NATIONAL HIGHWAYS AUTHORITY OF INDIA
(M/O ROAD TRANSPORT AND HIGHWAYS)

STANDARDS OF GEOTEXTILES FOR IMPROVING PERFORMANCE OF HIGHWAYS

INTRODUCTION

- Synthetic material in the form of strong flexible sheets, Permeable or water tight are in use to improve soil quality and better performance in geotechnical engineering

- They are used for lining, drainage and protection of slopes and embankments

- The common generic name given to them is Geosynthetics

GEOSYNTHETICS AND THEIR VARITIES

- Geotextiles
  - Geotextile fabric shall be woven, non-woven or knitted fabric.
  - Consist of Polypropylene, Polyethylene, Polyester or combination thereof.
- Geogrids
  - Net like Polymeric material having large aperture.
  - Possess relatively high strength properties.
- Geonets
  - Polymer strands crossing one another at an angle (usually acute angle to give a diamond pattern aperture).
  - Used in combination with Geotextile or Geomembrane for drainage.
  - Not used for strength.

GEOSYNTHETICS AND THEIR VARITIES

- Geocomposites
  - A composite material which could be a combination any two or more synthetic materials like geotextiles, geogrids, geonets and geomembranes etc.
  - Good drainage property and used for prefabricated vertical drains.
- Geomembrane
  - An impervious synthetic material.
  - Used to control migration of water i.e. lining of drains/Canals.
- Geocells
  - Three dimensional structure with interconnected cells.
  - Confinement provided by Cell walls gives strength.
  - Improves bearing capacity of Weak foundations.

GEOSYNTHETICS AND THEIR VARITIES

- Geosynthetic Mats
  - Two dimensional or three dimensional mats with apertures to allow vegetation growth.
  - Steel wireless or geogrid can be included in these mats as reinforcement.
  - Used for erosion protection of slopes.
- Natural Geotextiles
  - Made of natural fibres like jute or Coir.
  - Add in quick growth of vegetation and used for erosion control applications.

FUNCTIONS OF GEOTEXTILES

- Separation/Filtration
  - Prevention of intermixing of two layers of dissimilar materials.
  - Prevents pumping of soil into base/subbase course.
  - Dissipates the development of c

    pore water pressure by allowing flow of water across the plane of geotextile.
- Reinforcement
  - Materials having high tensile strength can compliment those materials that are weak in tension.
  - Low strength soils are prime target for geotextiles reinforcement.

FUNCTIONS OF GEOTEXTILES

- Filtration/Drainage
  - Geotextile should be able to convey water across the plane of the fabric throughout its design life.
  - Serves concurrent objectives of retaining the soil particles while permitting flow of water across it.
- Erosion control
  - Used as a protective cover over the slopes subjected to wind/water erosion.

MINIMUM GEOTEXTILE STRENGTH PROPERTY REQUIREMENTS

Installation Condition	Type	Strength Property Requirement (MARV)							
		Grab Strength in Newton (N) as per ASTM D 4632/ IS: 13162 Part 5		Tear strength in Newton (N) as per ASTM D 4533/ IS: 14293		Puncture Strength in Newton (N) as per IS: 13162 Part 4		Burst Strength in Newton (N) as per ASTM D 3786/ IS: 1966	
		Elongation at Failure							
		<50%	>50%	<50%	>50%	<50%	>50%	<50%	>50%
Harsh installation condition	Type I	1400	900	500	350	500	350	3500	1700
Moderate Installation condition	Type II	1100	700	400	250	400	250	2700	1300
Less Severe Installation condition	Type III	800	500	300	180	300	180	2100	950

GEOTEXTILE REQUIREMENTS FOR SUBSURFACE DRAINAGE

In-situ soil Passing 0.075 mm Sieve (%)	Permittivity, per sec, as per ASTM D 4491/IS: 14324-1995	Maximum Apparent Opening Size, mm ASTM D 4751/IS: 14294-1995
< 15	0.5	0.43
15 to 50	0.2	0.25
> 50	0.1	0.22

GEOTEXTILE REQUIREMENTS FOR SEPARATION (SUBGRADES SOAKED CBR > 3)

S.No.	Geotextile Property	Requirement
1)	Permittivity as per ASTM D 4491	0.02 sec^{-1}(per sec)
2)	Maximum Apparent Opening Size as per ASTM D 4751	0.60 mm

GEOTEXTILE REQUIREMENTS FOR SEPARATION (SUBGRADES SOAKED CBR < 3)

S.No.	Geotextile Property	Requirement
1)	Permittivity as per ASTM D 4491	0.05 sec^{-1}(per sec)
2)	Maximum apparent Opening Size as per ASTM D 4751	0.43

GEOTEXTILE REQUIREMENTS FOR EROSION CONTROL

In-situ Soil Passing 0.075 mm Sieve (%)	Permittivity, per sec ASTM D 4491	Maximum Apparent Opening Size, mm ASTM D 4751
< 15	0.7	0.43
15 to 50	0.2	0.25
>50	0.1	0.22

MINIMUM REQUIREMENTS FOR GEOGRID FOR SUB-BASE OF FLEXIBLE PAVEMENT

Property	Test Method	Unit	Requirement
Stiffness at 0.5 % strain	ISO- 10319	kN/m	>350; both in machine and cross-machine direction
Tensile strength @2% strain	ASTM D6637	kN/m	> 15% of T_{ult} ; both in machine and cross-machine direction
Tensile strength @5% strain	ASTM D6637	kN/m	>20% of T_{ult} ; both in machine and cross-machine direction
Junction Efficiency for extruded geogrids	ASTM-WK 14256	-	90% of rib ultimate tensile strength
Ultraviolet stability	ASTM D4355	-	70% after 500 hrs exposure

PUBLISHED SPECIFICATIONS & STANDARDS

- IRC SP 59: Guidelines for use of Geotextiles in road pavements and associated works

  -

- Specification for road and bridge works – Fifth revision 2013: Published by Indian Roads Congress

REQUIREMENTS FROM THE SUPPLIER

- The supplier of the geotextile should provide the following
  - Name of the manufacturer
  - Product Name
  - Roll Number
  - Chemical Composition
  - Property value of individual rolls

REQUIREMENTS FROM THE MANUFACTURER

- The manufacturer of the geotextile is responsible for the following

  - Establishing & maintaining a quality control programme

  - Ensure requirement of the specifications

  - Providing manufacturer’s certificate furnishing MARV results

THANKS