



**COMMENTS OF THE INDUSTRY EXPERTS
INVITED TO MAKE THE REPORT ON
GEOTEXTILES MORE COMPREHENSIVE.**

**Please send your comments to our email
textilec@gmail.com latest by
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Report on Geotextiles for Roadways in India

1. Introduction :

Geotextiles are permeable textile materials applied in geotechnical applications, as an integral part of the structure. International experience in the application of geotextiles is more than five decades old. In India the Science is only a few years old, although academic and research activity started decades ago. In fact, the earliest reference dates back to 1933 of the experiments undertaken by Indian Jute Mills Association wherein a bitumanised Jute cloth was used for road surfacing. Around 1940, experiments on using cotton fabric for road construction has also been reported. Bitumanised hessian was also reportedly used as portable Aircraft runway in India during 2nd world war. Further the Ministry of Textiles, Govt. of India had in the VII plan identified geotextiles as a thrust area and at the request of Bombay Textile Research Association (BTRA) had sanctioned a project on nonwoven geotextiles under which complete nonwoven pilot plant was set up and many seminars were organized in 1987-1991 period. However the attempts were perhaps premature and ahead of times.

2. Functions and Advantages of Geotextiles :

In the formative years while available carpets/sackings were used for the purpose, the application gradually grew to specially engineered fabrics for performing specific functions and in recent years, specially structured materials like geonets, geomats and geocomposites are increasingly being used. These may be made by either synthetic fibres or natural fibres. Soil has certain drawbacks when used as basis for building any structures; soil can only absorb tensile/shear forces to a limited extent ; it is also easily deformable under the effect of water flow and shifts under a hydraulic/dynamic load because it has insufficient structural stability. This is why even our ancestors used straw, wood, etc. to stabilise the soil to assist in reinforcement, filtration and drainage applications.

Use of geotextiles in Highway applications aims at better quality roads and to make them more economical (either through greater durability, long life thus reducing maintenance costs or lower initial costs.)

Geotextiles normally perform the following major functions :

- i) Separation
- ii) Filtration
- iii) Drainage
- iv) Reinforcement

Separation refers to separation of two dissimilar soils. The geotextile prevents intermixing of two soils throughout the design life of the structure. Filtration is one of the most widely used geotext functions. The filtration function has to retain soil particles while permitting water to pass through the plane of geotextile material.

In the drainage application, the concept is similar to filtration but the flow is across the geotextile. The geotextile perform reinforcement function when set below the sub base by withstanding sustained tensile force or load. As a result, it offers strength to soil on which it is applied.

Geotextile can of course perform many other application in prevention of seepage in canals as canal liners or preventing erosion in river banks or preventing land slides in hilly areas and as land fills in waste management.

Geotextile offer following additional advantages.

- i. They can help in many cases to reduce the space or volume occupied in a structure or help in reducing the aggregate than comparable soil / aggregate layer.
- ii. Geotextile can be engineered with specific required properties with minimum variations unlike normal soil aggregates.
- iii. Better quality control can be exercised at construction site.

3. Type of Geotextiles

The geotextiles are categorised by manufacturing process as woven, nonwoven or knitted structures. Woven Geotextiles are made by normal weaving process and give high tensile strength/modulus to the system. Nonwovens are highly permeable and high strain characteristics and can be engineered to meet specific requirements. They are widely used for seperation, drainage functions. They are laid from a roll and are light and easy to handle. Knitted textiles have fewer applications as compared to nonwovens⁴. and wovens. Geomembranes are synthetic manufactured sheets and their main task is liquid barriers. Geogrids are again polymeric structure which work as reinforcement materials. Similar variants are geogrids, geonets and geocells, which are all different forms for stabilization or reinforcement of structures.

