

## Typical Comparative Rate Analysis for Rural Road Construction Works of 1km

It has been found from laboratory studies corroborated by approximately 50 field trials in roads that with JGT application, CBR enhances by **at least 1.5 times** over the control value of sub-grade in all cases of field applications. Soil consolidation being a protracted process increment in CBR value is more than 1.5 times over varying periods after completion of works in question. Cost competitiveness of JGT in roads is best illustrated by a practical example.

### **Assumptions for Computation of Initial Construction Cost –**

As an example CBR of sub-grade soil is taken as 4% which is enhanced by 1.5 times the control value by use of JGT / SGT to 6%. The following are the assumptions for the example -

- a) CBR of sub-grade soil : 4%
- b) Considering Enhancement of CBR of sub-grade soil by 1.5 times from control value of 4% to 6%
- c) Cumulative Traffic ESAL : 60,000 – 1,00,000
- d) Length of Pavement : 1000 m
- e) Carriageway Width of Pavement : 3.75 m
- f) Width of JGT with 10% overlapping : 8.2 m

### ***The calculated savings are considered under idealized conditions of road construction.***

Rates of materials are as per SOR for Rural Works of Panchayat and Rural Development Department, WBSRDA 2012, Howrah Region of West Bengal. Sub-base layer consists of well graded material (Brick Bats and sand Gr- II and stone grit & sand Gr-III). The calculated savings may vary from region to region due to varying distances between worksite from source of materials. Cross-section of road is designed as per IRC:SP:72 – 2007 guidelines. Total thickness of pavement from IRC specifications for conventional method is taken as 325mm and with JGT/SGT pavement thickness as 275mm.

### **a) Rate Analysis of Initial Construction Cost /Base Course Materials (Cost per km Basis)**

Sl. No.	Description of Items	Rate of materials (Rs.)	Conventional Method		With Synthetic Geotextile		With Jute Geotextile	
			Quantity (m <sup>3</sup> )	Amount (Rs.)	Quantity (m <sup>3</sup> )	Amount (Rs.)	Quantity (m <sup>3</sup> )	Amount (Rs.)
1.	GSB – II	1350/m <sup>3</sup>	1000x8.8x0.1	1188000	1000x4.05x0.125	683438		
2.	GSB – III	1800/m <sup>3</sup>	1000x4.05x0.075	546750			1000x4.05x0.075	546750
3.	WBM (Gr. II)	2350/m <sup>3</sup>	1000x3.9x0.075	687375	1000x3.9x0.075	687375	1000x3.9x0.075	687375
4.	WBM (Gr.III)	2400/m <sup>3</sup>	1000x3.75x0.075	675000	1000x3.75x0.075	675000	1000x3.75x0.075	675000
5.	Sand below JGT	330/m <sup>3</sup>					1000x8.6x0.025	70950
6.	Woven JGT	70/m <sup>2</sup>					1000x9.0	630000
7.	Sand above JGT	875/m <sup>3</sup>					1000x5.0x0.025	109375
8.	Synthetic GT	130/m <sup>2</sup>			1000x9.0	1170000		
<b>TOTAL</b>				<b>3097125.00</b>		<b>3215813.00</b>		<b>2719450.00</b>

b) **Maintenance Cost during 5-year life phase** (Source : Handbook of Geosynthetics 2013 (ITTA))

Assume Cost of 25mm Overlay per sqm = Rs 250.00 and Area/km (3.75m width) = 3750 m<sup>2</sup>

Year	Conventional Method			With Synthetic Geotextile			With Jute Geotextile		
	Overlays (Rs.)	Maintenance	Cost/km (Rs.)	Overlays (Rs.)	Maintenance	Cost/km (Rs.)	Overlays (Rs.)	Maintenance	Cost/km (Rs.)
1		2.5 %	77500		1.5 %	48235		1.5 %	40500
2		2.5 %	77500		1.5 %	48235		1.5 %	40500
3		3.5 %	108500		2.0 %	64315		2.0 %	54000
4		3.5 %	108500		2.0 %	64315		2.0 %	54000
5	937500	3.5 %	1046000	937500	2.0 %	1001810	937500	2.0 %	991500
<b>Total Cost for 5 years</b>			<b>1418000.00</b>			<b>1226910.00</b>			<b>1180500.00</b>

**Comparative Analysis**

	Conventional Method	With Synthetic Geotextile	With Jute Geotextile	Savings using JGT vis-à-vis (per km)	
				Conventional	SGT
Initial Construction Cost	3097125.00	3215813.00	2719450.00	≈ 12.2 %	≈ 15.4 %
Maintenance Cost for 5 years	1418000.00	1226910.00	1180500.00	≈ 16.8 %	≈ 3.8 %
<b>Total Cost</b>	<b>4515125.00</b>	<b>4442723.00</b>	<b>3899950.00</b>	<b>≈ 13.6 %</b>	<b>≈ 12.2 %</b>

Thus for a range of CBR of sub-grade (2 – 6 %), the cost savings following the aforesaid design methodology the savings could be in the range of 11% – 16%.

