



STUDY OF GEOTEXTILE IN PAVEMENT DESIGN

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A geotextile may be a category of industrial-grade textile that's composed of plastic and/or polyester rosin (products of the oil refinement process) that have yarns. Yarns have property of chemical and thermal bonding to create a flat semipermeable sheet. Alternative styles of textiles are accessible. Chiefly geotextiles have four functions in pavement-separation, drainage, filtration and reinforcement. Pavements generally encompass a hydrocarbon or concrete surface, aggregate base layer, or support layer and so the natural soil subgrade. Geotextiles forestall the blending of the fine subgrade soils with the mixture support layer. By preventing this compounding, geotextiles forestall early deterioration of roadways. There square measure 2 basic classes of geotextiles – woven and non-woven. Woven geotextiles will typically categorise as slit film or filament. Woven geotextiles square measure made up of either monofilaments or multifilaments of slit films. Non-woven geotextiles square measure factory made from either staple fibers or continuous filaments. Geotextiles will serve many basic functions once utilized in soil (or) soil/geosynthetic systems. Geotextiles square measure normally won't to separate, filter, conducts planate flow and reinforces soil lots.

KEYWORDS: geotextiles; separators, drainage, filtration, reinforcement, woven and non-woven materials.

1. INTRODUCTION

Geotextile is permeable geosynthetic comprised solely of textiles. Geotextiles are used with foundations, soil, rock, earth or any other related material as an integral part of human made project, structure or system. The use of natural fabric in the construction industry probably occurred decades ago when some innovative individual with the idea of strengthening the material, decided to embed it within soil. The concept of embedding straw and branches in clay could be considered to fall within this category.

Geotextiles are defined as a permeable geosynthetic material or we can say these are the permeable fabric which has ability to separate, filter, reinforce and protect, when used with soil. These are generally made up of polypropylene or polyester, but other ingredients are also there they are-polyamide (nylon), polyvinylidene chloride, and fiberglass. There are many forms available of geotextiles in its producing companies. Among the different geosynthetics geotextile is present in a wide range with respect to its properties, that's the reason it is used in various forms. It has been using from last 30 years successfully but now the numbers and types of geotextiles manufactured with aspecific focus in roadway design. Water has lot of effect on pavement surface. In fact, moisture damage in asphalt pavements is global concern. In situation when rainwater is not properly drained off the pavement surface, it will penetrate into the pavement thereby deteriorating the

pavement layers. Geotextiles when used for drainage purpose.

2. CHARACTERISTICS OF GEOTEXTILE

The characteristics of geotextiles are broadly classified as:

2.1. Physical properties:

- a) Specific gravity
- b) Weight
- c) Thickness
- d) Stiffness
- e) Density

2.2. Mechanical properties:

- a) Tenacity
- b) Tensile strength
- c) Bursting strength
- d) Drapability
- e) Compatibility
- f) Flexibility
- g) Tearing strength
- h) Frictional resistance

2.3. Hydraulic properties:

- a) Porosity
- b) Permeability
- c) Permittivity
- d) Transitivity
- e) Turbidity /Soil retention
- f) Filtration length etc.

2.4. Degradation properties:

- a) Biodegradation

- b) Hydrolytic degradation
- c) Photo degradation
- d) Chemical degradation
- e) Mechanical degradation
- f) Other degradation occurring due to attack of rodent, termite, etc.

2.5. Endurance properties:

- a) Elongation
- b) Abrasion resistance
- c) Clogging length and flow etc.

3. TYPES OF GEOTEXTILE:

Types of Geotextile are Woven fabrics, Non woven, Knitted fabric.

3.1. Woven Fabrics-

As per The Great Soviet Encyclopaedia(1979), article produced by weaving should be interlocked by perpendicular threads-warp in longitudinal and weft in transverse direction. In certain cases to form a nap or patterns some other additional systems of threads can also be adopted. Woven fabrics are the most common textiles; they may be produced as cloth or finished goods, such as kerchiefs or table cloths. Woven fabrics are thin (usually less than 5mm), wide (generally up to 1.5m and sometimes up to 12m) and of varying length. Example of woven fabric-linen, denim, cotton twill, satin, chiffon, corduroy, tweed and canvas.