4. Potential for use of Geotextiles for Highways

Quality of roads, in addition to travel comfort, have a direct relation to fuel waste/fuel consumption. It is estimated that annual loss to economy due to poor roads / congestion is between US \$3-6 million. In India massive investments are being planned for infrastructures developments in terms of :

- Roads, ports, airport modernisation.
- Buildings/construction.
- Water sewerage
- Other industrial infrastructure

Total length of our road network is 33 lakhs km. and is second largest in the world. About 65 % of freight and 80 % passenger traffic is carried by roads. National Highways constitute only about 2 % of road network but carry about 40 % of traffic. Further, the vehicles have been growing at an average of 10.16 % per annum.

The National Highway Authority of India (NHAI) has been mandated to implement the Rs.54,000/- Crores (US \$ 13.2. billion). National Highway Development Project (NHDP) which includes the Golden Quadrilateral and the NS-EW corridor.

It is estimated that out of US \$ 311 billion investment by 2012 for total infrastructure, around 10% i.e. US \$ 34 billion will be spent on roads alone.

In the last 4-5 years, large quantity of imported geotextiles are being used. It is understood that Karnataka State Highway Improvement Project (KSHIP), Andhra Pradesh Highways and Kerala

Highways have used substantial quantity nonwoven geotextile to improve road network in the last 5 years. A list of such projects is enclosed as **Annexure 1**.

One source puts domestic consumption of Geotextiles in 2004-2005 was around 4000 tons - mainly in highways and flyovers and the remaining for irrigation and other applications. The potential for usage in infrastructure projects is envisaged at around 30,000 tonnes in next five years.

Annexure 2 shows some of the projects in coastal and road applications using geotextiles, where woven and nonwoven geotextiles are used.

Annexure 3 shows use of geogrids in some of projects in India.

Studies conducted by many agencies, including CRRI have proved the benefits of geotextile in the construction of stronger and long lasting roads in India. CRRI studies indicate that Geotextiles are effective substitutes for conventional sand blanket course. Its use is very cost effective when good quality sub base material are not available within the economic level and the sub grade CBR is below 3.0. Geotextile used by many agencies are being tested at Indian laboratories certified as per ISO - 17025 standards by NABL. **Annexure 4** shows some of recent tests carried out at BTRA laboratories.

In view of the above, it is clear that the geotextile are a PROVEN TECHNOLOGY and no more of pilot studies are required. It is necessary that the construction authorities include geotextile in tender documents and create awareness of appropriate geotextiles for different applications.

5. Standards for Geotextiles in India :

Another constraint often raised by the industry is the lack of specifications for use in India. For this purpose the Textile Commissioner, Ministry of Textiles, Govt. of India, recently constituted a Committee with Director, BTRA as convener for coming up with specifications for different technical textiles. The groups consisted of experts from IIT, CRRI, practicing civil design engineers and other research organisations. The specifications recommended by the committee for highways are enclosed in **Annexure 5**. Specifications for geogrids are under finalisation.

Some of the major manufactures and suppliers of geotextiles/geogrids in India are given in **Annexure 6**.

6. A few immediate measures required to be taken by the Government :

- Mandatory use of Geotextiles in infrastructure projects, like National Highways, retaining walls, erosion control etc.
- The recommendations of the Committee set up for standards formulations may be passed onto agencies like NHAI for implementation and to BIS for consideration and adoption.
- The Indian laboratories accredited with ISO 17025 and appropriate manpower may be identified and funded for upgradation of laboratory facilities.

