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Research Paper :

Use of geotexitles for different purposes

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ABSTRACT

Though Geotextile is not a new name or concept in engineering field but still it requires more acceptability in different fields of construction civil and agricultural engineering. Having more than one engineering function, geotextile is of a great importance. It is used as separator, rein forcing material, filters, proper drainage device, moisture barrier etc. It is not less than boon for Civil Engineering and Agricultural Engineering. It is extensively used in construction of pavements, dams, retaining wall, soil stabilization etc. Results show that as a separator it maintains identity and strength of dissimilar materials. Having characteristics of good tensile strength it is proved that by using geotextiles strength of soil can be increased, shown by triaxial test. Geotextiles fulfills the purpose of filtration and retention because of its wooven pattern. Results show that it also serves the purpose of drainage and moisture barriers.

Key words : Geotextile, Polyster, Nylon, Polypropylenes, Polyethylene, PVC, Separation, Reinforcement, Filtration, Drainage, Moisture barrier

During some last year the name of Geotexiles has become very popular in different sectors of engineering. Basically geotextiles is like a textile with little difference. It is of synthetic fibers such as polyster, nylon, polypropylene, polyethylene, PVC and composite of these, hence biodegradation doesn't take place in it. These fibres are woven, matted or knitted in such a manner that the product fabric becomes porous. The beauty of geotextiles is that they are porous to water flow across their manufactured plane and also within plane, but with a wide variation. The geotextiles always performs at least one or more than one among its functions like separation, Reinforcement, filtration and drainage.

METHODOLOGY

- Separation
- Reinforcement
- Filtration
- Drainage
- Moisture barrier (When Impregnated)

All the following mechanism were observed and verified at Departemnt of Civil Engineering, College of Agricultural Engineering and Technology, Etawah (U.P.)

Separation:

The geotextile (a flexible synthetic layer) is introduced between two dissimilar materials such that the identity or integrity and functioning of both materials can remain intact or be improved.

Two systems or mechanisms can be seen when stones are placed on soil. First the particles of soil attempt to enter the voids of stones, hence drainage capability gets disturbed. The second is that the stones attempt to punch into the soil, hence strength of stones get ruin. By placing geotextile the above situations may be avoided. It may be understood in the following manner (Fig. 1)

– Soil Fines pumping into stone voids and its prevention using geotextiles;

– Mechanism of stone intrusion into soil sub grade and its prevention using geotextiles.

Reinforcement:

Geotextile has a very good property of tensile strength. Geotextile is a boon for soil which is weak in tension and rich in compression. Geotextiles serve not only as separators but also increase the bearing capacity of the soil to take heavier loads.

Improvement in strength can be evaluated in a number of ways, but the triaxial tests illustrate the beneficial effects of the geotexile when properly placed. Fig. 2 shows two sets of triaxial tests on dense sand samples at confining pressures for different soils and geotextiles configuration.

Curves 1 shows onle sand curves 2 have goetexile on the top and bottom of the soil and do not show improved strength. Curves 3 shows improved strength when fabric is placed at middle also. Curves 4 show the mush improved strength because of geotextiles at right zones, as in figure.

