

BAMBOO FLOORING MANUFACTURING UNIT

Synopsis: Laminated bamboo flooring is a unique flooring material. The natural grain of the bamboo shows up clearly and is very attractive. The flooring is resistant to moisture, pressure and damage. Laminated bamboo flooring is produced by splitting bamboo culms into thick sections or sheets. These are then coated with resin, assembled into units three layers thick and then pressed firmly together in a hot press. After curing the pieces are trimmed to shape and painted or varnished. Bamboo flooring boards are very popular worldwide and markets are developing in Japan, Europe and North America. The unit will provide employment for unskilled, semi-skilled and technically trained people in the rural communities in which it is established.

Detailed description of the technology

PART ONE

INTRODUCTION

DEVELOPMENT ATTRIBUTES, TARGET GROUPS and BENEFITS

1. Introduction

Sympodial bamboo flooring is a type of decorative flooring. It is a high quality product that can be used widely and has a large consumer market. It has many advantages, such as its smoothness, stability, resistance to wear, sound insulation, resistance to dampness, pressure resistance, and flexibility. The bamboo floor has a soft and natural lustre, and maintains the natural gloss and grain of the bamboo culm. Bamboo flooring is exceptional and unique and very attractive.

In order to meet increasing demands for wood-based products, many forests have been over-harvested in recent years. Developing non-tree wood alternatives is one means of solving the problem. Sympodial bamboos grow fast, produce a high yield and can become fully rejuvenated within a few years of cutting. Bamboo is a perfect substitute for some wood based products. Bamboo is highly suited to the production of flooring. Bamboo flooring has some excellent advantages over wood flooring, such as its high strength and size stability, and its special decorative effects, so it is popular and has a large market potential in China, Europe, Japan and North America.

2. General development attributes and advantages

The main development attributes of the technology are as follows:

- Provides employment and income generation for rural people
- Increases the use of natural bamboo resources and promotes timber substitution
- Improves living standards of the rural communities in which it is established

The main advantages of the technology are:

- Bamboo flooring is more attractive than wood flooring
- It is cheaper to produce and hence the retail price is cheaper

- Bamboo flooring is more marketable due to its production from renewable bamboo resources.

3. Suitable agro-ecological regions

There are rich sympodial bamboo resources in the tropics and subtropics and the unit may be established anywhere throughout these regions. Once the bamboo forest is mature culms can be harvested every year. The unit is especially suitable for areas where bamboo plantations are desirable for the restoration of degraded forests or wastelands such as abandoned shifting cultivation areas, or where bamboos can be grown to reduce soil erosion, particularly on steep slopes in high rainfall areas. Bamboo can thus play an important role in raising the productivity of degraded land and in protecting the environment and forest ecology.

4. Target groups

The main target group are the people that will be employed by the unit. The unit will require unskilled, semi-skilled and technically trained personnel and these can all be recruited from the community in which the unit is established. If established as a community cooperative then all members of the community will benefit. Another target group are the local bamboo cultivators who will benefit from the increased area of plantations and demand for bamboo culms that the unit will generate.

5. Requirement for success

The essential requirements for a successful bamboo flooring manufacturing unit are:

- Start-up capital
- Source of raw bamboo materials
- Secure workforce
- Market access

Concluding remarks

The bamboo flooring unit is a commercially and socially effective means of processing bamboo into quality flooring materials. It has significant potential for income and welfare improvement for poor rural people both in the unit itself and in its forward and backward linkages. In addition, by using bamboo as a substitute for wood timber it reduces environmental degradation due to the overharvesting of timber trees. The unit requires considerable start-up capital and may be best established with the guidance of state agencies or NGOs.

PART TWO

THE BAMBOO FLOORING MANUFACTURING UNIT

1. Introduction

Laminated bamboo flooring is produced by the following basic steps

- Production of longitudinal bamboo sheets (sections)
- Bleaching sheets
- Drying, sanding and selecting sheets
- Applying glue to sheets and allowing them to dry
- Hot pressing sheets together into floorboards
- Shaping floorboards
- Sanding and painting floorboards

2. Production of bamboo flooring

There are two types of floor based on the colour: naturally-coloured floor, and coffee-coloured floor and two types based on the arrangement of bamboo sheets: horizontal and vertical.

