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# JUTE GEOTEXTILES

TECHNOLOGY & APPLICATIONS

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*Road Construction with JGT*



*River Bank Protection with JGT*



*Slope Protection with JGT*

# **JUTE GEOTEXTILES**

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**TECHNOLOGY & APPLICATIONS**

*Prepared by*

**National Jute Board**

Ministry of Textiles, Govt. of India



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## INTRODUCTION

Natural fibre like jute is an eco-friendly, biodegradable material which grows abundantly in India. Jute has several socio-economic and environment related advantages. Apart from traditional usage of jute as sacks various Jute Diversified Products (JDP) are now being used for a variety of purposes. One such JDP is technical textile like, Geotextile. This when applied in soil help improve its engineering behavior.

The product is gaining acceptability among end-users in view of its effectiveness, eco-compatibility, appropriate techno-physical features and price-competitiveness. Research and studies on jute have helped continuous improvement in its technical feature.

Jute Geotextiles (JGT) is used for Road construction, Erosion Control, Hill Slope Management etc. Jute being one of the most versatile natural fibres has a long history of applications in these areas. However, primary use of jute has been limited, for a longtime, to packaging sector only. Now, Jute Geotextiles, a class of innovative technical textiles specially designed to address soil related problems have been introduced successfully on a commercial scale.

The National Jute Board, Ministry of Textiles has been working on development and promotion of this engineering fabric for the last few years. BIS standard and RD & SO guidelines have already been published. IRS has also published number of documents for the convenience of user organisation and published guidelines (ICR:SP: 126-2019) for road construction with use of JGT. Few states and Indian Railways have included JGT as an item of work in their Schedule of Rates (SoR). So far, more than 580 civil engineering projects in different states of India under different soil and climatic conditions have been carried out with success.

National Jute Board has taken the efforts for attempting to bring out an informative technical document of Technology and Application of JGT for its usage in Rural Road Construction, River Bank Protection and Slope stabilization which would encourage engineers to use this eco-friendly material in a bigger way. Apart from its eco-friendliness, JGT is also economical in comparison to all other types of Geotextiles in India.

It is expected that NJB in collaboration with all other stakeholders will leave no stone unturned for popularizing JGT in India and abroad as a technical textile of days to come.

## TECHNOLOGY

Technology for use of JGT stands proven on the strength of laboratory studies and substantive field applications. It has been and is being used all over the country for erosion control, river / canal bank protection, in road construction, for prevention of railway track subsidence and slope protection. The technology of application is similar to the one for synthetic geotextiles. The three functions of geotextiles, viz separation, filtration and drainage act concurrently to build up effective stress within the soil. JGT when placed in the interface of sub-grade and sub-base it prevents intermixing of two different layers keeping the designed pavement thickness intact and also accelerate the consolidation process of sub-grade soil leading to enhanced load bearing capacity (CBR %) of the road. The common perception that durability is essential for developing effective stress stands contested by finding of the lab-scale studies and field-scale applications with JGT which have conclusively shown that in no case durability of more than two years is normally needed for consolidation of soil to an optimal level. The period over which soil condolidates in the presence of geotextiles for most applications does not warrant the durability of the geotextiles beyond the effective period of consolidation. For erosion control of river bank, treated and durable JGT is used as filter media in place of inverted filter aggregates for effective filtration function and also prevent intrusion of armor into the bank soil. Generally within two season cycle bank soil is stabilized and erosion checked. For protection of earthen or hill slopes when JGT is laid over the slope surface its thick yarns act as mini check dam that arrest migration of detached soil particles flowing down the slope during surface run-off. Being hydrophilic in nature JGT absorbs water from atmosphere and release during the dry spell. It also attenuates extreme of temperature thus creates a congenial environment to help faster growth of vegetation. After growth of vegetation function of JGT and for that matter any geotextile ceases. The vulnerable slope is thereby stabilized. Thus bio-degradability of JGT after it has achieved its purpose is its greatest advantage over other types of geotextiles. In view of the global concern for preservation of environment, JGT with its strong eco-concordance becomes a natural choice for policy makers and engineers alike for addressing various geotechnical problems in civil engineering.

## **ADVANTAGES OF JGT**

**Advantages of JGT are several. These are -**

- High initial modulus
- Low elongation-at-break
- High roughness co-efficient
- Its drapability is the best of all geotextiles— synthetics and natural.
- Being highly water-absorbent (about 5 times its dry weight), JGT effects better on-land storage than any other geotextile needed for surficial soil erosion control.

