International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 06 | June 2019 www.irjet.net p-ISSN: 2395-0072

EVALUATING THE BENEFITS OF USING GEOTEXTILES IN ROAD CONSTRUCTION

Mr. Ghanasham Sarode[1], Dhanashree Jagtap[2], Shankar Gaikwad[3], PrajaktaGaikwad[4], Pooja Bhange[5]

[1]*Assistant Professor, Dr. D. Y. Patil Institute of Technology, Pimpri, Pune*
[2,3,4,5]*Student, Dr. D. Y. Patil Institute of Technology, Pimpri, Pune*

Abstract – *The economical development of a country depends on the road transport infrastructure facilities available .The periodic maintenance of the road is limited due to the cost consideration which will disrupt the service and affect the function of the road. To overcome these constraints, Geotextiles can be used to increase the strength of the pavement, in this paper we have compared the bearing capacity of the road with and without Geotextiles.*

Geotextiles are manmade materials used to improve soil conditions. They are typically made from petrochemical-based polymers that are biologically inert and will not decompose from bacterial or fungal infection. While most are essentially chemical inert, some may be damaged by petrochemicals and most have some degree of susceptibility to ultraviolet light.

Key Words: Geotextiles, geosynthetics, pavement.

1. INTRODUCTION

Geotextiles are manmade materials used to improve soil conditions. They are typically made from petrochemical-based polymers that are biologically inert and will not decompose from bacterial or fungal infection. While most are essentially chemical inert, some may be damaged by petrochemicals and most have some degree of susceptibility to ultraviolet light.

The word geosynthetics derived from geo means earth or soil and synthetics is manmade. Geosynthetics are synthetics products and polymeric products used to solve the civil engineering problems. The different synthetic products are: Geotextiles, geogrids, geonets, geocells, geosynthetics have the potential to improve the pavement service life, provides strength, protects from frequent damage and decreases the frequent maintenance. According to the American Standard for testing of materials a geotextile is "any permeable textile material used with foundation, soil, rock, earth, or any other geotechnical engineering related material, as an integral part of manmade project, structure or system".

1.1 Aim & Objective

The aim of this research paper is to evaluate the benefits of geotextile in road construction:

(1)To classify the available geosynthetics in the country.

(2)To evaluate the benefits of use of geotextile in road construction in comparison to normal road.

(3)To analyze the results and make appropriate recommendation for optimal use.

1.2 History of Geotextile

Geotextiles were originally intended to be an alternative to granular soil filters. The original, and still sometimes used, term for geotextiles is filter fabrics. Work originally began in the 1950s with R.J. Barrett using geotextiles behind precast concrete seawalls, under precast concrete erosion control blocks, beneath large stone riprap, and in other erosion control situations. He used different styles of woven monofilament fabrics, all characterized by a relatively high percentage open area (varying from 6 to 30%). He discussed the need for both adequate permeability and soil retention, along with adequate fabric strength and proper elongation and set the tone for geotextile use in filtration situations.

2. CLASSIFICATION OF GEOTEXTILE

1. Woven Geotextiles

this category of geotextiles is manufactured by weaving. Individual threads, be it monofilaments, fibrillated yarns, slit films or other material, are woven together on a loom one large, uniform piece. This process gives woven geotextiles a high load capacity, which makes them good for applications like road construction. Weaving threads or films together means these geotextiles aren't very porous, which makes them a poor fit for projects where drainage is important. That same characteristic does make them ideal for some erosion control projects where water must be passed over a surface without draining through to the soil below. Woven geotextiles will also resist corrosion and hold up for long-term applications.

The opening size of the fabric is critical when the geotextile serves as a filter for piping or if seepage gradients are significant. It provides a means of evaluating the retention characteristics of a geotextile and adequate to clogging. To use a woven geotextile, the soil gradation must be known and

ask the manufacturer for the guidelines concerned to fabric and proper selection.

Fig -1 Woven Geotextiles

2. Non-woven Geotextiles

The size opening is not a critical property with the woven geotextiles as these geotextiles have a wide range of size openings. In general, non- woven geotextiles retain more soil fines than woven geotextiles. Nonwoven geotextiles have rougher surface than that of woven geotextiles therefore the bond between the soil and the geotextiles offers more resistance to sliding along the plane of contact.

Fig - 2: Non-woven Geotextiles

3. Knitted Geotextiles

Knitted geotextiles are manufactured using the process which is adopted from the textiles clothing industries which is also known as knitting. Interlocking various series of the loops of yarn together is done in this process. All knitted geotextiles are made using the knitted method in addition with some other method of geosynthetics manufacture like weaving. Geotextiles are permeable textile materials, which are designed for use in civil engineering applications such as erosion control, soil reinforcement, separation, filtration and drainage, etc.

Geotextiles are forecast to be the fastest growing sector within the market for technical textiles. At least 70 per cent of all geotextile fabrics fall into the category of nonwoven geotextiles and at least 25 per cent are woven both warp knitted and weft knitted structures are used in the manufacture of geotextiles.

