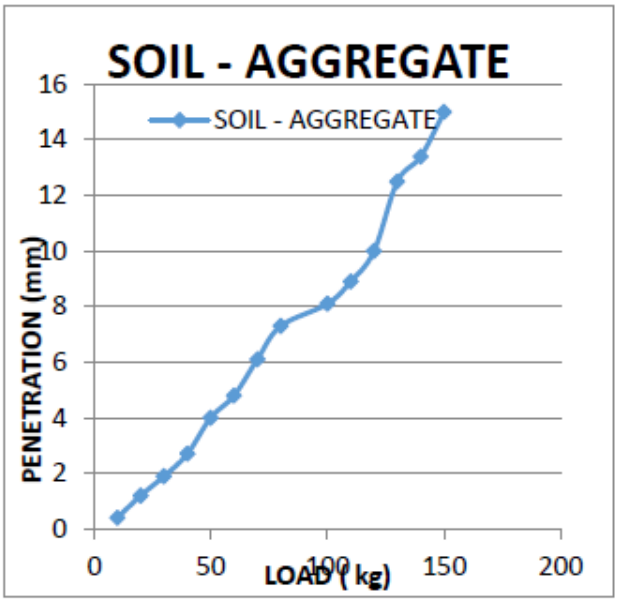

Figure 1.Soil – Aggregate relationship

The above graph shows the relation between the soil and the aggregate . Then after this the test is done with woven geotextile placed in between the soil and the geotextile . Then the graph for this combination is given below. The woven geotextile is cut into a piece that fits into the apparatus . The diameter of the apparatus is 150 mm and the geotextile is cut in the shape of the mould with a diameter of 150 mm . The soil is first filled in the apparatus for a height of upto 150mm and then the geotextile is placed and after that the aggregate is placed for the rest of the space.

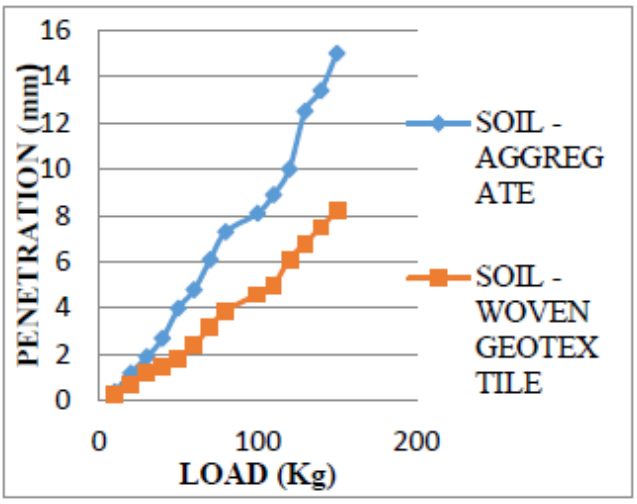

Figure 2.Soil-Woven-Aggregate

The above graph shows the change in strength of the arrangement when the woven geotextile is placed in between the soil and the aggregate . The strength parameters are taken and the graph is drawn .After this, the same procedure is repeated by replacing woven geotextile by non-woven geotextile . The results for this are to be shown in a graph which is shown below.

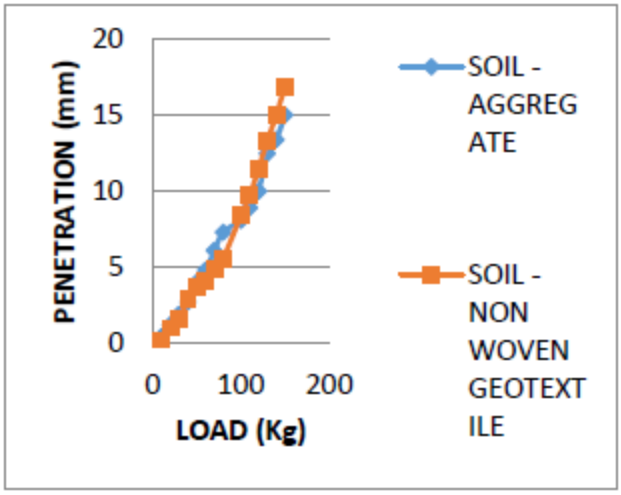

Figure 3.Soil-nonwoven-Aggregate

III. RESULTS AND DISCUSSION

The California bearing ratio strength is found by measuring the penetration resistance for the soil – aggregate, soil – woven geotextile and soil – non woven geotextile combination . The results are found by comparing the graphs drawn for various combinations of tests. The combined graphs for all the three are given below.

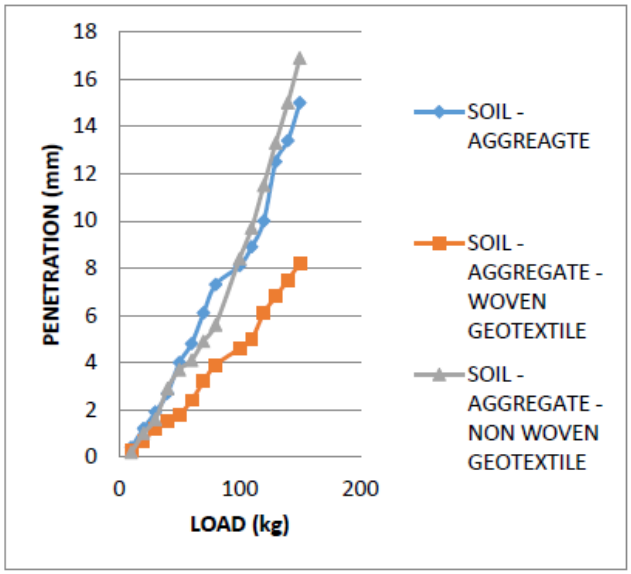

Figure 4.Combined graph showing the combination

From the above graph , it is visible that the penetration is reduced when the geotextile are placed in the arrangement . When geotextile are not placed, the strength or the penetration value is less when compared to the strength obtained by placing the geotextile in the arrangement. Especially the strength is found to increase well when the woven geotextile are placed there is a tremendous decrease in the penetration. When non woven geotextiles are used the strength seemed to be less than the woven geotextile. Thus the strength of the combination is tested and the combination with geotextile is seemed to have increased strength . From the graph , it is proved that the Woven geotextile has the maximum strength and can be used for laying roads .

Thus the values of penetration are found and the comparative graph is drawn and it is found that the woven geotextile has higher penetration resistance and it can be used for laying unpaved roads.

IV. CONCLUSION :

In this project we tried to increase the strength of the unpaved road with the help of geotextile (both woven and non-woven) . To do this we have placed the geotextile between the aggregate and sand . It not only had increased the strength but also functioned as a filter layer and also helpful in separating the sub grades thus reducing the differential settlement . The increase in strength is found using CBR values found by drawing the graph between the load and the penetration .

So we conclude that when geotextile are placed between the soil and the aggregate , there is an increase in the strength of the road thus helping in reducing the maintenance cost of the road .

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