### **An excellent drainage medium.**

- Thickness of open weave JGT helps reduce the velocity of overland flow and entrap detached soil particles thus facilitating control over surface soil erosion.
- Easy availability.
- Can be tailor-made to conform to the specifications of the end-users.
- Cost-competitive compared to man-made and other geotextiles.
- Environment-friendly. Annual agricultural resource; hence renewable. Acts as mulch.

### **On biodegradation it becomes miscible with soil and improves its characteristics.**

- Excellent spinable and weavable fibre

## **PRICE COMPETITIVENESS OF JGT**

- One of the advantages of using JGT is its price competitiveness against all other types of geotextiles available in India. JGT is priced almost half the prevailing cost of similar synthetic geotextiles in India. Cost of coir geotextiles is also much above than that of JGT. Use of JGT results in significant economy in construction of roads and river bank protection. National Jute Board (NJB) provides technical guidance to end-users in regard to design, procurement, testing and installation of JGT.
- If the current Schedule of Rates of PW (Roads) and Irrigation & Waterways Department of the Govt. of West Bengal are considered, there could be a direct saving of about 10% to 12% compared to the conventional cost by using JGT excluding the 'environmental cost'. In river-bank protection works, the cost savings may be as high as 20% of the conventional as JGT fully replaces the granular filter conventionally used. For slope protection, however, there would

not be any direct saving but use of JGT will facilitate growth of vegetation denser, deeper and quicker without structural corrections.

- It is thus economical and environmentally advisable to use JGT where use of geotextiles is called for geotechnical reasons.

### **BIO-DEGRADABILITY OF JGT — IS IT A TECHNICAL DETERRENT ?**

- The question about low durability of JGT is often asked by the end-users who apprehend that the stability of any construction gained as a result of use of JGT may be at a stake on bio-degradation of JGT. This notion is not based on reality and stems from a superficial conception about the mechanism of geotextiles-soil interaction. All geotextiles act as change agents to the soil on which they are laid and improve its behaviour by concurrent functions of separation, filtration and drainage. The three functions aided by the high initial strength of JGT help consolidate the soil. Consolidation incidentally is a protracted process and implies gradual reduction of the pore water-content in a soil body over a period of time. With the use of appropriate geotextiles the process of consolidation is quickened and optimized within about a couple of season-cycles. If JGT can be made to retain its initial essential features such as strength and porometry up to acceptable limits, there is no technical reason why it cannot act as effectively as its synthetic counterpart. Bio-degradation of JGT after a year or so is thus not a technical deterrent as is commonly perceived.

### **COMPARISON WITH SYNTHETIC (MAN-MADE) GEOTEXTILES**

- The features shown in the Tables in the annexures highlight the physical and functional properties of JGT and SGT. SGT experiences much higher extension-at-break (30% - 50%) compared to JGT (within 10% - 12%). Lower extension-at-break helps induce larger membrane effect and resultant higher CBR in roads.
- Except in applications of harsh survivability, JGT can be used with acceptable reliability in most of the geotechnical applications. In applications where use of impervious geotextiles are recommended and where persistent contact with saline water as in case of control of coastal erosion is envisaged, use of appropriate SGT is the preferred option. In all other cases of soil erosion, environmentally and price-wise JGT has an edge over its synthetic counterpart.



# STANDARDIZATION OF JGT IN INDIA

## A. Bureau of Indian Standards (BIS)

Sl. No.	Standards/ Guidelines	Year of publication
1.	Guidelines for the Design and Construction of Low Volume Rural Roads using Jute Geotextiles - IRC:SP:126-2019	2019
2.	Jute Agrotexiles for Growth of Plants and Suppression of Weeds — Specification IS 17070 : 2018	2018
3.	Jute Geotextiles - Control of Bank Erosion in Rivers and Waterways — Specification - IS 14715 (Part 2) : 2016	2016
4.	Jute Geotextiles - Strengthening of Sub-Grade in Roads — Specification-IS 14715 (Part 1) : 2016	2016
5.	Jute Agro-textile — Sapling Bags for Growth of seedling/sapling — specification IS 16089 : 2013	2013
6.	Guidelines for Application of Jute Geotextiles for Rain Water Erosion Control in Road and Railway Embankments and Hill Slopes-IS 14986:2001	2001

## B. Indian Railways

Sl. No.	Standards/ Guidelines	Year of publication
1.	Unified Standard Schedule of Rates ( Works & Materials) 2019	2019
2.	Guidelines of Application of Jute Geotextiles in Railway Embankment and Hill Slopes - (RDSO/2007/GE : G-0008)- RDSO, Ministry of Railways	2007
3.	Unified Standard SoR 2011 - Guidelines for earth work in railway project	2011