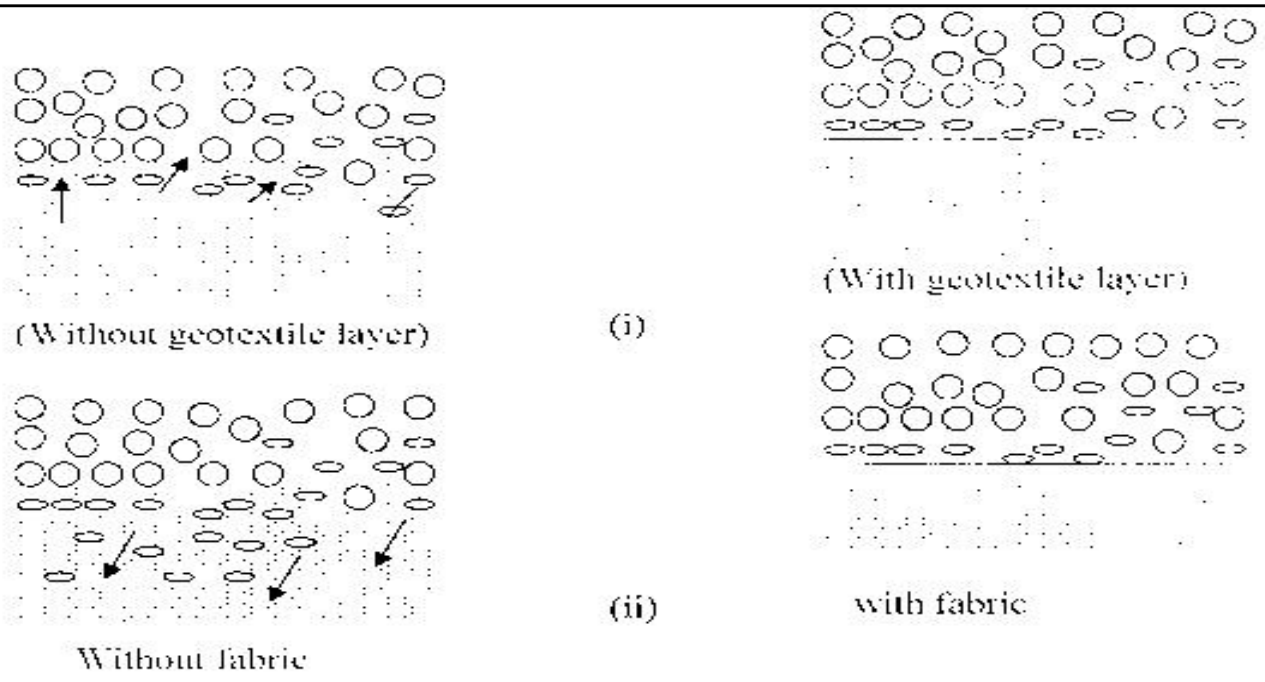

Fig. 1 : Different mechanism involved in the use of geotextiles involved in the function

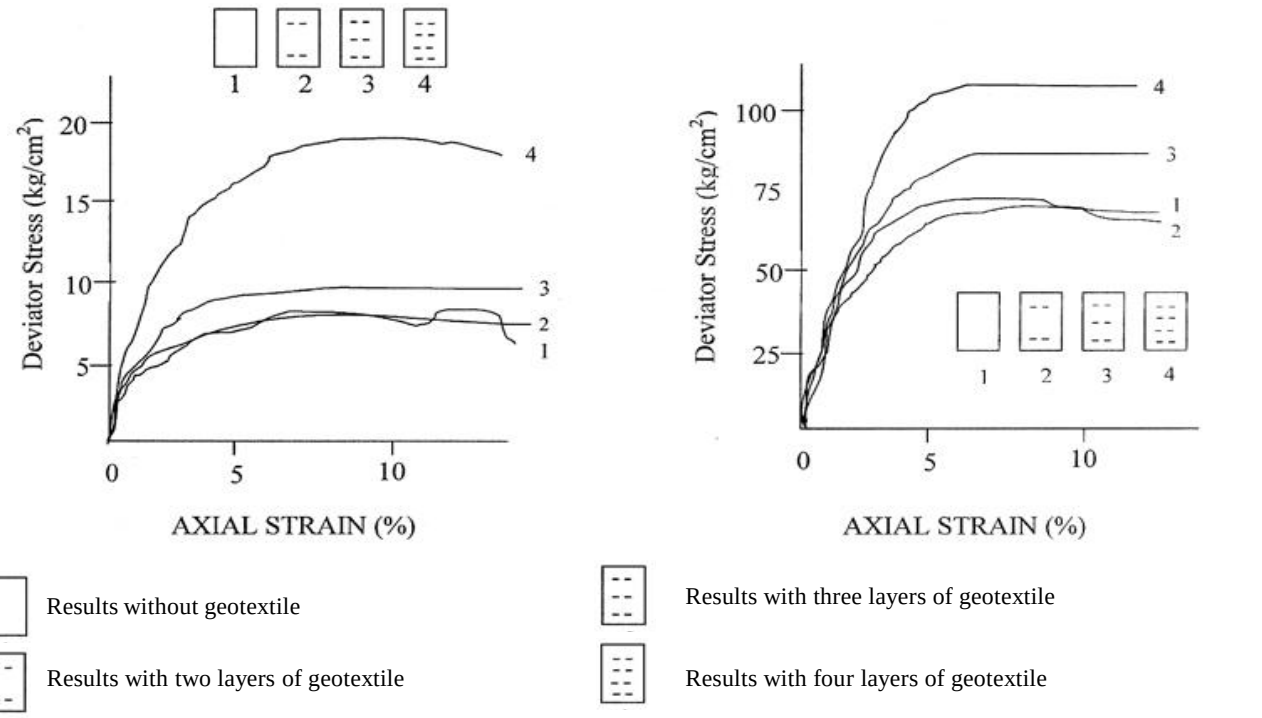

Fig. 2 : Triaxial test results showing influence of geotextiles placed at various locations within soil specimen

