Case Studies

Some Case Studies in Low volume Roads
1. Re-construction of damaged highway on soft marine soil using JGT at Kakinada Port (Andhra Pradesh)

2. Strengthening of UT Road - Jorabari with JGT (Assam)

3. Strengthening of Chatumary - MDR14 road with JGT (Odisha)

4. Widening and strengthening of Munshirhat – Rajpur Road with JGT (West Bengal).

5. Strengthening of Andulia – Boyratola Road with JGT (West Bengal)
Re-construction of damaged highway on soft marine soil using JGT at Kakinada Port – Andhra Pradesh
• **LOCATION**: Kakinada Port Area, Andhra Pradesh

• **SITE CONDITION:**
The subsoil is soft clay up to 4m depth and water table is about 0.5m below G.L.

• **SOLUTION:**
Woven JGT was used to re-build & strengthen the damaged carriageway on the existing soft soil

• **CLIENT NAME:**
CRRI and Kakinada Municipality

• **YEAR OF APPLICATION**: 1996

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**CROSS-SECTIONAL DETAILS OF PAVEMENT WITH JUTE GEOTEXTILE**

Pavement composition

JGT on prepared sub-grade overlain by compacted sand of 1.2 m as sub-base & 10 cm thick compacted gravel as base. 1m deep side drains on either side
• **PROPERTIES OF SUBGRADE SOIL:**
  Plasticity Index: 32
  CBR of un-soaked specimen: 2.1%
  CBR of soaked specimen: 1.61%
  Soil type: CH

• **PROPERTIES OF JUTE GEOTEXTILE USED:**
  Weight: 760 gsm
  Tensile Strength: 20 kN/m
  Pore Size ($O_{90}$): 300 micron
  Type of JGT: Woven (Rot-proof)

[Laying of JGT over sand]

[Finished road after 7 years of construction]
**CBR VALUES OF SUB-GRADE SOIL BEFORE AND AFTER LAYING OF JGT**

<table>
<thead>
<tr>
<th></th>
<th>Natural soil (before laying JGT)</th>
<th>Improved soil (after laying JGT)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CBR %</td>
<td>CBR %</td>
</tr>
<tr>
<td>Un-soaked specimen</td>
<td>2.10</td>
<td>6.03</td>
</tr>
<tr>
<td>Soaked specimen</td>
<td>1.61</td>
<td>4.78</td>
</tr>
</tbody>
</table>

*Test was performed after 30 months of laying JGT*
FINDING:

• Jute Geotextile helped increase of CBR% in weak marine soil even after reduction in the strength of JGT after a lapse of 7 years as reflected from the performance and increase in CBR.
Strengthening of UT Road - Jorabari (Assam) with JGT
• **LOCATION:**
  The road (UT Road to Jorabari) is located at Udalguri in Darrang district, Assam

• **SITE CONDITIONS:**
  This was an earthen road under PMGSY Pilot project. Flash flooding of the area occurs occasionally. Deep ruts had formed at some locations. Average annual rainfall is 1600 – 1700 mm. The water table is 3 to 4 m below G.L during summer and 1.5 to 2 m during monsoon.

• **SOLUTION:**
  Jute Geotextile was used on sub-grade to strengthen the road.

• **ROAD LENGTH:** 4.6 Km

Before construction

Pavement composition
Woven JGT sandwiched bet. sand layers (100) & overlain by GSB (100), gravel (100) & WBM Gr III (75) with bituminous overlay
• CLIENT NAME:
Chief Engineer PWD, Rural Road Works, Assam
• YEAR OF APPLICATION: 2007
• PROPERTIES OF SUBGRADE SOIL:
  Liquid Limit: 24%
  Plastic Limit: Non-plastic
  CBR of soaked specimen: 4%
  Soil type: ML
• PROPERTIES OF JGT USED:
  Weight: 643/760/810 gsm
  Tensile Strength: 15/20/30 kN/m
  Pore Size ($O_{90}$): 150 – 200 micron
  Type of JGT: Woven (Rot-proof)
CBR VALUES OF SUB-GRADE SOIL BEFORE AND AFTER LAYING OF JGT