## C. Indian Roads Congress (IRC)

Sl.No.	Standards/ Guidelines	Year of publication
1.	Guidelines for the Design and Construction of Low Volume Rural Roads using Jute Geotextiles -IRC:SP:126-2019	2019
2.	MoRTH Specification for Road & Bridge Works	2013
3.	State-of-the Art Report on: use of Jute Geotextiles in Road Construction and prevention of soil erosion/landslides (IRC-HRB SR No.-21-2012)	2012
4.	Hill Road Manual - IRC:SP: 48 -1998	1998

Besides there are references in RD & SO and IRC literatures advocating use of JGT. Rural Roads Manual, IRC (IRC:SP:20:2002) also mentioned use of JGT in road construction works . JGT is an accredited material by IRC (IRC Journal December, 2012)

National Jute Board (NJB)— erstwhile JMDC — has published a manual on applications of JGT describing important tests for quality assessment, design approach and installation guidelines. A book on performance evaluation of some of the significant case studies with JGT and an anthology of authentic papers on JGT have also been published by NJB (Sept, 2011).

Indian Academy of Highway Engineers (IAHE) at Noida under the Ministry of Road Transport & Highways, Indian Railway Institute of Civil Engineers (IRICEN,

Pune under Ministry of Railways and Central Road Research Institute (CRRI) have included Jute Geotextiles in its course. The institutes conduct regular courses for practicing engineers of the government departments throughout the country wherein the experts of NJB deliver lecture as and when requested by them.

It is pertinent to mention in this context that to secure international accreditation, JGT should be used more extensively for generation of sufficient field data.

#### D. Inclusion of JGT-related items in scheduled of Rates

Sl. No.	Published by	Standards / Guidelines
1.	R & B Department, Govt. of Gujarat	Schedule of Rates for Buildings, Roads & Bridges works
2.	WBSRDA-Govt. of West Bengal	Schedule of Rates for Road Works, Culverts & Carriage-for all District of West Bengal- 2011 & 2019
3.	PWD (Roads) Govt. of West Bengal	Schedule of Rates - for Road & Bridge Works (2008-2009) & 2018
4.	PWD (Roads) Govt. of Meghalaya	Schedule of Rates - for Road & Bridge Works (2015 -2016)
5.	PWD (Roads) Govt. of Assam	Schedule of Rates - for Road & Bridge Works (2015 -2016)
6.	Indian Roads Congress	Rural Roads Manual - Indian Roads Congress Special Publication 20
7.	Irrigation & Waterways, Govt. of West Bengal	Schedule of Rates -2007 & USoR 2016
8.	Eastern Railway, Engineering Department	Unified Standard Schedule of Rates ( Works & Materials) 2011 & 2019
9.	Boarder Roads Organisation	Standard Schedule of Rates for Project Sampark -2016

#### APPLICATION AREAS OF JGT

##### JGT can be used with advantage in the following areas —

- Protection of slopes in earthen embankments & cuttings, rainwater harvesting tank, hill slopes, dumps and heaps of granular materials like pond ash in thermal power plants, slime in iron mines etc.
- Stabilization of embankments.
- Control of erosion in banks of rivers, waterways, canals.
- Construction of roads, haul roads.
- Control of settlement of railway tracks.
- Construction of concealed drains especially in hill roads.
- Consolidation of any type of soft soil by pre-fabricated vertical jute drains.
- Management of watersheds and prevention of denudation of arid and semi-arid lands.

Potential of JGT in geo-environmental applications still remains unexplored in India. Solid waste cover with JGT is one such area in urban conglomerates. JGT holds an edge over its synthetic counterpart in geo-environmental applications because of its bio-degradability and its conduciveness for growth of vegetation.

JGT facilitates bio-engineering measures. World Bank now favours treatment of eroded soil with bio-engineering techniques. JGT exerts a mulching action to accentuate growth of vegetation in such cases.

However it is necessary to point out JGT is not a panacea to all soil-related problems. It cannot be used in situations where full imperviousness of the fabric (geo-membrane) is a criterion.

### **IMPORTANT PROJECTS WITH JGT**

#### **a) PMGSY Pilot Project with JGT**

A pilot project with JGT was taken up in 2006 in nine roads (total length 40.34 kms) in five states viz. Assam, Chhattisgarh, Madhya Pradesh, Orissa & West Bengal with the support of the Ministry of Rural Development and the Ministry of Textiles. Central Road Research Institute (CRRI) prepared the DPRs and monitored performance of these five roads. The project was executed by the respective state governments. The report on satisfactory performance of the JGT-applied roads submitted by CRRI has been accepted by NRIDA, the nodal agency for execution of rural roads under PMGSY/ Bharat Nirman. Ministry of Rural Development, supports execution of rural roads under PMGSY with JGT.