The processing procedure is as follows:

2.1. Raw materials

Sympodial bamboos with large diameter culms are suitable for manufacturing flooring (e.g. *Dendrocalamus giganteus* Munro, *D. barbatus* Hsueh et D.Z. Li and *D. membranaceus* Munro). Culms with a diameter at breast height of over 10 cm should be harvested when four years old. The culms are first crosscut into sections of the desired length (the floor length plus an additional 11-13.5cm) and the sections are then cut into slips of the same width (25 cm, 30 cm or 35 cm). Bamboo sheet is produced after planing the slips to the same width, thickness and length.

2.2. Manufacturing bamboo sheets

Because bamboo can not be cut in some seasons (eg. spring), the factory should store some dried bamboo sheets according to its manufacturing capability. Boiling is a key procedure in the manufacturing of floors. It removes some water-soluble extracts and at the same time can add insecticides and preservatives if these are included in the boiling mixture. Bamboos are usually boiled for about 3-4 hours.

After being boiled all the bamboo sheets are piled up in the drying kiln (800C) for 4-5 days. If the sheets have been carbonised, they are removed when the moisture content reaches 14-25%. The moisture content of other dried sheets is reduced to 5-8%.

At present, there are the two main ways for color treatment: bleaching and light carbonisation. In bleaching, the bleaching agent solution can be brushed onto the surface of the bamboo sheets, and the bleaching agent, such as H₂O₂, can be added to the water during boiling. In

carbonization, high temperature and moisture are required to treat bamboo sheets in a closed container. Steam at 0.3 MPa is passed into the container for 40-120 minutes. Then the sheets are taken out and piled up to dry to 5-8% moisture content. After finishing the sheets are planed to a thickness variation allowance of 0.2mm.

Sheets are then selected to weed out faulty sheets and to reduce the colour differences among the sheets, so that finished floor has an even colour.

2.3. Laying up and hot pressing

Urea-formaldehyde (UF) adhesive is usually used to bond bamboo sheets. The solid content of UF adhesive is above 60%, the viscosity is 30-50 Pa.S and the free formaldehyde content is below 0.5%. Modifiers can be added to UF adhesive to improve its properties, or an alternative adhesive can be used.

Usually floors are made of 3 layers. There are two kinds of flooring: one in which the three layers are parallel to each other, and the other in which the outer layer and the central layer are vertically orientated. The two edges of the bamboo sheet and both surfaces of the central sheet should be spread with liquid adhesive at about 150g/m² per surface. Sheets of the same color should be placed on the upper face and those of different colours may be used for the lower and central layers. String is used to tie the sheets after laying up. UF adhesive should be spread on both surfaces of each sheet for a vertical floor at a similar rate. The inner and outer surface layers of adjoining sheets should face one-another. Two pieces of string should be used to tie up the two sides after laying-up to the desired width.

The hot pressing method is used to seal the sheets together as floorboards. A two-dimensional single open hot press is required with heat provided by steam or high frequency heating. Place the laid-up sheets in the hot press, add a few press stops between each lay-up and then apply the heated pressure. If the heat source is steam a steam pressure of 1.0MPa is required. The pressure of the hot press should be 1.5-2.0MPa, the temperature of the hot press plates should be 105-1100C, and the pressing time required is 1.1-1.2 minutes per millimeter of thickness of lay-up. If high-frequency heating is used, 5-minutes is sufficient.

2.4. Planing, moulding and sanding process

The following procedures are the same as for the manufacture of wood floors. The back and one side of the blank of bamboo floor should be manufactured to be the datums plane from which all measurements will be taken. Then the longitudinal tongue-groove and the back slots should be moulded. The next process is manufacturing the transverse tongue-groove.

Initial sanding is done with an 80 grit belt sander. Final sanding is with a 180 or 240 grit belt sander so the blank surface is smooth and level. All these procedures are in preparation for painting.

2.5. Painting

UV-cured paint is usually used for painting. Several undercoats are painted on the upper face of the floor with one final topcoat. The sides and the rear receive only one coat.

Source(s): INBAR TRANSFER OF TECHNOLOGY MODEL (TOTEM): BAMBOO FLOORING MANUFACTURING UNIT

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Additional external resources: <http://www.inbar.int/totem/totemain.asp>

<http://www.inbar.int/totem/ppt/BambooFlooring.ppt>

<http://www.inbar.int/totem/video/BambooFlooring.rm>