<table>
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<tr>
<th>Natural soil (before laying JGT)</th>
<th>Improved soil (after laying JGT)*</th>
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<tbody>
<tr>
<td>CBR %</td>
<td>CBR %</td>
</tr>
<tr>
<td>Soaked specimen</td>
<td>Soaked specimen</td>
</tr>
<tr>
<td>4.00</td>
<td>14.30</td>
</tr>
</tbody>
</table>

*after 3 years
FINDING:

• The CBR values increased by more than 3.5 times with decrease in moisture content.

• The blacktop pavement surface was distress-free in all the sub-sections during the entire period of performance monitoring.

• Shoulders as well as side slope was in shape without any rain-cut or settlement with green grass over it.
Strengthening of Chatumary – MDR-14 road, Odisha with JGT
• **LOCATION:**
The road (Chatumari to MDR 14) is located under Tehsil – Bari in Jajpur district, Odisha.

• **SITE CONDITIONS:**
This was an earthen road under PMGSY Pilot project. Deep ruts had formed at some locations. Average annual rainfall is 1400 mm. The water table is at a depth of 1.5 to 3 m.

• **SOLUTION:**
Jute Geotextile was used on sub-grade to add to stability of the road.

• **ROAD LENGTH:** 2.67 Km

Pavement composition
Woven JGT sandwiched bet. sand layers (100) & overlain by GSB (100), gravel (100) & WBM Gr III (75) with bituminous overlay
• **CLIENT NAME:**
  Chief Engineer PWD, Rural Works – II Orissa

• **YEAR OF APPLICATION:** 2007

• **PROPERTIES OF SUBGRADE SOIL:**
  - Liquid Limit: 27%
  - Plastic Limit: Non-plastic
  - CBR of Soaked specimen: 3%
  - Soil type: ML

• **PROPERTIES OF JGT USED:**
  - Weight: 643/760/810 gsm
  - Tensile Strength: 15/20/30 kN/m
  - Pore Size ($O_{90}$): 150 – 200 micron
  - Type of JGT: Woven (Rot-proof)

*Laying of Jute Geo-textile*

*Finished Road*
CBR VALUES OF SUB-GRADE SOIL BEFORE AND AFTER LAYING OF JGT

<table>
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<th>Natural soil (before laying JGT) CBR %</th>
<th>Improved soil (after laying JGT)* CBR %</th>
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<tbody>
<tr>
<td>Soaked specimen</td>
<td>Soaked specimen</td>
</tr>
<tr>
<td>3.00</td>
<td>10.13</td>
</tr>
</tbody>
</table>

*after 2 years
FINDING:

• The CBR values increased more than 3 times with decrease in moisture content.
• The blacktop pavement surface was distress-free in all the sub-sections during the entire period of performance monitoring.
• Shoulders as well as side slope condition was satisfactory with a green cover of grass.
Widening and strengthening of Munshirhat – Rajpur Road (West Bengal) with JGT.
• **LOCATION**: Munshirhat to Penro Khila Rajpur Road, Howrah, West Bengal.

• **SITE CONDITIONS**: It is a rural road which was to be widened to carry the increased traffic.

• **SOLUTION**: Jute Geotextile was laid on the extended portion.