#### **b) International Project on JGT**

An international project on JGT was undertaken by National Jute Board as the Project Executing Agency (PEA). The objective of the project which was spread over India & Bangladesh was to secure global accreditation of JGT and evolve JGT-specific design methodology for application in low volume roads, river bank erosion control and hill slope management. The project was sponsored by the Common Fund for Commodities (CFC), a financial institution under the UN, with the support of the two governments.

Fabrics developed under the project were used in total 26 field trials, 16 in India and 10 in Bangladesh with success. Results of the study in both the countries were found highly encouraging. On application of JGT the CBR value of road sub-grade enhanced by more than two times, erosion of river bank checked and slopes of earthen embankment and hills were stabilized. National level standards like, BIS and BDS have already been published in

the two countries respectively for the JGTs developed under the project. The fabric is now being widely used in India for road construction work.

**c) Project on Pre-fabricated Vertical Jute Drain (PVJD)**

National Jute Board entered into an agreement with the University of Wollongong (UoW), Australia for conducting field trials and corroborative laboratory studies on the effectiveness of PVJD in consolidating soft marine soil. The project took off in July, 2013. The results of the study indicated that the consolidation rate of soft soil with PVJD is well comparable with that of manmade PVD.

**FIELD APPLICATION WITH JGT**

So far more than 800 field applications have been carried out in India with success. Rural Roads Development Agencies of different states have already constructed 236 roads and a good number of new DPRs have been prepared to construct rural roads under PMGSY with the use of JGT. Irrigation & Waterways Department, Govt. of West Bengal has executed about 51 number of river bank erosion control works and 71 embankment protection works in the Aila affected Sunderbans area in the state and it has also planned to take up 28 more projects in the area. For control of soil erosion 114 projects has been completed by different Govt. depts. with success. Indian Railways has used JGT successfully in more than 61 projects both for rehabilitation of weak formation and slope stabilization.

Rural Roads Depts, Indian Railways, National Hydroelectric Power Corporation (NHPC), NTPC, BRO, Water Resource Depts. etc. regularly using JGT all over the country. Railway and BRO have reported effectiveness of JGT in different climatic zones. NRIDA has been encouraging all the states to use JGT for strengthening sub-grade of rural roads under PMGSY. NJB provides all sorts of technical support and guidance to such organizations and is constantly keeping track of JGT-related projects in India. The works are evaluated and documented.

**Application in Railways**

Eastern Railway used JGT in three problem-ridden railway formations in Howrah-Burdwan Chord line with a package of solutions recommended by National Jute Board. As of date three number of bad banks have been treated with JGT with success. In fact the Ministry of Railways has accepted JGT as a potent material for use in unstable formations (refer the Budget Speeches of the Hon'ble Railway Minister in 2010-11 & 2011-12). Railways have been using JGT at different zones in the country on regular basis.

## ENVIRONMENTAL BENEFITS OF JGT

JGT has an indisputable environmental edge over its man-made counterpart. The present global emphasis is on carbon foot print reduction in construction. LCA study conducted on jute by Pricewaterhouse Coopers Ltd. (PwC) at the behest of NJB has shown its effectiveness in carbon sequestration, CO<sub>2</sub> absorption and O<sub>2</sub> release. It is for this reason; adoption of bio-engineering measures is being advocated for control of surficial soil-related damages and distresses. JGT fits in with this trend.

Life Cycle Analysis (LCA) of Jute was conducted by Pricewaterhouse Coopers Ltd. (PwC) in an assignment awarded to the firm in 2006 for developing an eco-label protocol for jute by Jute Manufactures Development Council (now National Jute Board).

The LCA was aimed at identifying the extent of environment impacts associated with cultivation of jute, manufacture of jute products including JGT and their use from the stage of extraction of raw fibre till their final disposal ('cradle-to-grave' approach). The entire life cycle of jute was divided into three phases viz. the cultivation phase, processing & manufacturing phase and transportation and installation phase.

**PwC carried out the LCA study on different categories of JGT. The Life Cycle Analysis of jute products (version 3, May 2006) made by PwC mentions the following :**

- a) The most significant impact on the jute life cycle is carbon sequestration by green jute plants in the agricultural stage. Approx 4.88 tons of CO<sub>2</sub> get sequestered per ton of raw jute fibre production. Jute plantation acts as a sinks for carbon.
- b) The study also reveals -  
IPCC-Greenhouse effect (direct 100 years) - CO<sub>2</sub>, CO<sub>2</sub> equivalent CH<sub>4</sub> - show a value of (-) 4502370 g. eq. CO<sub>2</sub>.
- c) The CO<sub>2</sub> emission from jute is carbon-neutral in nature since the product is from plant-source and can be considered as a bio-mass.