3.2. Non-Woven-

When it's asked to some average person, it looks to be terribly new term, as a result of it's not like ancient plain-woven cloth. It is one thing trendy and advanced term is somewhat clearer to the consultants. Nonwoven materials don't seem to be supported yarn, these area unit supported webs of individual fibers. Or we will outline it as sheet or net structures (long fibers) warranted along by entangling fibre or filaments (and by perforating films) automatically, thermally, or with chemicals. They're flat, porous sheets that area unit created directly from separate fibers or from melted plastic or plastic.

Some nonwoven materials lack decent strength unless densified or strengthened by a backing. In recent years, nonwovens became another to polymer. Non plain-woven geo-synthetics is factory made from either short staple fibre or continuous filament yarn. Uses of nonwoven fabrics isolation robes, surgical robes, surgical drapes and covers, surgical scrub suits, caps, sterilization, gloves, shoe covers.

3.3. Knitted Fabrics-

Knitted geo-synthetics area unit factory-made victimization another process which is adopted from the consumer goods textiles trade, particularly that of knitting. During this method interlocking a series of loops of yarn along is formed. All of the unwoven geo-synthetics area unit shaped by victimization the knitting technique in conjunction with another technique of geo-

synthetics manufacture, like weaving. Fashion designers like this sort of materials for its comfort, texture, wrinkle resistance, and elasticity. To boot, knit cloth is straight forward to stitch with the proper machine and sewing technique. It's characteristics that please it to crafters and wearers alike. These cloths have completely different properties than plain-woven kind. These area unit versatile than plain-woven kind and may be created into additional little items than that kind, creating it ideal for socks and hats. Its properties area unit completely different from nonwoven cloth with relevancy its sturdiness, that it's additional sturdy however takes additional resources to form, creating it appropriate for multiple uses.

4. APPLICATIONS OF GEO-TEXTILES IN PAVEMENTS-

Every textile product utilized in soil is geotextile, it's utilized in reinforcement of streets, embankments, ponds, pipelines, and similar applications. Counting on the desired perform, they're utilized in open-mesh versions, like a plain-woven or rarely, warp knitted structure, or with a closed cloth surface, like a non-woven. Mode of geotextile in pavement is outlined by these functions-

Separation, Filtration, Reinforcement, Drainage, Erosion Control, Moisture barrier, Sediment control.

4.1 Separation:

Geotextile layer as a separation layer tends to forestall the blending of 2 dissimilar materials so they will perform effectively, and Lifetime of structure may be improved or higher use of material provided. For instance, a serious explanation for failure of roadways created over soft foundations is contamination of the combination base course with the underlying soft subgrade soil. Thus a geo-textile is provided between combination layer and subgrade that acts as centrifuge, minimizing the contamination of combination base by subgrade.

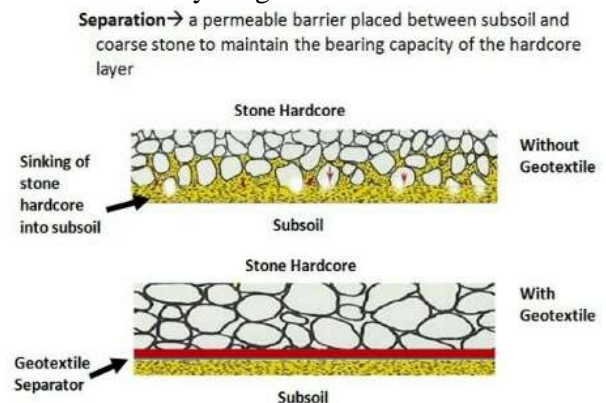


Fig-1: Separation

4.2 Filtration-

It is outlined because the equilibrium of a geotextile-soil system that enables for adequate liquid flow with restricted soil loss across the plane of the geo-textile

over a service period of time compatible with the applying into consideration. In filtration cloth may be plain-woven or non-woven for passes the water and holding the soil particles. Consistence and porousness are the main properties of geo-textile that are to contemplate in filtration. This method ought to deliver the goods associate degree equilibrium that allows for adequate liquid flow underneath conditions of thought.