• **ROAD LENGTH**: 2 Km

• **CLIENT**: Howrah Highway Division, PW (Roads) Deptt., Government of West Bengal

• **YEAR OF APPLICATION**: 2000
• PROPERTIES OF SUBGRADE SOIL:
  
  O.M.C : 19%
  Plasticity Index : 19%
  CBR of Soaked specimen : 3.5%
  Soil type : OL

• PROPERTIES OF JGT USED:
  
  Weight : 760 gsm
  Tensile Strength : 20 kN/m
  Pore Size ($O_{90}$) : 300 micron
  Type of JGT : Woven (Rot-proof)

Pavement composition
Woven JGT was placed on the sub-grade of the widened portion overlain by 2 layers of brick soling as sub-base and WBM (150) as base layer with bituminous top (20 cm PMC).
CBR VALUES OF SUB-GRADE SOIL BEFORE AND AFTER LAYING OF JGT

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</tr>
<tr>
<td>Soaked specimen</td>
<td>Soaked specimen</td>
</tr>
<tr>
<td>3.50</td>
<td>6.0</td>
</tr>
</tbody>
</table>

*after 1 year
FINDING:
The sub-grade was strengthened by application of JGT attaining CBR value of 6% from initial 3.5% with decrease in liquid and plastic limits. No distress of the road was noticed after several years despite increase in projected traffic load.
Strengthening of Andulalia – Boyratola Road, West Bengal with JGT
• **LOCATION:**
Andulia (Kalupukur More) to Boyratala in Haroa Block, District North 24-Paraganas, West Bengal.

• **SITE CONDITIONS:**
Rural road under PMGSY on soft sub-grade resulting in reduction of effective pavement thickness due to interpenetration of sub-base and sub-grade.

**SOLUTION:**
Jute Geo-textile was used on the sub-grade and under the sub-base basically as a separator.

• **ROAD LENGTH:** 3.3 Km

Pavement composition
Woven JGT overlain by GSB (200)) & WBM II& III (150) with bituminous overlay (PMC)
• **CLIENT NAME:**
  North 24-Paraganas Zilla Parishad, West Bengal

• **YEAR OF APPLICATION:** 2005

• **PROPERTIES OF SUBGRADE SOIL:**
  Optimum Moisture Content: 23.5%
  Plasticity Index: 18.10
  Soaked CBR at 2.5mm penetration: 3.22%
  Soaked CBR at 5.0mm penetration: 3.16%
  Soil type: OL

• **PROPERTIES OF JGT USED:**
  Weight: 810 gsm
  Tensile Strength: 30 kN/m
  Pore Size ($O_{90}$): 150micron
  Type of JGT: Woven JGT
# CBR VALUES OF SUB-GRADE SOIL BEFORE AND AFTER LAYING OF JGT

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<tr>
<td>Soaked specimen</td>
<td>Un-soaked specimen</td>
</tr>
<tr>
<td>3.16</td>
<td>10.47</td>
</tr>
</tbody>
</table>

*Test was performed after 18 months of laying JGT*
Some Photographs of JGT-treated Rural Roads
Typical cross-section of a low volume road with JGT

COMPACTED SHOULDER

MIN. SIDE SLOPE 1:2

1875
SHOULDER

266
3%
SLOPE

2.5%
SLOPE

2.5%
SLOPE

225
SHOULDER

COMPACTED SHOULDER

20THK PREMIX CARPET WITH SEAL COAT
75THK WBM GR II
75THK WBM GR III
175 THK GSB(CBR NOT LESS THAN 30)
50 THK SAND LAYER
COMPACTED SUBGRADE (LOCAL SOIL)

TYPICAL CROSS-SECTION OF ROAD — (1)

SCALE 1:25

NOTE: ALL DIMENSIONS ARE IN MILLIMETRE UNLESS SPECIFIED OTHERWISE.
Natural geosynthetics, especially JGT, deserves encouragement from the Govts-state & central, consultants & end-using organizations considering in the first place its effectiveness, distinct environmental advantages & ultimate economy and finally for its role in the national economy sustaining directly and indirectly a work-force of 4 million people and earning valuable foreign exchequer for the country.

National Jute Board (NJB), a national body under MoT, constituted under an Act of the Parliament, is ready to provide free technical support & consultancy services to any willing organization for use of JGT.