(ref. : [ww.areenfloors.com/HP/Linoleum/index.htm](http://ww.areenfloors.com/HP/Linoleum/index.htm))

CHG emissions from jute are negative on account of large carbon sequestration in Phase I. All synthetic geotextiles exhibit positive GHG emissions. Air-acidification of jute and JGT is also far lower when compared to other synthetic alternatives.

The life cycle of jute is shown below :

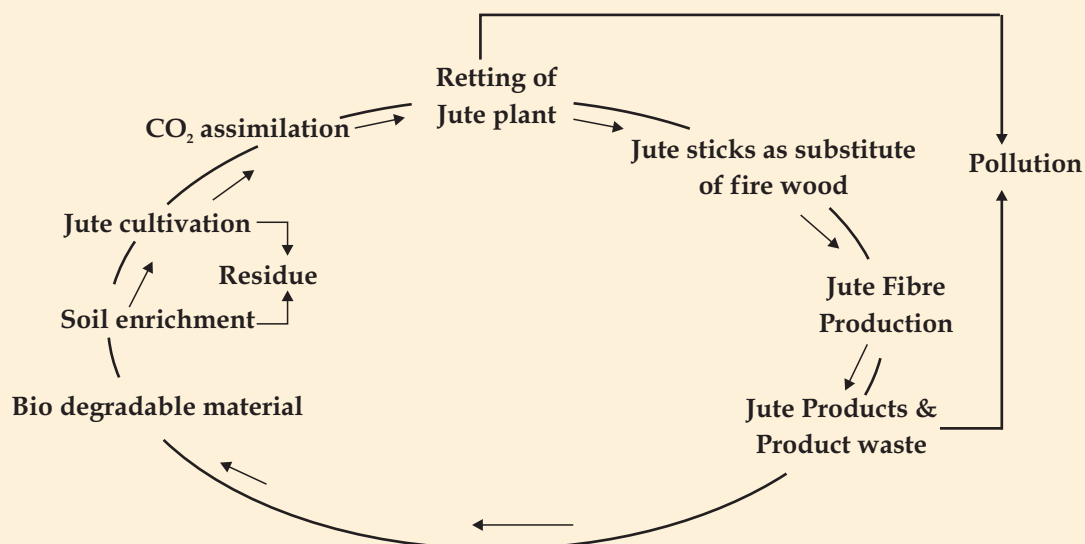


Fig- 2 : Life Cycle of Jute (based on Ray, Samanta & Datta, 2004)

Following points are relevant in the context of eco-concordance and socio-economic value of Jute :

- During the 100 days of jute growing period, 1 Hectare of jute plant can absorb about 15 MT of CO<sub>2</sub> from atmosphere and liberate about 11 MT of O<sub>2</sub>. Studies reveal that CO<sub>2</sub> assimilation rate of jute is several times higher than that of trees (Inagaki, 2000; USG 2003).
- The main use of jute stick (a retting output) is as fuel apart from other household uses. Yield of jute sticks is 2.5 times the fibre by weight. Taking overall production of raw jute / mesta fibre at 2.7 million tone (in India and Bangladesh), the total output of jute sticks comes to 6.75 million tons. Considering the other household use at 25% level, jute sticks annually saves 5.06 million tons of forest wood and bamboo in these two countries and help in preserving ecological balance.
- Leaves which are left in the field are good manures and increase the fertility of land.
- Jute cultivation creates a large direct employment to the farmers, industrial workers and indirect employment to workers associated with ancillary industries.

Environmental Protection Encouragement Agency, Hamburg is association with the FAO secretariat made a comparative study of jute and polypropylene

in respect of waste generation, energy consumption and CO<sub>2</sub> - emission. Data for embodies energy has been collected from [www.vuw.ac.nz / cdpr / documents / pdfs / ee-coefficients.pdf](http://www.vuw.ac.nz/cdpr/documents/pdfs/ee-coefficients.pdf), 16 Dec. 2006

### Comparison of environmental effects of Jute and PP Fibres per Ton Basis

Parameter	Jute	PP	Ratio (PP/Jute)
Waste produced (tons of Waste / ton of product)	0.9	5.5	6.1
Water Consumption per ton of product (m <sup>3</sup> )	54 to 81	1.3	0.016 to 0.02
Energy Consumption per ton of product (Giga Joules / ton)	5.4 to 14.35	84.3	5.69 to 15.6
CO <sub>2</sub> emission (tons of CO <sub>2</sub> / ton of product)	-1.2 to 0	3.7 to 7.5	-
Embodies Energy (MJ/Kg till delivery)	3.75 to 8.02	64 to 84.3	17.6 to 76.28

