

Novel Use of Jute Bags for Rural Roads in Developing Countries

Tapobrata Sanyal

Geotechnical Advisor, Jute Manufactures Development Council, Kolkata-700 016

ABSTRACT: In far-flung rural areas in developing countries, quick construction/restoration of pathways is imperative. Used jute-bags filled with locally available fine aggregates may provide an answer to such a situation. Similar technology, known as 'do-now' technology, has been used successfully in some developing countries.

1 INTRODUCTION

Maintaining trafficability of unpaved rural roads in developing countries such as India especially during wet seasons has long been a problem. In India the situation has vastly improved as a result of implementation of PMGSY. But there still remain roads that lose their traffic-worthiness during the monsoon in particular. Rural road sites are usually far from the nearest facility-points which is why there is delay in addressing the problems and restoring normalcy. It is worth exploring if the villagers can be involved in maintaining such roads with easy-to-use indigenous technology. This will help in poverty alleviation in such areas and empower the rural community with additional resources. There are several schemes of the Central Government that may be utilized for this purpose through Panchayats (e.g. Jawahar Rozgar Yojana).

In this paper concept of a new indigenous technology is presented for maintaining traffic-worthiness of unpaved rural roads. The technology may be suitably modified commensurate with the prevailing conditions.

“Do-nou” Technology

An innovative concept has been developed in Japan and has been applied successfully in Papua New Guinea, Philippines and Kenya (Kimura & Fulkubayashi-2007). The technology has been named “do-nou” which, in Japanese, means soil-bag. Studies have confirmed high compressive strength and can be applied in as soil reinforcement for railway’s ballast foundation, soft building foundation and in retaining walls (Matsuoka & Liu—2003).

The “do-nou” technology consists in placement of fine aggregates inside bags arranged usually in two layers one above the other. The bags are usually used bags for sugar, crop-seeds, fertilizer. The advantages are—

- bearing capacity is improved
- bags are cheap and available in rural areas
- no special construction equipments are necessary
- suitable for encapsulating a wide range of fine aggregates.

When filled-in bags are subjected to extraneous moving loads, tensile strength develops along the bags. This induces a sort of ‘membrane effect’ enabling the bags to sustain higher loads. It is necessary to control the degree of compaction of the fine aggregates placed inside the bags. Compaction machines (e.g. plate compactor) being not available in rural areas, improvised methods of compaction are used in “do-nou” technology. Wooden mallets

are often used for compaction. Sometimes thumping with foot is also done. A comparative assessment of compaction with plate compactor vis-à-vis compaction by improvised methods may be done to ascertain the number of blows by wooden mallets or the number of foot-thumps. Normally 10 blows with wooden mallets achieve almost the same degree of compaction with plate compactor (Kimura & Fulkubayashi-2007).

In unpaved rural roads ruts develop due to clay content in the riding surface which causes ‘slip’ between the wheel and the riding surface. The lack of wheel grip exerts a kind of kneading effect reducing the shear strength of the riding surface. Ruts developed as a consequence deepens. The problem can be obviated by arraying bags encapsulating appropriate aggregates on the road surface as indicated.

The pre-conditions for a technology to be effective and acceptable in rural road construction are—

- easy availability of the construction materials
- labour-intensive methodology
- & --economy.

“Do-nou” technology fulfills the aforesaid criteria besides empowering the rural community to become self-reliant.

Application of “Do-nou” Technology with Jute Bags

The proponents of the Japanese concept have not stated about the kind of bags used in “do-nou” technology. Mention has been made of utilizing used bags containing sugar, cereals etc for the technology. It appears that B-Twill jute bags may be conveniently used for the purpose. The bags may be new or used.

The Bureau of Indian Standards recommends the following specifications for 50 kg sacking bags for packing of food grains (vide IS:12650:2003).