Filtration → permit liquid to pass through its plane whilst blocking the path of soil particles

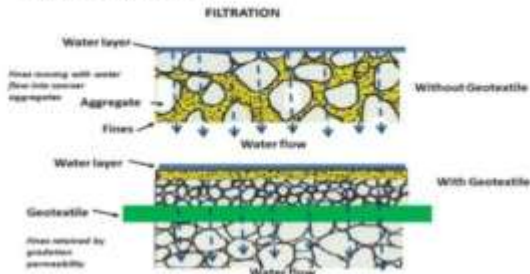


Fig-2.Filtration

4.3 Reinforcement-

It is a significance increase in strength of pavement, created by the introduction of geo textiles into pavement layer.

In U.S. this operate is consummated by mistreatment geo grids rather than geo textiles. In most cases Geotextiles interacts with soil to resist resistance and adhesive force. This can be condition for reinforcement that a geotextile should have a sufficient strength and embedment length to resist the developed tensile force, and strength should be developed at little strain to stop excessive moment of strengthened structure. Mechanism-

- Lateral restraint through friction between soil/aggregate and geo-textile. once transportation moves on a road it attempt to move laterally, unless it's restrained by geosynthetic reinforcement or subgrade. Thereforeft and week soil permits a lot of movement so rutting develops which become atangle by the movement of combination, which may be stop by geotextile having an honest resistant capability the potential bearing surface failure plane to develop at a higher shear strength surface.

- Membrane style of support of the wheel hundreds.

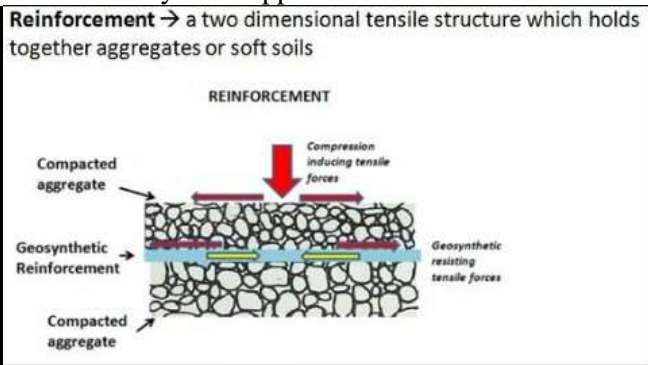


Fig-3.Reinforcement

4.4 Drainage-

In civil engineering, the need for drainage has long been recognized and has created the need for filter to prevent in-situ soil from being wash into the drainage system. Such wash in soil causes clogging of the drains and potential surface instability of adjacent to the drains. The use of geotextiles to filter the soil and a more or less single size granular material to transport water in increasingly seen as a technical and commercially viable alternative to the conventional system. Geotextiles perform the filter mechanism for drainage in earth dam, in road and highways, in reservoirs, behind retaining walls, deep drainage trenches and agriculture.

Drainage (Fluid transmission) → transportation of liquid or gas within its own plane to an outlet:- transmissivity

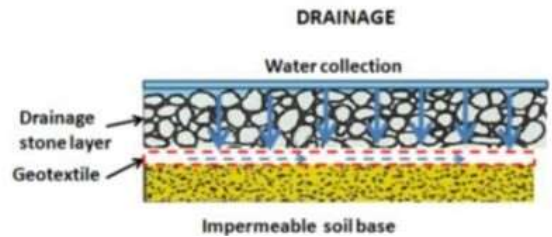


Fig-4.Drainage

4.5 Erosion Control-

In erosion control the geotextile protects soil surfaces from the tractive forces of moving water or wind and rainfall erosion. Geotextiles can be used in ditch linings to protect erodible fine sands or cohesionless silts. The geotextile is placed in the ditch and is secured in place by stakes or is covered with rock or gravel to secure the geotextile, shield it from ultraviolet light, and dissipate the energy of the flowing water. Geotextiles are also used for temporary protection against erosion on newly seeded slopes. After the slope has been seeded, the geotextile is anchored to the slope holding the soil and seed in-place until the seeds germinate and vegetative cover is established. The erosion control function can be thought of as a special case of the combination of the filtration and separation function.