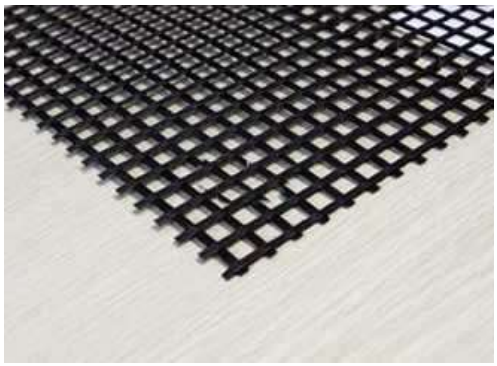

Fig - 3 Knitted Geotextiles

3. GEOMETRICAL PARAMETERS & FUNCTION OF GEOTEXTILE

3.1 Geometrical Parameters:

1) Porosity: The amount of open space per unit volume of twists. As fibre diameter and yarn diameter increases, the structure tends to be porous. Porosity of the twists is inversely proportional to the comprehensiveness or surface covering factor twists. Porous fabrics tend to be lighter and more permeable.

2) Surface Texture: Surface geometry is characterized by smooth fabric surface, which in turn is regulated by fibre and yarn diameter. Modularity fibre or yarn length geometric repeating unit twists.

3) Puffiness: A reflection on the extensiveness of the knitting for a particular surface density (mass per unit area). Knitting tends to be more voluminous if the diameter of the fibre/yarn greater freedom and mobility of fibres in the geometric repeating unit is great. Puffiness is directly associated with the density of fibres in this voluminous material tends to be thicker.

4) Thickness twists: Just as large in volume, thickness twists concerning the diameter of the fibres and yarns. The larger the diameter of the fibre and yarn, thicker and bulky knitting.

3.2 Functions of Geotextiles:

The mode of operation of a geotextile in any application is defined by six discrete functions:

i. •Separation.
ii. •Filtration.
iii. •Drainage.
iv. •Reinforcement.
v. •Sealing.
vi. •Protection.

This application is just what the name suggests. The geotextile is laid between two distinct layers of different materials. This could be two different types of soil, old and new pavement, or soil and new construction. There are an endless amount of possibilities.

i) Stabilization

In a typical stabilization application, the geotextile is laid on a material that's compressible. Most often, that's a wet, soft soil. The geotextile is then able to allow water from the soft soil to pass into a more freely draining material. This consolidates the bottom layer, which strengthens it and makes it a more reliable base.

ii) Reinforcement

In this application, the geotextile is a source of strength rather than strengthening the bottom soil as in stabilization. That also means that rather than being placed on top of a layer that needs to be strengthened, reinforcement applications are accomplished by placing the layer within the weak layer. In this way, reinforcement through geotextiles is similar to reinforcement techniques for other materials, like concrete.

iii) Filtration

This application is also similar to stabilization in that the primary function is to allow water to be passed out of the covered layer. The goal of filtration is to remove water without allowing soil or other fine materials to pass through. This is accomplished in conjunction with a filter behind the geotextile.

4. METHODOLOGY & PROPERTIES OF GEOTEXTILES

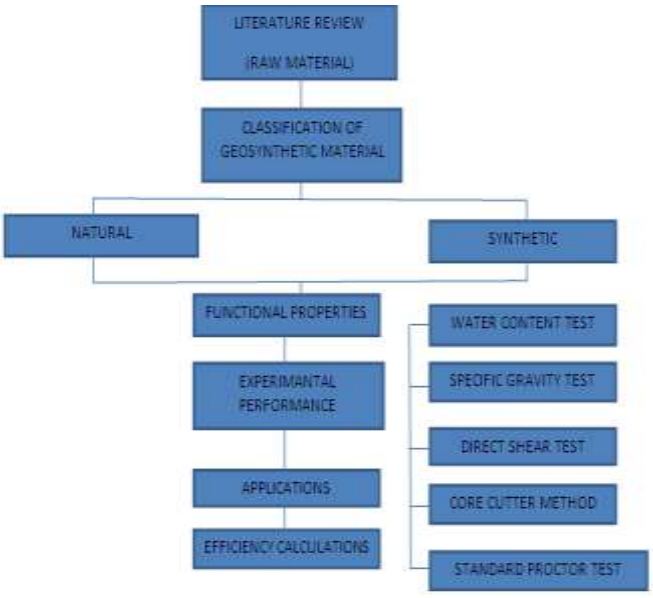

Fig - 4 Methodology

The properties of polymer material are affected by its average molecular weight and its statistical distribution.

- Tensile strength.
- Elongation.
- Impact strength.
- Stress crack resistance.
- Heat resistance.

5. APPLICATION OF GEOTEXTILES

(1)Road works: The geotextile is used to provide tensile strength to the earth mass in location where the shear stress would be generated.

(2)Railway works: In this he woven and nonwoven geotextiles are used to separate the soil from the sub-soil without implementing the ground water circulation where ground is unstable.

(3)River canals and coastal works: Geotextiles protect the river banks from erosion due to current or lapping.