Geotextiles Supply

Year	Contractor	Project	Product	Quantity sq.m	Application
2001-02	K.Yellaiah & Sons	APSH, Nizamabad	Paving Fabric	130,000	PP Nonwoven geotextile one side needlepunched and other side heat set used as an internal layer in road pavements to avoid reflective cracks in overlays.
	A.Srinivasulu & co.,	APSH, Chittoor	Paving Fabric	77000	
	AK Mohanan	Kerala State Highway	TS 20	5000	PP Nonwoven needle punched geotextile used for constructing sub surface drains in roads.
	K Reghunathan	Kerala State Highway	TS 20	3800	
2002-03	KMC construction	KSHIP	TS 20	37000	PP Nonwoven needle punched geotextile used for constructing sub surface drains in roads.
	HCC-SEL (JV)	KSHIP	TS 20	75000	
	Bhooratnam & Co.,	APSH	Paving Fabric	8000	PP Nonwoven geotextile one side needlepunched and other side heat set used as an internal layer in road pavements to avoid reflective cracks in overlays.
	UNITECH-NCC	APSH	Paving Fabric	13000	
	Maytas Infra pvt ltd	KSHIP	TS 20	120000	PP Nonwoven needle punched geotextile used for constructing sub surface drains in roads.
	Atlanta Infrastructure	NH-2	TS 20	10000	
	PBA Infrastructure Pvt Ltd.,	NH-2	TS 20	20000	
	Mukund Limited	NH-2	TS 20	5000	
	AK Mohanan	Kerala State Highway	TS 20	4000	
	Enn Cee Cee	APSH	Paving Fabric	38475	PP Nonwoven geotextile one side needlepunched and other side heat set used as an internal layer in road pavements to avoid reflective cracks in overlays.
	ECI Projects India Limited	Airforce Station, Dindigal	Paving Fabric	8550	
	RN Shetty	KSHIP	TS 20	5000	PP Nonwoven needle punched geotextile used for constructing sub surface drains in roads.
	Executive Engineers	Roads and Buildings Department	TS 20	5000	
2003-2004	L&T ECC	Karnataka State Highway Improvement Project (KSHIP)	KET-9	174000	
	KMC constructions	..	..	17250	
	Gayatri Projects	..	..	15000	
	PBA Infrastructures	..	..	9000	
	Tantia Constructions	..	..	3000	
2004-2005	RN chetty&co.,	..	..	7200	
	KMC constructions	..	..	37800	
	HCC-SEL (JV)	..	..	16800	
2004-2005	Techni Bharathi limited	..	..	36000	
	HCC-SEL (JV)	..	..	33600	
	L&T ECC	Vemagiri Power Plant	..	8000	

	Patel Engineering company	Srisailem Dam Weir work	300gsm	2000	PP Nonwoven needle punched geotextile used for filtration purpose, which is place back side of retaining wall. General practice is different sizes of aggrigates layer.
	Reddy Veeranna constructions Ltd	Karnataka State Highway Improvement Project (KSHIP)	KET-9	1200	
	Gayatri Projects	..	..	49600	
	PBA Infrastructures	Lucknow Bypass Project (NHAI)	..	23900	
	Tantia Constructions	Karnataka State Highway Improvement Project (KSHIP)	..	3500	
	B.Seenaiah and company(Projects)Limited	..	..	5600	
	KMC constructions	..	..	48000	PP Nonwoven needle punched geotextile used for constructing sub surface drains in roads.
	Gayatri Projects	..	..	76200	Polyester Woven Multifilament geotextile 100kN/50kN used for reinforcement in road embankment to avoid failures in road when cosntructed in Marine clays location.
	GEA-MECON (JV)	Tuticorin Port connectivity project (NHAI)	KE100/50	35000	
	Climax Synthetics pvt Ltd	Land fill application at Gwalior	KET-24	6000	PP Non woven needle punched geotextile used for filter layer below the canal lining using precast concrete blocks.
	Suravaram Marketing (Field turf)	Construction of football stadium at Goa	KET-9	8000	
	KNR Constructions limited	Karnataka State Highway Improvement Project (KSHIP)	KET-15	15800	
	Tantia Constructions	..	KET-15	5400	
	PWD, Andaman	Tsunami Protection works	KET-9	8000	
	Sadbhav Engineering Limited	Gujarat State highway project	..	3000	PP Nonwoven needle punched geotextile used for constructing sub surface drains in roads.
2005-2006	KMC constructions	Karnataka State Highway Improvement Project (KSHIP)	KES-140	66880	PP Nonwoven geotextile one side needlepunched and ather side heat set used as a internal layer in road pavements to avoid reflective cracks in overlays.

