



International Network for Bamboo and Rattan

CORRUGATED BAMBOO ROOFING SHEETS

A MODERN WAY TO SHELTER UNDER A BAMBOO

Source of the Technology

Forest Science Institute, Hanoi, Vietnam and other institutions in India and China.

Expected Benefits

Income generation for rural peoples, environmental amelioration, skills enhancement.

Suitable for

Community-based enterprises, individual particularly female weavers

Key Words

Corrugated Bamboo Roofing Sheets, income generation, poverty alleviation, employment.

Corrugated bamboo roofing sheets



Corrugated bamboo roofing sheets (CBRS) are an excellent alternative to corrugated asbestos, iron, plastic or zinc roofing sheets. They are produced from natural materials and are attractive, durable and resilient to adverse weather conditions and pest attack. They can be produced in a range of standard sizes and can be used to roof dwellings, stores, animal pens and other buildings. They are quieter in the rain and cooler in the sun than metal sheets – a study in India has shown that cows in sheds roofed with CBRS yield more milk than those under corrugated iron sheets because the bamboo sheets keep the shed cooler.

CBRS are produced by pressing firmly together woven bamboo mats that have been impregnated with an adhesive resin. The corrugations are formed by pressing them between corrugated pressing plates in the pressing machine.

Impact on Poverty and Environment

The environmental benefits of a CBRS - producing unit are considerable. The use of large quantities of bamboo used in the production of mats promotes the sustainable management and increased area of plantations of bamboos. The cultivation of bamboo is also beneficial for soil conservation and afforestation activities and plantations are often encouraged as part of social forestry programmes.

The employment opportunities for a range of people in rural areas are considerable. A unit producing half a million

square metres of roofing sheet per year will create employment for about 200 people, most of whom will be required for the production of bamboo mats. More economic activities will be created in the region, particularly in the marketing and selling of the sheets, and the social and cultural conditions of the communities involved should improve as a result. The large scale use of corrugated iron roofing sheets in low-cost housing programmes offers considerable opportunities for substitution by bamboo roofing sheets, and hence potentially very large markets.

The main development attributes of the technology are:

- Increase in the area of bamboo plantations will benefit the environment and protect precious forest resource through substitution of bamboo wood for timber.
- Rehabilitation of degraded forests and other waste lands through planting bamboo.
- Creation of employment opportunities in bamboo cultivation, splitting, mat weaving and the CBRS unit itself.
- Opportunities for family members, particularly women, to spend their time weaving bamboo mats at or near their homes for income generation.
- The CBRS unit is not capital-intensive but is labour-oriented and develops small-scale industries in rural and mountainous regions.

The main advantages of the technology are:

- CBRS are an environmentally friendly and safe alternative to asbestos, zinc or corrugated iron roofing panels.
- The sheets are also quieter in the rain and cooler in the sun than metal roofing panels.
- The sheets are durable and strong with excellent internal bond strengths and high resistance to weathering and biological agencies such as insect attack.
- They have a natural appearance.

Key points for success

A CBRS factory can be very successful and bring significant long-term benefits to poor rural communities. The forwards and backwards linkages required for sustainability of the business support many more people than work at the factory itself, including bamboo growers and harvesters, transporters and marketing people.

The essential requirements for a successful corrugated bamboo roofing sheets unit are:

- Land for the unit.
- Regular supply of raw bamboos for weaving into mats
- Access to appropriate machines and equipment for the production of mats and sheets and some technically trained personnel to install, manage and maintain the unit.
- Availability of skilled bamboo weavers, or people willing to be trained.
- Coordinated means of transporting bamboos to decentralised weavers and mats from weavers to the factory.
- Reliable electricity supply.
- Suitable markets and marketing mechanisms for sheets
- Start-up capital

Producing corrugated bamboo roofing sheets

The process of producing corrugated bamboo roofing sheets involves six steps, and is identical to the production of bamboo mat board, except that the sheets are formed by pressing the mats between corrugated rather than flat pressing plates:

1. Bamboos are split into thin slivers
2. Slivers are woven into mats
3. Mats are soaked in adhesive resin
4. Mats are allowed to drain and dry
5. Mats are pressed together under high temperature and pressure using corrugated pressing plates.
6. Sheets are trimmed to shape.

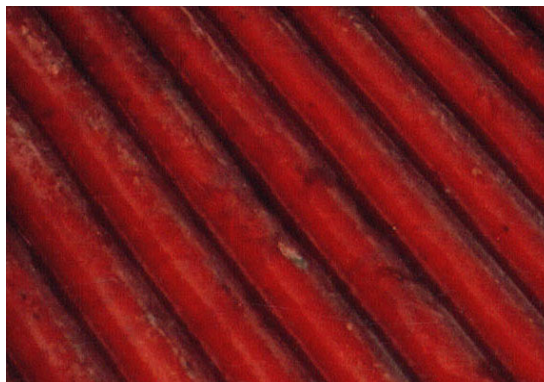
The main materials are bamboo slivers to produce the bamboo mats and adhesive resin in which to soak the mats. A resin applicator is needed, and a drying chamber is optional. Corrugated pressing plates for the hot press are, of course, essential.

Details of the process of producing mats, preparing the resin, soaking drying and pressing are given in INBARs Bamboo Mat Board Technology Page which can be accessed here: (<http://www.inbar.int/livelihood/doc/Matboard.pdf>).

Uses and Markets

CBRS have significant potential in low-cost bamboo housing, both in commercial production and in government sponsored housing schemes. India's IAY housing scheme is a prime example, with 15, 000 low cost houses built each year the roofs of which could all be of bamboo roofing sheets. Although there is often no major price difference between bamboo and metal roofing sheets, the environmental benefits of the sheets, coupled with the far greater involvement of local peoples in their production (and hence increased incomes that come directly to them from their involvement) means that bamboo roofing sheets are more favourable for

rural and community development and for environmental sustainability than metal sheets.



Financial aspects

Based on an example from Vietnam

The capital cost of establishing a CBRS unit producing 500, 000 m² of roofing per year is 375 million VN Dong (USD\$25, 600). The costs of producing a single, 5-layered corrugated bamboo roofing sheet, 0.8 x 2.0 m in size, in this sample factory is US \$1.96. Further details of the financial aspects of producing roofing sheets are given in INBARs CBRS Transfer of Technology Model (TOTEM).

References and further reading

Corrugated Bamboo Roofing Sheets TOTEM from INBAR via <http://www.inbar.int/totem/totemain.asp>.

Bamboo Mat Board TOTEM from INBAR via <http://www.inbar.int/totem/totemain.asp>.

Bamboo Splitting and Slivering TOTEM from INBAR via <http://www.inbar.int/totem/totemain.asp>.

<http://www.bamboocomposites.com> – IPIRTI's bamboo subsite, with contacts therein.

Ganapathy, P. M., Zhu H.M., Zoolagud, S.S., Turcke, D. and Espiloy, Z. B. 1996. Bamboo Panel Boards - A State of the Art Report (<http://www.inbar.int/publication/pubdetail.asp?publicid=12>)

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