Application of Geotextile in Ground Improvement Technique: An Over View.

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Abstract. This Paper is a part of On-going study over the application of geotextile in Ground Improvement Techniques. A review was conducted on various application of geotextile for ground impartment techniques. The major finding from literature on application of geotextile in costal projection and costal engineering works, Geotextile and its application to civil engineering, Geotextile-Reinforced embankment on soft ground, Soil-nonwoven geotextile filtration behaviour under contact with drainage materials, Application of Geotextiles in Pavement Drainage Systems, Opening size recommendations for separation geotextiles used in pavements.

Abstract.Keywords: Ground Improvement Techniques, Geotextile, Coastal projection.

1 Introduction

Geotextiles are permeable fabrics which, when used in association with soil, have the ability to separate, filter, reinforce. protect, or drain.Geotextiles have been used very successfully in road construction for over 30 years. Their primary function is to separate the sub base from the subgrade resulting in a stronger road construction.Geotextiles have proven to be among the most versatile and cost-effective ground modification materials. Their use has expanded rapidly into nearly all areas of civil, geotechnical, environmental, coastal, and hydraulic engineering. They form the major component of the field of geosynthetics, the others being geogrids, geomembranes and geo composites[1].

1.1 Types Of Geotextile

1. Woven Fabrics:
. Large numbers of geosynthetics are of woven type, which can be sub-divided into several categories based upon their method of manufacture.These were the first to be developed from the synthetic fibres.This type has the characteristic appearance of two

sets of parallel threads or yarns .the yarn running along the length is called warp and the one perpendicular is called weft[1].

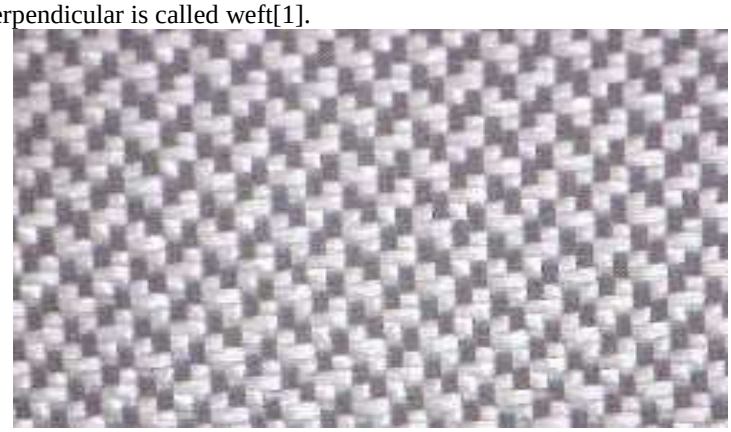

Fig.1

Installation of Woven Geotextiles Geotextile Installation can be an easy process when you have the proper tools and installation procedure. Below you will find a general guide to installation any of our geotextile fabrics. Please feel free to contact us with any additional questions or site-specific requirements for your location. Geotextile Installation Procedure:

Step 1: Prepare the install area. This will typically involve a process of removing trees and brush from the top layer of soil and vegetation from the subgrade materials. Weak pockets of soil should be replaced with granular fill.

Step 2: Smooth and level the subgrade. All depression or humps within the subgrade should be removed.

Step 3: Place the geotextile in the prepared installation area. Fabric should be laid out stight and as flat as possible.

Step 4: Overlap adjacent rolls as specified for your site. If no instructions exist, fabric should be overlapped at a minimum or 100mm Securing Geotextiles and Fill Placement

Step 5: Secure the fabric with staples, pins, soil or other suitable materials. Fabric should be secured along the edges and then at overlapping portions.

Step 6: Loosely place fill directly on the geotextile in 100mm lifts. For very weak subgrades, 300mm or thicker may be required.

2. Non-woven:

. Non-woven geo-synthetics can be manufactured from either short staple fibre or continuous filament yarn. The fibres can be bonded together by adopting thermal, chemical or mechanical techniques or a combination of techniques. Thermally bonded non-woven contain wide range of opening sizes and a typical thickness of about 0.5-1 mm. chemically bonded non-woven are comparatively thick usually in the order of 3 mm. the other hand mechanically bonded non-woven have a typical thickness in the range of 2-5 mm[1].

Fig.2

Nonwoven geotextiles should be installed only after the underlying material or subgrade has been properly inspected and approved. The nonwoven geotextiles should be installed to the grade and location specified in project specifications. The project construction quality assurance and construction quality control (CQA/CQC) guidelines must be followed during the installation. An additional important resource for construction guidelines for all geosynthetics is "Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities" by United States Environmental Protection Agency (Ref. EPA/600/R-93/182). GSE recommends minimum geotextile overlap distance from 12 inch to 24 inch, in both machine and transverse directions, unless the project CQA/CQC guidelines specify otherwise. Care should be taken not to entrap stones or excessive moisture in the nonwoven geotextile during placement. In the presence of wind, all geotextiles should be weighed with temporary ballasting such as sandbags. On slopes, the nonwoven geotextile should be securely anchored and then rolled down the slope in such a manner as indicated by good construction practices and safety considerations. Prior to the placement of overlying materials, a Certificate of Acceptance (Appendix B) must be signed by a responsible party and an installer's representative. All overlying materials on the nonwoven geotextile should be placed such that: • The nonwoven geotextile and the underlying material are not damaged. • Any movement of the nonwoven geotextile is kept to a minimum. • Excess stresses in the nonwoven geotextile are kept to a minimum.