(4)Drainage: Geotextiles perform the filter mechanism for drainages in the earth dams, in roads and highways, reservoirs.

(5)Agriculture: It is used for mud control.

6. EXPERIMENTAL PERFORMANCE TEST

The following tests are to be conducted :

6.1. Water Content Test
6.2. Specific Gravity Test
6.3. Direct Shear Test
6.4. Core Cutter Method
6.5 Standard Proctor Test
6.6 CBR Test

Table -1: Observation

Sr. No.	TESTS	WITHOUT GEOTEXTILE	WITH GEOTEXTILE
1.	Water Content	26.2%	28.07%
2.	Specific Gravity	2.85	3.01
3.	Direct Shear	C=0.489kg/cm2 α= 32	C=0.512kg/cm2 α=35
4.	Core Cutter Method	ρs= 1.68gm/cm3 ρd= 1.14gm/cm3	ρs=1.80gm/cm3 ρd=1.84gm/cm3
5.	Standard Proctor Test	MDD=1.54 OMC=13.16	MDD=1.63 OMC=14.53
6.	California Bearing Ratio	3.6 %	14.3 %

Fig -5: Working Model (Application of Geotextiles)

Sample paragraph Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper.

6. CONCLUSIONS

Geotextiles effectiveness depends upon the strength of the fabric and proper installation. Geotextiles are a cost effective way to insure better drainage and stabilization of the sub grades. Hence it can be concluded that the geotextiles are beneficiary in road construction of proper installation, handling and maintenance is done.

Permeability should also always be considered in separation uses to allow moisture to move freely through the system. This avoids excessive hydrostatic pressures which cause soil failure.

Most geotextile system failures result from improper installation, improper selection of fabrics, a change of conditions from the original design, or a combination of these factors. - In the present realm of growing global emphasis on adoption of bio-technical measures, Jute Geotextile deserves encouragement due to its several striking attributes. Of all the ingredients of natural geosynthetics, jute happens to be the best spendable fibre that ensures making of customizes fabric to meet sites specific format.

FUTURE OF GEOTEXTILES

In developing countries, the use of geosynthetics is relatively new but gaining widespread popularity in construction. They are becoming popular due to their ability to perform certain functions which are necessary while offering practical advantages

1. They are easily available in the market.

2. Rapid installation.

3. Lightweight in comparison with other construction materials.

4. The durability and life is more if properly selected.

5. General environment safe and they do note degrade.

ADVANTAGES

Woven geotextile fabric is constructed by blending and weaving fibers. The result is a product that is not only strong, but also remarkably well equipped to handle drainage and erosion control problems.

- ✓ High in Strength
- ✓ UV Resistant
- ✓ Rot Resistant
- ✓ Resists Biological Degradation
- ✓ Chemically Inert
- ✓ Increases the Life of your Roads
- ✓ Strengthens and Supports Aggregates

REFERENCES

[1] A.BHOSALE, Swapnil K Sutar, Rahul M Hattalage, Nadeem D Maner, Amit B Jadhhav, Manjunath S Dhage. "Application of Geotextile used in Road pavement construction", International Journal of Engineering Technology, Management & Applied Sciences, vol. 5, issue 4, pp.149-154.

[2] Haresh Bakale, Mr. G. C. Sarode "Experimental Performance On Optimum Utilization of Polyethylene Terephthalate (PET) Resin In Flexible Pavement-A Review", International Journal of Innovative Studies in Sciences and Engineering Technology, vol.4, issue 4, pp.19-23

[3] D. A. Ogundare ,A. O. Familusi, A. B. Osunkunle & J. O. Olusami. "Utilization of Geotextile for soil Stabilization." American Journal of Engineering Research, vol. 7, issue 8, pp.224-231.

[4] Dheemu Lavanya Kumari, Ummenthala Veda Vyas, Veerabathini Srujith kumar. "Experimental investigation of functions of Geotextiles in road construction", Technical Research Organization India, vol. 5, issue 5, pp.51-57.

[5] Qurishee, Murad. "Application of Geosynthetics in Pavement Design."(2017).Chaudhary, S.K. "Timely Preventive Maintenance of Roads: A Cost Effective Solution."

[6] ZORNbERG, JORGE G. "Advances in the use of Geosynthetics design." Geosynthetics India 11 (2011): 23-24.

[7] Annu, Maiyank Verma, "USE OF GEOTEXTILE PAVEMENT IN ROAD CONSTRUCTION IN INDIA", International Organization of Scientific Research, vol. 8, issue 9, pp. 01-05.

[8] Jay Narendrabhai Panchal. "Comparision of advanced (Geosynthetics) road pavement and conventional (Asphalt/Bitumen) Road pavement." International Journal of Advanced Engineering & Research Development, Vol. 4, issue 8, pp.333-335.

[9] IS: 2720 (Part 6)-1987,CBR Test Manual, Page No.-1-6.

[10] IS:2720 (Part 8)-1983, Determination of Water Treatment – Dry Density Relation.