(Source : BTRA Clients)

List of Projects in Coastal& Road applications using Geotextiles:

SN	Description	Contractor	Product	Quantity sqm
1	AD Hydropower Ltd,Manali	ADHPL , Noida	Non woven Geotextile	61,500
2	Solid Waste Management,Vamanjoor Managlore	KUIDFC/SMS-Bangalore	Non woven Geotextile	1,500
3	Doharighat Pump Canal	U.P.Irrigation / Bahadur & Co.	Non woven Geotextile	23,000
4	Uttar Pradesh Jal Nigam	U.P Jal Nigam Lucknow	Non woven Geotextile	24000
5	Flood Mitigation and Erosion Control of River	Structural Waterproofing	Non woven Geotextile	3800
6	Flood Mitigation and Erosion Control of River	Structural Waterproofing	Non woven Geotextile	4500
5	ONGC project at Ankleshwar	Yojaka Marine	Woven Geotextile	27690
6	Flood Protection work at Bhavnagar	Indiana Build	Woven Geotextile	10000
7	River Protection work for Surat Municipal Corpn	Sonal Construction	Woven Geotextile	50000
8	River Protection work for Surat Municipal Corpn	D.P.Vekariya & Co	Woven Geotextile	23500
9	River Protection work for Surat Municipal Corpn	Yojaka Marine	Woven Geotextile	35000
10	Flood Protection work at Village Tavdi	Shruti /Akar Constructions	Woven Geotextile	10000
8	Widening of Road under I.T Expressway Ltd	ITEL	Woven Geotextile	9471
9	Bund Protection for Reliance Industries Ltd RIL-Kakinada	Dredging International	Woven Geotextile	25500
10	Flood Mitigation and Erosion Control of River	Water Resource Dept	Woven Geotextile	1,18,510
11	Flood Mitigation and Erosion control of River Banks	Kusumagar Corporates	Woven Geotextile	28,910
12	Flood Mitigation and Erosion control of River Banks	Vijeta Constructions	Woven Geotextile	17,500
13	Construction of Road for Reliance Industries Ltd at Gadimoga near Kakinada	Reliance Industries Ltd	Woven Geotextile	2,10,000
	Total Quantity of Woven Geotextile			5,66,081 sqm
	Non woven Geotextile			1,18,300 sqm

(Source : BTRA Clients)

List of clientele/ Major orders in Geogrids in ROB & flyover applications

SN	Description	Client	Contractor	Quantity of Geogrids
1	Reinforced soil Wall at Meshow Aqueduct of Sujalam Sufalam Spreading Canal	Narmada Water Resources Water Supply & Kalpasar Dept	Ajay Engineers	4500 sqm
2	Reinforced soil Wall for ROB on Kalol-Mansa-Vijapur Road	Roads & Buildings Dept. Gandhinagar Govt of Gujarat	Rakesh Constructions	34000 sqm
3	TechGrid B-90 geogrid for sand pad foundations for storage Tanks at Mehsana	ONGC	Bridge & Roof	27300 sqm
4	TechGrid B-90 geogrid for sand pad foundations for storage Tanks at Nawagam	ONGC	Bridge & Roof	38250 sqm
5	Reinforced soil Walls for ROB at Alwar	RIDCOR	IVRCL	3,00,000sqm
6	TechGrid Uniaxial TGU for widening & ground stabilization for IT Corridor project	IT Expressway Ltd		17,135sqm
7	Reinforced soil walls for Rehabilitation & upgrading of NH-76, EW-II (RJ-III)	NHAI	Ranjit Constructions	2,83,000sqm
8	Reinforced soil wall with wrap-around & vegetated facia for Gunni Railway Tunnel near Katra (J&K)	Konkan Railway	Progressive Constructions	28000 sqm
9	PP Geogrids for Reinforced Soil Slope in Landslide Mitigation	Tehari Hydro Development Corporation	Shring Construction Pvt. Ltd.	26,000sqm
10	Reinforced soil walls for Underpasses of 4-Laning of NH-28, LMNHP-6	NHAI	NCC-VEE Jv	43,520sqm
11	Reinforced soil wall for ROB on Mumbai Pune section near Dapodi Rly stn	Pimpri Chinchwad Municipal Corpn PCMC-Pune	Manoja sthapatya	12000 sqm
12	Reinforced soil wall for ROB at Patiala	PIDB & PWD-Punjab	S.P.Singla Construction	20000 sqm
13	Reinforced soil wall for ROB at Vyas	PIDB & PWD-Punjab	S.P.Singla Construction	20000 sqm
14	Reinforced soil wall for ROB on Salem to Erode	NHAI	IVRCL Sai Sudhir Infrastructures	7,50,000 sqm
15	Ground Improvement & Reinforced soil wall for 4 laning of Jhansi- Lakhdon section on NH-26	NHAI	B.Seeniah & Company (Projects) Ltd	1,20,000 sqm
16	Reinforced soil wall for ROB at Mansa in Punjab	PIDB & PWD-Punjab	M/s V.K.Gupta Associates	35,500 sqm
17	Reinforced soil wall for ROB projects to L&T	Larsen & Toubro		16,00,000 sqm
	Total Geogrid Quantity			33,59,205 sqm