3. Knitted Fabrics.

. Knitted geosynthetics are manufactured using another process which is adopted from the clothing textiles industry, namely that of knitting. In this process interlocking a series of loops of yarn together is made. An example of a knitted fabric is illustrated in figure. Only a very few knitted types are produced. All of the knitted geosynthetics are formed by using the knitting technique in conjunction with some other method of geosynthetics manufacture, such as weaving. Apart from these three main types of geotextiles, other geosynthetics used are geonets, geogrids, geo-cells, geo membranes, geo composites, etc. each having its own distinct features and used for special applications[1].

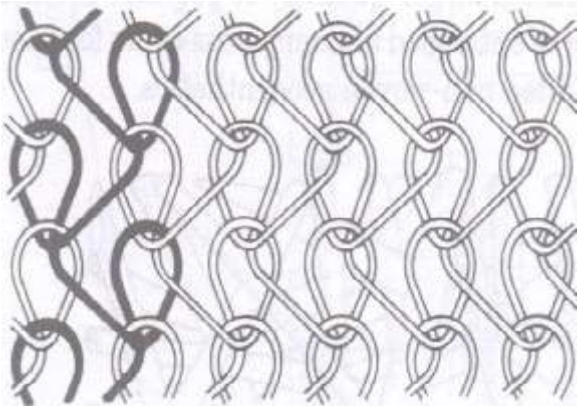

Fig. 3

2 Materials and Methods

2.1 Functions of Geotextiles

Every textile product applied under the soil is a geotextile. The product are used for reinforcement of street. Embankment ponds, pipelines, and similar application. Dpending on the required function.

2.1a. Filtration:

The equilibrium geotextile to soil system that allows for adequate liquid flow with limited soil loss across the plane of geotextile over a service lifetime(figure:4)[1].

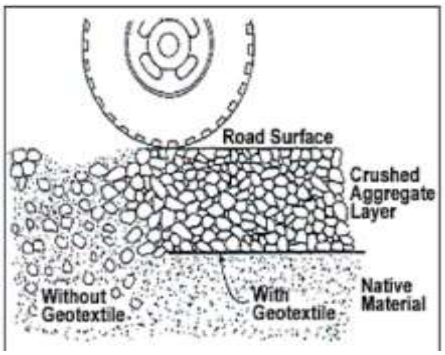

Fig. 4

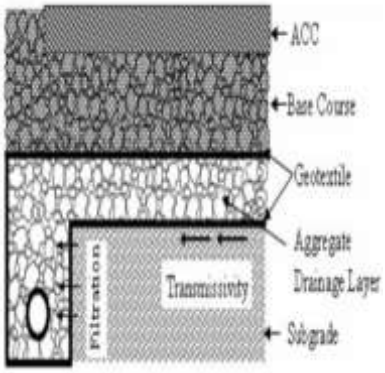

Fig.5

2.1b. Drainage

Ability of thickness non-woven geotextile whose 3-demsional structure provides an avenue for flow of water through the plane of the geotextile.

2.1c.Separation

. The introduction of a flexible porous textile placed between dissimilar materials so that integrity and functioning of both the materials can remain intact or be improved (Fig.5).

2.1d. Reinforcement.

Geotextile acts as a reinforcement element in soil mass or in combination with the soil to produce a composite that has improved strength and deformation properties(Fig.6).

2.1e. Sealing

The classic application of a geotextile as a liquid barrier is paved road rehabilitation. It minimizes vertical flow of water into the pavement structure (Fig.7)[1].

Fig.6

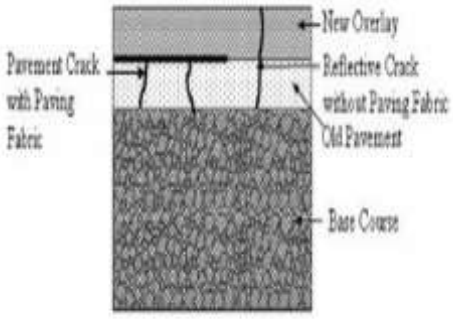

Fig.7

3 Applications

1. The use of geotextile tubes forthe purpose of coastal defence started in the last decade. the use of sand-filled geotextile tubes for the coastal protection works is in the developing phase. The compilation and analysis of the data regarding success/failure of projects may improve the techniques of using geotextile tubes.