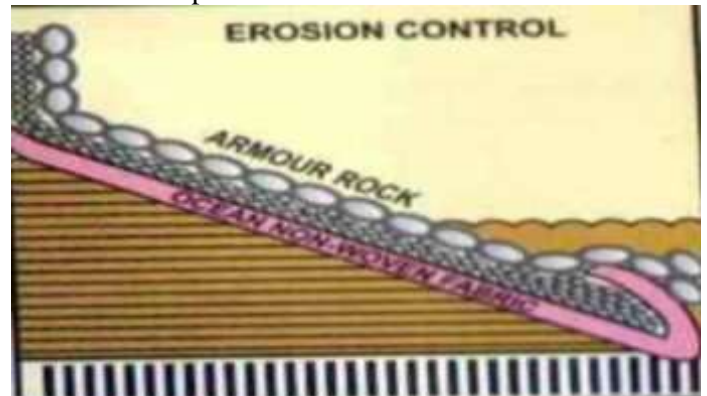


Fig-5.Erosion control

4.6 Moisture Barrier-

Both woven and nonwoven geotextiles cancel as moisture barriers when impregnated with bituminous, rubble-bitumen, polymeric mixture. Search impregnation reduces both the cross-plane and in-plane flow capacity of the geotextile to a minimum. This function place important role in the use of geotextiles in paving overlay systems. In such a system, the impregnated material seals the existing pavement and reduces the amount of surface water entering the base and subgrade. This prevents reduction in strength of these component and improve the performance of the pavement system.

4.7 Sediment Control-

A geotextile serves to control sediment when it stops particles suspended in surface fluid flow while allowing the fluid pass through. After some period of time, particles accumulate again the geotextile, reducing the flow of fluid at increasing the pressure against the geotextile. Example of these application are silt fences place to reduce the amount of sediment carried of construction sites and into nearby water courses. The sediment control function is actually a filtration function.

5. ADVANTAGES OF GEOTEXTILE:

The geotextile market wants bulk quantities cloth. Warp unwoven thread insertion geotextiles offer the advantage once compare to plain-woven geotextiles:

1. Strength for strength, they are lighter than plain-woven geotextiles using constant yarn. This makes for easier handling and makes contact with site; thus transport and labour costs unit less in real terms.
2. Knitted geotextiles have exceptional tear strength. Additional strength are designed and intrinsic to the decide direction fixed a bi-axial high tensile, high strength warp/weft geotextile becomes a reality; e.g. 500kNm warp and 500kNm decide.
3. Knitted geotextile can incorporate an additional material to make in true composite geotextile, the fabric being simply knitted-in.
4. The individual yarns inside the warp felted weft-insertion geotextile unit straight once incorporated, in order that they unit able to take-up the strain quickly on loading. Those in plain-woven geotextiles unit meshed.

6. DISADVANTAGES OF GEOTEXTILE:

1. Properly statesman matting provides marvellous erosion management but do so at relatively high worth.
2. Geotextiles and mats might delay seed germination, as results of reduction in soil temperature.
3. Plastic textile is well vandalized, merely torn, and photodegradable and should be disposed of at lowland.
4. Plastic lands up in 100% escape, which might cause serious erosion problems among the areas receiving the accumulated flow.

5. Textile material compared to poor intensity and strength.

6. The fibrein associate degree passing certain direction, so merely from the right angle crack etc. so the recent improvement of the assembly methodology within the main

Concentrate on preventing the division into improvement. Its main uses are typically divided into: Protective wear, masks, pack medical care object, wipes, improvement object, etc.

CONCLUSION:

Geotextiles are very important part of pavement construction regarding its strength, durability, and working performance. Very useful in case of silt and clay. The purpose of this study to create awareness about new concept of geotextile in pavement design. Geotextiles perform the filter mechanism for drainages in roads and highway.

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