**II. Typical Comparative Rate Analysis for River Bank Protection Works of 1km**

JGT provides effective and technically precise alternative to inverted granular filters conventionally used for riverbank protection. Properly designed woven JGT prevents migration of soil and helps in developing natural graded filter (*filter cake*) within the soil body. Replacing conventional inverted filter with JGT will conserve sufficient amount of materials, time and money with concurrent environmental advantages. Armour of boulders are placed over JGT to avoid direct exposure to sunlight and water as well as to dissipate the thrust of wave actions. An illustrative example below quantifies the cost savings.

**Assumptions for Computation of riverbank construction savings –**

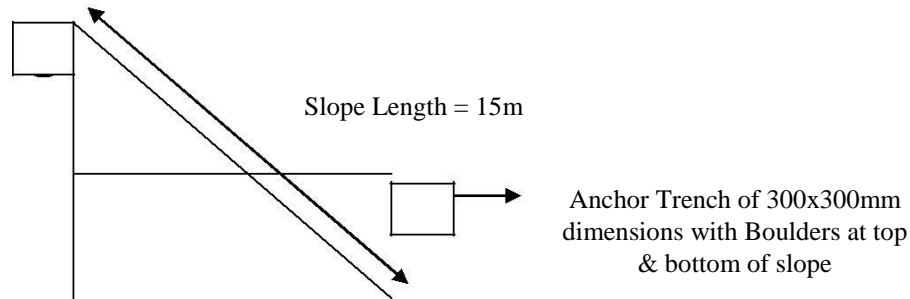
A typical cost comparative analysis has been done assuming the following :-  
Total Length of protection work = 1km

Length of Slope of protection work = 15 m

Thickness of conventional graded inverted filter = 125 mm

Quantity of JGT / SGT required for total length of protection work including anchorage (300 x 300mm trench) at toe and bottom = 17400 m<sup>2</sup>

Thickness of riprap/armor (boulders of 30/45 kg) = 300 mm



The rates are derived from SoR, Eastern Circle, I & W Directorate, Oct 2009. Rates of stone aggregates are inclusive of carriage by road transport and loading, unloading upto 50 km to the site location with 30% hike. The rate of JGT / SGT is considered as per prevailing market price. In case of riverbank protection works, *maintenance aspect has not been considered.*

**a) Rate Analysis of Initial Construction Cost (Cost per km Basis)**

Description of Materials	Conventional / Inverted Granular Filter			With Jute G.T			With Synthetic GT		
	Quantity (m <sup>3</sup> )	Rate (Rs./m <sup>3</sup> )	Amount (Rs.)	Quantity	Rate (Rs./m <sup>2</sup> )	Amount (Rs.)	Quantity	Rate (Rs./m <sup>2</sup> )	Amount (Rs.)
Filter Layer - Graded inverted filter 125mm thick	1000 x 15 x 0.125	2020.00	3787500.00						
Jute Geotextiles				1000 x 17.4	85.00	1496400.00			
Synthetic Geotextiles							1000 x 17.4	160.00	2784000.00
Boulder 30/45 kg of 300 mm thick riprap	1000 x 15 x 0.3	2100.00	9450000.00	1000 x 17.4 x 0.3	2100.00	10962000.00	1000 x 17.4 x 0.3	2100.00	10962000.00
<b>TOTAL</b>			<b>Rs. 13237500.00 ≈Rs. 883/m<sup>2</sup></b>			<b>Rs. 12458400.00 ≈Rs. 716/m<sup>2</sup></b>			<b>Rs. 13746000.00 ≈Rs. 790/m<sup>2</sup></b>

### COST COMPARISON WITH OTHER GTs

	Conventional Method (Rs/m <sup>2</sup> )	With Synthetic Geotextile (Rs/m <sup>2</sup> )	With Jute Geotextile (Rs/m <sup>2</sup> )	Savings using JGT vis-à-vis (per m <sup>2</sup> )	
				Conventional	SGT
Total Cost	Rs. 883/m <sup>2</sup>	Rs. 790/m <sup>2</sup>	Rs. 716/m <sup>2</sup>	≈ <u>19%</u>	≈ <u>9.5 %</u>

#### Inference-

Cost savings by use of JGT is of the order of 19% when compared to conventional granular filter and of the order of 9.5% when compared to synthetic geotextiles. The savings will vary with the location of the site and the distance of the source of materials.

### III. Typical Comparative Rate Analysis for Hill Slope Management Works

In slope management works there will be no direct savings using JGT / SGT/ Coir Geotextiles from conventional methods. JGT prevents soil erosion by fostering quick growth of vegetation on the eroded slope treated with open weave JGT which fits in with the present global trend of adoption of bio-engineering techniques to control top soil erosion. The major benefit is environmental. JGT however compares favourably cost-wise with other available geotextiles used in slope management.

#### Comparative rates between different types of geotextiles -

Rate of Synthetic GT. (Rs./m <sup>2</sup> )	Rate of Coir GT. (Rs./ m <sup>2</sup> )	Rate of Jute GT. (Rs./ m <sup>2</sup> )	Savings using JGT vis-à-vis (per m <sup>2</sup> )	
			Synthetic GT.	Coir GT.
65.00	40.00	20.00	≈ <u>69 %</u>	≈ <u>50 %</u>

N.B. Rates of fabric are indicative.

#### Inference –

There will be no direct savings due to use of JGT for slope management but there are obvious environmental advantages for using JGT for the application.