Fig. 8 Installation of geotextile tubes

Fig.9 Reclamation of bundh using geotextile container

2. In reclamation bundh using geotextile container in this Tubes were aligned parallel to the coast, the beach is also enhanced by providing beach nourishment. A series of off-shore reefs with sand-filled geotextile tubes was constructed to hold the nourished sand.
3. Road work: The fabrics are used to provide tensile strength in the earth mass in locations where shear stress would be generated. Moreover, to allow rapid dewatering of the roadbed, the geotextiles need to preserve its permeability without losing its separating functions.
4. Railway Works: The woven fabrics or non-woven are used to separate the soil from the sub-soil without impeding the ground water circulation where ground is unstable.
5. Drainage: Filter around trench drain and edge drain to prevent soil from migrating into aggregates. Filters beneath pavement permeable bases, blanket drain and base courses. Drains for structure such as retaining wall and bridge abutment. Geo-

textile wraps for slotted or joined drain and well pipes. Chimney and toe drains for earth dams and levees to provide seepage control.

6. Geotube: The rock armor protection for the dyke as well as for the bed protection in the inlet-outlet channel. Geotube systems were used as reclamation dyke to raise the earthworks platform above high water levels.
7. By using a suitable layer of geotextile at the interface of the granular fill and the subgrade. This not only keeps the thickness of the granular fill intact but the tensile strength of geotextile allows reduction in thickness of the stone filling as well. Effective use of geotextiles has been made in a fabrication yard on soft dredged fill to make the area suitable for movement of heavy cranes for jacket fabrication [6].
8. In case of railway, to scatter the huge amount of load into the subgrade soil the rail lines are subjected on a gravel layer. High performance geotextiles can be used for separating the gravels and equal load distribution on subgrade. As per estimation 2,400 km of track belonging to Indian Railways is founded on weak soil and approximately 300 km of rail track require strengthening every year [7]. Nonwoven geotextiles have been recommended for reinforcement of tracks in Indian Railways.

4 Literature Review

1. Dr.Umesh Sharma(2014):In this study briefly explained about geotextiles are used in various including roads, airfields, embankments, retaining structure, reservoirs and construction site. There are several key applications, construction of pavements, in asphalt concrete overlays and for drainage systems, which helps in enhancing the performance and extending the service life of roads. They have concluded that when a geotextile form part of a drainage system, where the geo-textile is used to separate a soil and a coarse-grained drainage layer, the function is filtration.

2. Mitra Ashis(2015):In this paper, the constructional and functional aspects ofgeotextiles have been highlighted, and the potential role of various geotextile products in the domain of coastal protection,coastal engineering and off-shore engineering has been elaborated with some real-life ventures both in India and abroad.Geotextile used as Geotextile bags, tubes and containersmade with geotextiles are playing a proactive role in hydraulic, coastal, offshore engineering and river protection works. Geotextiles are eco-friendly and cheapest;theinstallationsof geotextiles/geosystems are application specific and requiresound understanding of the nature of problem to be solved. The use of sand-filled geotextiletubes and geobags for the coastal protection works is in thedeveloping phase.

3. Dennes T. Bergado et al. (2002): In this paper the geotextile-reinforced embankment on soft ground, the high-strength geotextile can reduce the plastic defor-

mation in the underlying foundation soil, increase the collapse height of the embankment on soft ground, and produce a two-step failure mechanism. In this case study, the critical strain in the geotextile corresponding to the primary failure of foundation soils may be taken as 2.5–3% irrespective of the geotextile reinforcement stiffness. The deformations and stability of geotextile-reinforced embankment during construction up to failure of two test embankments have been successfully investigated by finite element method using the PLAXIS program.

4. Dhani. B. Narejo (2003): The paper is a technical note on The _85% size of soil is compared with the apparent opening size of geotextiles. The data indicates that for sand and silt size particles, a geotextile with apparent opening size (O95) less than _85% size (d85) of retained soil would perform satisfactorily. The data indicates that in most cases, geotextiles with an apparent opening size of less than _85% size of soil would function adequately. However, some of the studies indicate that for fine silt and clayey soils the apparent opening size of a geotextile should be calculated as 0.5 times the 85% size of soil. At least one of the studies indicates that even a smaller opening size may be necessary for some conditions.

5. Subrata Chandra Das (2017) :In this study briefly explained about geotextiles are used in various filed of science and engineering work together like major geotextile application are used in railways,highways,embankments and retaining wall, erosion control and drainage geotextiles or geosynthetics have been applied remarkably.

5 Conclusion

Applications of geotextile in the form of geocontainer ,geobag, geomat, geotube ect.in various coastal and maire structures have been highlighted as measures of coastal protection and coastal engineering works. The case histories and the results of theoretical analyses using Finite element modeling suggested the two-step failure mechanism of high-strength geotextile-reinforced embankment on soft ground. The primary failure of foundation soils may occur at thesame deformations as that of the unreinforced embankment just prior to collapse. The secondary failure or collapse of embankment and foundation as a whole may occur with the rupture or pullout of the geotextile reinforcement.Geo-textiles are widely used for drainage in earth and construction works.the range of functions of geotextiles can be enhanced and the product can be made more potential and versatility of applications.

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