(Source : BTRA Clients)

GEO-SYNTHETICS RECENTLY TESTED BY BTRA

Manufacturer / Supplier	Product	Applications	Project / site	User
Garware wall Rope, Pune	Woven geo-textile (filament)	Drainage	Navasari	Executive Engineer, Drainage Div, Navsari
		River bank protection	mkvdc, kolhapur	
		Land filling		
Ammalines	Woven geo-textile (filament)			
Tech Fab, Mumbai	Woven geo-textile (filament)	Damanganga Canal Flood Protection	Valsad Umargaon Flood Protection Works	ex. Engineer Valsad Irrigation Sub Div.
		Land filling		Reliance
				Surat Municipal Corporation
				Executive Engineer, Drainage Div, Navsari
			Flood protection , Gokak	Dredging International Pvt.Ltd
		Oil Well Protection from sea water at Ankleshwar	Ongc, Ankleshwar	
	Rope Gabions			executive Engineer, Drainage Div, Navsari
Hi-Tech Speciality Fabrics	Woven geo-textile (filament)			
Sravya	Woven geo-textile (filament)			
balmer lawrie	Geocell	Slope protection		
	Woven geo-textile (filament)			
Kusumgar Corporate	Woven geo-textile (filament)	Land filling / Road	jamnagar	Exe. Engr, Backbone Enterprises, Jamnagar
Khosla Profiles	Woven geo-textile (filament)			
Maccaferri	Nonwoven Geotextiles	Land filling	Haldia port	AFCONS
Harish Pacific	Nonwoven Geotextiles			
Jeevan Products	Nonwoven Geotextiles	Land filling / Road		Reliance
Supreme Nonwovens	Nonwoven Geotextiles	Land filling / Road		
Fiberweb (India)	Spunbonded			

)	Nonwoven Geotextile			
Soham Geosynthetics	PVD	Ground Improvement	Anik-Panjrapole Road	MMRDA
			Uran	MMRDA
			Nerul	CIDCO
Techno Fabrics	Woven geotextile (filament)	Land filling / Road		
Sharplex Concrete Piles (India) Ltd.	Woven geotextile (filament)			
Earthcon Systems	Geogrid	Reinforcement	Road at Jammu & Kashmir	IRCON International (GOI)
HCC	Woven geotextile (filament)			
Navyug Engineers Pvt Ltd	Woven geotextile (filament)			