- outside length-94 cm
- outside width-57 cm
- ends/dm-76
- picks/dm-28
- corrected mass/bag- 665 g
- minimum average breaking strength (raveled strip method 10cm x 20 cm)
 - warp-1570 N
 - weft- 1420 N
- minimum average seam strength-490 N
- maximum moisture regain-22%

It is advisable to put conventional used jute bags on trial first before deciding on workable specifications for bags.

The second point of consideration is regarding the fill material. Sand is the preferred material; but its availability near sites is doubtful in majority of areas. Suitable granular materials such as moorum, kiln waste may be considered as fills.

The third point of importance is regarding the riding surface which should allow cycles, push carts to move smoothly over it. Occasionally light trucks, automobiles will require using such roads. This will necessitate providing a stable cushion over the filled jute bags. Depressions between two bags need be leveled with a suitable material. In fact the problem of finding suitable fill and cushion materials has to be solved by making use of locally available materials.

It is also important to arrange jute bags in such a way that the wheels of automobiles, manually driven carts etc do not come over the depressed portions separating two bags. Properly arranged bags will obviate problems of riding. A typical arrangement is shown in Fig 1.

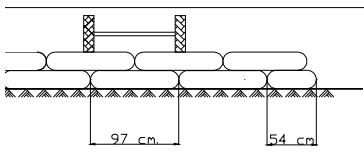


Fig. : Arrangement of Jute Bags

It is also necessary to tie up the bags with strong jute/coir threads to prevent displacement. Moving loads on jute bags will cause the bags to shift laterally. It is better to have some sort of lateral restraint with short bamboo stakes on either side of the pathway.

Indicative Cost- estimate

Approximate cost of a pathway with “do-nou” technology is indicated below based West Bengal experience. Cost of the fill material has not been considered as it will depend on the location of the source, distance from the site, mode of transport and above all, the cost of ‘borrowing’ if any.

- Cost of new jute bags-Rs 19.00
- Likely cost of used jute bags-Rs 15.00
- Transport cost of bags-Re 1.00 per bag (variable: depends on distance)

- No of jute bags required per % meter of a road with width of 3.88 meters-1440(approx) for 2 layers
- Cost of jute bags % meter - Rs 23,040.00 (A)
- Labour charges for filling & placing 1440 bags @ Rs 5.00 per bag=Rs 7,200.00 (B)
- Overhead-15% of (A)+ (B)- Rs 4,53600 (C)
- Total approximate construction cost %meter- **Rs 34,776.00 per %meter or Rs 89.62 per sqm**

Maintenance

Maintenance of the pathway is supposed to be done by the villagers themselves. Frequency of maintenance will depend on the type of conveyances using the pathway, their load and intensity. Second-hand jute bags should be kept handy for replacing damaged bags as soon as necessary though there is possibility of degradation of jute bags if stored for a long period. Location of the source of the fill materials should be known to villagers.

Closure

Admittedly “do-nou” technology is applicable in road construction where essential road-making facilities are not readily available. It is a temporary method of construction for ensuring improvised connectivity in far-flung rural areas. It is likely that such improvised pathways will be replaced by stable pavements in near future. But its utility will remain especially during and after floods when the need for a pathway at a sufficiently high level may have to be constructed without loss of time.

Acknowledgement-

The author gratefully acknowledges help provided by Sh P K Chaudhury, Sh Dipak Banerjee, Sh N K Mukherjee and Sh Arindam Das.

References:

- Matsuoka H & Liu S (2003)-“*New earth reinforcement method by soil bags (Do-nou)*” -Soils & Foundations, Japanese Geotechnical Society Vol 43.
- Kimura M & Fukubayeshi Y (2007)-“*Geotechnique for rural infrastructures to empower communities*”-Proc. of the 13th Asian Regional Conference on Soil Mechanics & Geotechnical Engineering, Kolkata, India- Vol II (post- conference volume)

C:\Documents and Settings\Geotech\Desktop\Paper on a new use of JGT in rural roads.doc