JGT poses no environmental threat. Being biodegradable JGT ultimately coalesces with the soil on which it is laid, exerts a mulching effect on soil, creates a congenial micro-climate, adds nutrients to it on bio-degradation and fosters quicker growth of vegetation. Unlike man-made Geotextiles which are not biodegradable, JGT does not pose disposal problems. (Special Report 21, IRC Highway Research Board, 2012)

The problem of GHG emissions in producing construction materials has of late attracted the attention of engineers prompting intensive search for and study on environment-friendly innovative alternative. The concern for environmental pollution as a result of unabated use of by-products of fossil fuel and mining of stones in construction has led to gradual shift from conventional materials to innovative less polluting construction ingredients.

### AVAILABILITY AND QUALITY CONTROL OF JGT

A number of jute mills are geared to manufacture customized JGT for specific end-uses. The list of manufacture / suppliers is available with NJB. NJB also provide technical support and guidance to the end users in regards to identifying site specific JGT and also provide installation guide lines at site.

There are full-fledged NABL accredited testing laboratories in Indian Jute Industries' Research Association (IJIRA) and Department of Jute & Fibre Technology (DJFT), Calcutta University (erstwhile IJT) where samples are sent for testing the quality of JGT before commercial production as well as prior to dispatch for application at site.

## **JUTE SECTOR AND NATIONAL ECONOMY**

Jute plays a crucial role in the national economy sustaining 4 million agricultural workers who cultivate jute and another almost half a million labour workforce engaged in production of jute goods. It is important to protect this sector which is a source of livelihood to many but it is even more necessary to protect the fibre in view of the long term implications for the environment. The Government of India had enacted the Jute Packaging Materials (Compulsory use in Packing Commodities) Act, 1987 which provides for compulsory use of jute in packing of certain commodities. This law was brought to protect the sector and it has achieved the purpose over the last two decades; state agencies use jute bags for storage of food grains and sugar mills use bags for packing sugar. However, the availability of cheaper substitutes (Polypropylene, Polyethylene), improvements in technology of bulk storage (such as in silos) and containerized transportation are challenges which may ultimately reduce the demand for jute bags in future. Diversified uses of jute deserve the Central & State encouragement from Government, particularly in segments where it has distinct environmental advantages, such as in geotextiles, need to be encouraged.