Filtration:

The function of filtration of geotextiles is the movement of water through the fabric itself (across the manufactured plane). Also at the same time, the fabric serves the task of retaining the soil on its upstream side. Both proper permeability and soil retention (open fabric and tight fabric structure) are required simultaneously. A most important facto which is also seen that being the long term soil to fabric compatibility that will not deteriorate (or entirely clog) during the life span of the system.

Permeability and soil retention:

Fabric permeability means to cross-plane permeability when water flow is perpendicular to the plane of the fabric. Many of the fabrics used for this purpose are relatively thick and compressible. For this reason the thickness is included in the permeability coefficient and is used as a 'Permittivity' which is

$$1 = \frac{kn}{t}$$

1 - permittivity
kn - cross-place permeability coeff
t - thick

If a big flow of water is to take place through the geotextile, the void spaces in geotextile must be made larger. These are, however, a limit that being when the upstream soil particles start to pass through the fabric voids along with the following water. This leads to an unacceptable situation called "Soil Piping", where finer soil particles are carried through the fabric, leaving larger soil voids behind. The water velocity then increases, accelerating the process, until the soil structure beings to collapse. This collapse. This collapse often leads to minute sinkhole type patterns which grow larger with time.

This entire process is prevented by making the geotextile voids small enough to retain the soil on the upstream side of the fabric. It is the finer soil fraction which must be initially retained and they are the targeted soil size in the design process. Fortunately, filtration concepts are well established in the design of soil filters and those same ideas will be used to design an adequate fabric filter.

Drainage :

Fabric (geotextiles) is introduced in that situation where water is transmitted in the place of their structure provided a drainage function. it may be defined a, "the condition of equilibrium between fabric and soil which permits for free water flow without soul loss in the plane of the fabric over an indefinitely long times period.

All fabrics can provide such a function but to widely varying degrees. A thin woven fabric, by virtue of the fibers crossing over and under one another, transmits water within the spaces created at these crossover points but to a very modest degree. On the contrary. the thick, needled non woven fabrics have considerable void space in their structure available for water transmission. Geocomposites can transmit musch more water than can thick, bulky geotextiles

The permeability, soil retention and long-term compatibility are well assured with geotextiles.

Moisture barrier:

A moisture barrier can be created by rendering the fabric relatively impermeable to both cross-plane and in-plane flow. One is in essence creating a geomembrance, albeit one with a fabric structure rather than a sheet of plastic or rubber. The impermeability referred to here in generally obtained by spraying bituminous, rubber-bitumen, or polymeric mixes into a properly deployed geotextile-thus the creation of an in-situ moisture barrier. While the permeability reffered to is obviously not zero,, it is very low compared to that of the original geotextile. Quite possibly its permeability is now in the range of 10^{-6} to 10^{-8} cm/ sec. This is comparable to the permeability coeff. of many fine grained soils in the clay family.

Within this function of moisture barrier, it is reffered to the impedance of the flow of water but also to the movement of vapour across the barrier.

RESULTS AND DISCUSSION

In the case of separation it is found that by introducing the layer of geotextile (as a separator) two dissimilar material did not inter mix. Retaining their identity they retained their strength. Along with these, the main thing which was that drainage capacity did remain proper and good after dyanamic loading.

In the form of reinforcement, geotextiles as a reinforcement material the tensile strength of soil increased remearkably. It is shown by triaxial test under the heading of reinforcement. The deviator stress increased from 5 kg/cm^2 to 10, 15 and 17 kg/cm^2. As a filter medium the geotextile serves in very nice manner. It does not filter or drain the water only but also retain the required material. In the case of construction of pavement really it is a gift to civil engineers because of having different functions like drainage, retention, separation etc.

Similarly geotextiles tested for drainage purpose and as a moisture barrier: Geotextiles affects the permeability as required as explained under the headings of moisture barrier.

Conclusion:

Geotextile is a boon for Irrigation Engineering, Civil Engineering and ultimately for society and the nation by using geotextiles many engineering problems can be solved at a time through placing the geotextiles in proper manner. Geotextic alone perform the various engineering functions like separation, reinforcement, filtration drainage, moisture barrier etc.

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