Table 1a Geotextile strength property requirements

Property	Test Methods	Units	Geotextile classification					
			Class 1		Class 2		Class 3	
			Strain < 50 %	Strain > 50 %	Strain < 50 %	Strain > 50 %	Strain < 50 %	Strain > 50 %
Grab tensile strength	ASTM D4632	N	1400	900	1100	700	800	500
Tear strength	ASTM D4533	N	500	350	400**	250	300	180
Puncture strength	ASTM D4833	N	500	350	400	250	300	180
Burst strength	ASTM D3786	kPa	3500	1700	2700	1300	2100	950
Permittivity	ASTM D4991	S ⁻¹	Minimum property requirements for permittivity, AOS and UV stability are based on geotextile application. Refer to Table 1b for subsurface drainage, Table 1c for separation, Table 1d for stabilization and Table 1e for permanent erosion control.					
AOS	ASTM D4751	mm						
UV Stability	ASTM D4355	%						

**Woven geotextiles fail at elongations (strains) < 50 %, while nonwovens fail at elongation (strains) > 50 %. The required MARV (Minimum Average Roll Value) tear strength for woven filament geotextiles is 250 N.

Table 1b Geotextile requirements for subsurface drainage.

Property	Test Methods	Units	Requirements		
			Percent In Situ Soil Passing 0.075 mm		
			<15	15 – 50 %	> 50 %
Geotextile class			Class 2*		
Permittivity**	ASTM D4991	S ⁻¹	0.5	0.2	0.1
AOS**, ^	ASTM D4751	Mm	0.43	0.25	0.22#
UV Stability (retained strength)	ASTM D4355	%	50 % after 500 hr of exposure		
Burst strength	ASTM D3786	kPa			

*The engineer may specify a class 3 geotextile if conditions are less severe.

** In addition to default permittivity value, the Engineer may require geotextile permeability and/or performance testing in problematic soil environments.

^ Site specific geotextile design should be performed if unstable or highly erodable soils such as non-cohesive silts; gap-graded soils; alternating sand/silt laminated soils; dispersive clays; and/or rock flour are encountered.

#For cohesive soils with a plasticity index greater than 7, geotextile Max ARV is 0.30 mm.

Table 1c Geotextile requirements for Separation (separation of soil subgrades- soaked CBR > 3; or shear strength > 90 kN/m²).

Property	Test Methods	Units	Requirements
Geotextile class			Class 2*
Permittivity	ASTM D4491	S ⁻¹	0.02**
AOS	ASTM D4751	mm	0.60 maximum average roll value
UV Stability (Retained strength)	ASTM D4355	%	50 % after 500 hr of exposure
*The engineer may specify a class 3 geotextile if conditions are less severe.			
**Permittivity of the geotextile should be greater than that of the soil. The engineer may also require the permeability of the geotextile to be greater than that of the soil.			

Table 1d Geotextile requirements for stabilization

(For soil subgrades- 1 < CBR > 3; or shear strengths between 30 kN/m² and 90 kN/m²).

Property	Test Methods	Units	Requirements
Geotextile class			Class 1*
Permittivity	ASTM D4491	S ⁻¹	0.05**
AOS	ASTM D4751	mm	0.43 maximum average roll value
UV Stability (Retained strength)	ASTM D4355	%	50 % after 500 hr of exposure
*The engineer may specify a class 2 or class 3 geotextile s if conditions are less severe.			
**Permittivity of the geotextile should be greater than that of the soil. The engineer may also require the permeability of the geotextile to be greater than that of the soil.			

Table 1e Geotextile requirements Permanent erosion control

Property	Test Methods	Units	Requirements		
			Percent In Situ Soil Passing 0.075 mm		
			<15	15 – 50 %	> 50 %
Geotextile class			Class 2*		
			Class 1*^		
Permittivity	ASTM D4991	S ⁻¹	0.7	0.2	0.1
AOS	ASTM D4751	mm	0.43	0.25	0.22**
			max. avg. roll value	max. avg. roll value	max. avg. roll value
UV Stability (Retained strength)	ASTM D4355	%	50 % after 500 hr of exposure		
<p>*Geotextile selection is appropriate for stone weights not to exceed 100 kg, stone drop height less than 1m, and the geotextile protected by a 150 mm thick bedding layer. More severe applications require an assessment of geotextile survivability based on a field trial section and may require a geotextile with higher strength properties.</p> <p>^The Engineer may specify a class 2 geotextile if conditions are less severe.</p> <p>**For cohesive soils with a plasticity index greater than 7, geotextile Max ARV for apparent opening size is 0.3 mm.</p>					