## **ANNEXURE I**

### **Sand Dune Stabilization with JGT**





# METHOD OF USING JGT IN FOUR MAJOR SOIL-RELATED APPLICATIONS

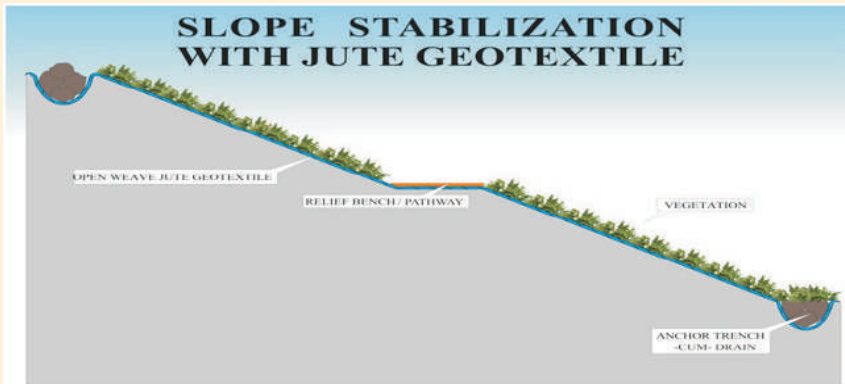


Fig. 1

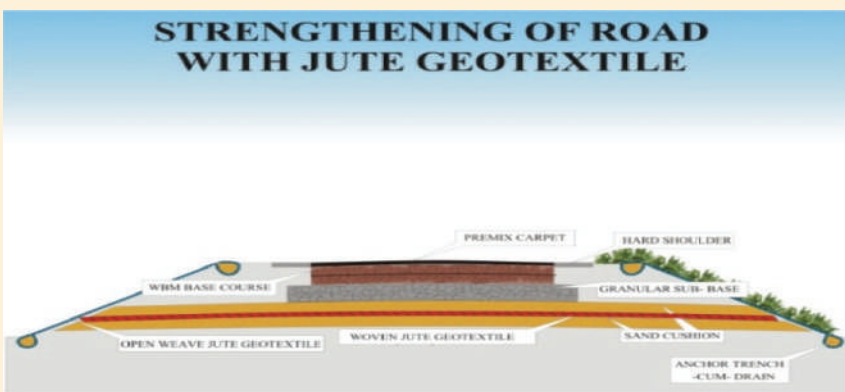


Fig. 2

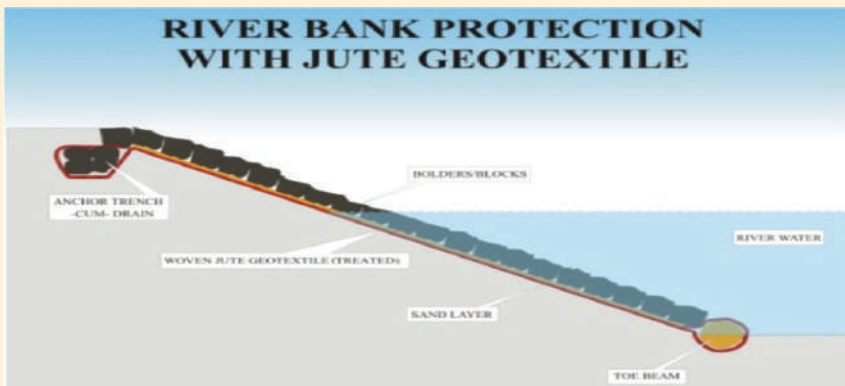


Fig. 3

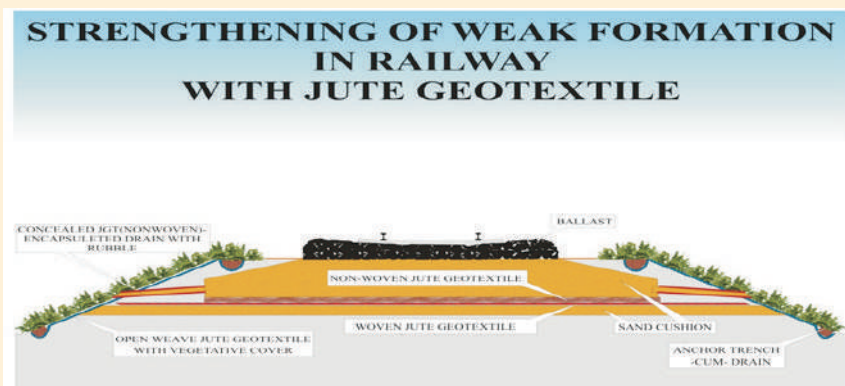


Fig. 4

## SPECIFICATION OF JUTE GEOTEXTILES

Construction	Double Warp Plain Weave for application in rural road IS 14715(Part1): 2016	Double Warp Plain Weave for application in river bank IS 14715(Part2): 2016	Open weave Jute Geotextiles (soil saver) for slope stabilisation IS 14986 : 2001		
Width (cm)	As agreed	As agreed		122 cm	
Weight (gsm) at 20% MR, Min	724	627 (To be treated with suitable additive)	Type -1 730 (No. tolerance)	Type -2 500 (No. tolerance)	Type -3 292 (No. tolerance)
Ends×Picks/ dm, Min	94x39	85x32	7x7	6.5x4.5	12x12
Thickness (mm)	1.85(±10%)	1.70(±10%)	7	5	3
Wide width Tensile strength (kN/m) MD x CD, Min	25x25	20x20	12x12 (N/10cm)	10.40x7.90 (N/10cm)	10x10 (N/10cm)
Elongation at break (%) MD x CD	10x10	8x8	10x12 (Max)	11x15 (Max)	12x12 (Max)
Puncture Resistance (kN), Min	0.500	0.400	x	x	x
Burst Strength (KPa) Min	3500	3100	x	x	x
Permittivity at 50 mm constant head (/s)	$350 \times 10^{-3}$	$350 \times 10^{-3}$	x	x	x
A.O.S. (Micron) O <sub>90</sub>	150-400	150-400	x	x	x
Aperture size (in)mm	x	x	12x12	13x20	8x7

### Control of Railway track subsidence with JGT



Table below shows the effect of JGT in enhancing CBR % of road sub-grade

INDIA							BANGLADESH					
Sl. No	Name of the Road	Type of Soil (Before Road Construction)	CBR before construction	CBR after construction	Span of time while the CBR increased (months)		Sl. No	Name of the Road	Type of Soil (Before Road Construction)	CBR before construction	CBR after construction	Span of time while the CBR increased (months)
1.	Udal to Chakrabhama, South Dinajpur, West Bengal	Silty Clay (CH- Inorganic clays of high plasticity)	2.8	11.39	47		1.	Turag-Rahitpur Bourvita Road	Silty Sand	3 (With JGT) 3 (Without JGT)	13.57 9.64	50
2.	Nihinagar to Hazratpur, South Dinajpur, West Bengal	Silty Clay (CH- Inorganic clays of high plasticity)	2.2	7.93	47		2.	Circular Road at Savar Cantonment	Medium to High Expansive Silty Clay	3.6 (With JGT) 3.6 (Without JGT)	12.68 7.61	34
3.	Kanksa to Bati, Murshidabad, West Bengal	Clayey Silt (CL-Inorganic clays of low to medium plasticity)	3.8	7.42	33		3.	Bancharampur southpara, Brahmanbaria	Silty Clay	2.3 (With JGT) 2.3 (Without JGT)	13.10 6.50	31
4.	Bagdimarimulo Barada Nagar to Damkal Kheya Ghat, Mathurapur, South 24 Paraganas, West Bengal	Silty Clay (CH- Inorganic clays of high plasticity)	2.8	11.39	47		4.	Tezkhali-Titas Riverghat Road Brahmanbaria	Clayey Silt	3.3 (With JGT) 3.3 (Without JGT)	8.2 7.7	33
5.	Promod Nagar to Muga Chandra Para, Agartala, Tripura	Data Not available	8	10.86	19		5.	Noabanki Shamnagar Road Saifkira	Silty Clay	1.4 (With JGT) 1.4 (Without JGT)	19.80 5	39
6.	Koracharahatfi to T-10 Road, Bidar, Karnataka	CL-Inorganic clays of low to medium plasticity	4	13.4	36							
7.	Devarahospet to Gundur, Davangere, Karnataka	CL-Inorganic clays of low to medium plasticity	2.8	14.6	36							

## Construction of paved PMGSY Road in Murshidabad district, W.B



Condition of Road before construction



JGT laid over sand layer



Finished Condition of road after 1 year (2015)

## Stabilization of slide zone of down-hill slope on Imphal - Jiribam Road ( NH-53), Manipur



Destabilized Slope



Installation of JGT



Stabilized Hill Slope

## Control of reflection cracks & potholes of rural road under PMGSY with use of JGT at Nadia, West Bengal



Damaged Road



Repaired surface of damaged road



Laying of JGT



Spreading Prime & Tack Coat on JGT



Pre-mix Carpeting



Finished Road

## River Bank Erosion control at river Phulahar, W.B.



View of Eroded River Bank



View during laying of JGT



View of condition river bank after three years of JGT application



## PREFABRICATED JUTE DRAIN FOR ACCELERATED CONSOLIDATION OF SOFT SOIL

### Indicative Specification

Material	Coir-wicks within Jute sheath
Width (mm)	100
Thickness (mm)	5
Strength (kN)/100 mm	45
Pore size (O <sub>90</sub> ) [micron]	300
Discharge Capacity at 50 kPa (ml/s)	13



PVJD installation in progress at Ballina, Australia

### APPLICATION AREAS

- AIRPORTS, WAREHOUSE, CAR PARKING
  - REPAIRING OF ROAD & RAILWAY EMBANKMENT
- MADE OF COMPRESSIBLE FILL MATERIAL

**Slope stabilization of cuttings, Northern railway's, Nangal, Panjab**



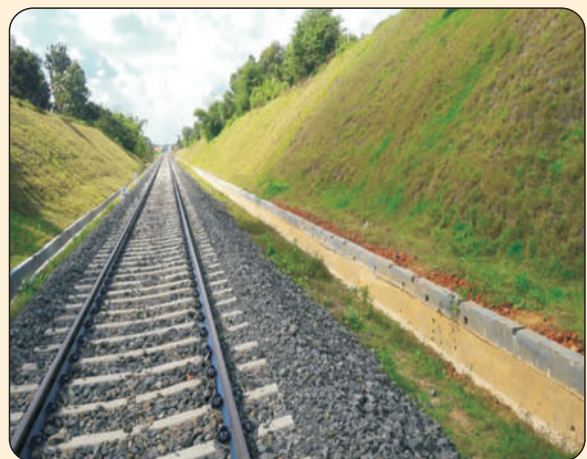
Eroded Slope of Cuttings



Dressing & Installation of JGT



Sprouting of grass seeds through pores of JGT



Slope Stabilized with Vegetative Cover



<b>राष्ट्रीय पटसन बोर्ड</b>	 <small>सत्यमेव जयते</small>	<b>NATIONAL JUTE BOARD</b>
National Jute Board   Ministry of Textiles   Govt. of India		

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