Table 1f. Geotextile requirements for temporary silt fencing

Property	Test Methods	Units	Requirements		
			Supported Silt Fence*	Unsupported Silt Fence	
				Geotextile elongation > 50 %	Geotextiel elongation < 50%
Maximum post spacing			1.2 m	1.2 m	2.0 m
Grab tensile strength		N	400	550	550
-Machine Direction			400	450	450
-X Machine Direction					
Permittivity	ASTM D4491	S ⁻¹	0.05	0.05	0.05
AOS**	ASTM D4751	mm	0.60	0.60	0.60
			max. avg. roll value	max. avg. roll value	max. avg. roll value
UV Stability (Retained strength)	ASTM D4355	%	70% after 500 hr of exposure	70% after 500 hr of exposure	70% after 500 hr of exposure
*Silt fence support shall consist of 14 gage steel wire with a mesh spacing of 150 mm x 150 mm or prefabricated polymeric mesh of equivalent strength.					
**These default filtration property values are based on empirical evidence with a variety of sediments. For environmentally sensitive areas, a review of previous experience and/or site or regionally specific geotextile tests should be performed.					

Table 1g. Geotextile requirements for prevention of reflective cracking i.e. Paving Fabrics

Property	Test Methods	Units	Requirements
Mass per unit area	ASTM D3776	gm/m ²	140
Grab strength	ASTM D4632	N	450
Ultimate elongation	ASTM D4751	%	□ 50
Asphalt retention*	Texas DOT Item 3099	lt/m ²	*, ^
Melting point	ASTM D276	□C	150
*Asphalt required to saturate paving fabric only. Asphalt retention must be provided in manufacturer certification. Value does not indicate the asphalt retention rate required for construction.			
**Product asphalt retention property must meet the MARV provided by the manufacturers certification.			

Annexure 6

Some Major Manufacturers and Suppliers of Geotextiles in India

Manufacturers	Products		
Garware Wall Rope	Geotextiles	Woven	Filament
	Gabions	PP Rope	
		Metallic wire	
Hitkari	Geotextiles	Nonwoven	Needle punched
Jeevan Products	Geotextiles	Nonwoven	Needle punched
Jai Corp	Geotextiles	Woven	PP Tape
Kusumgar Corporate	Geotextiles	Woven	Filament
Maccaferri	Geotextiles	Nonwoven	Spun bonded
	PVD (composite)	Nonwoven	Spun bonded
	Composites	Nonwoven	Spun bonded
	Gabions	Metallic wire	
Nonwoven India	Geotextiles	Nonwoven	Needle punched
Obeettee Textiles	Geotextiles	Nonwovens	Needle punched
Supreme nonwovens	Geotextiles	Nonwovens	Needle punched
TechFab	Geotextiles	Woven	PP Tape
	Geotextiles	Woven	Filament
	Gabions	PP Rope	
Uniproducts	Geotextiles	Nonwoven	Needle punched

Supplier / contractor	Products		
Jeevan Products	Geotextiles	Nonwoven	Spun bonded
	PVD (composite)	Nonwoven	Spun bonded
	Composites	Nonwoven	Spun bonded
	Gabions	Metallic wire	
	Geo pipe	Nonwoven	Inside PVC perforated pipe
	Geogrids	Moulded	Polymer
		Ribs (yarn)	Heat sealed tapes
Planck Infrastructure	Geotextiles	Nonwoven	Spun bonded
	Geotextiles	Woven	PP Tape
	Geotextiles	Woven	Filament
	Composites	Nonwoven	Spun bonded
	Gabions	Metallic wire	
Soham Foundations	PVD (composite)	Nonwoven	Spun bonded
Hi-Tech Speciality Fabrics	Geotextiles	Woven	Filament

(Source : BTRA Clients)