CENTRAL BUILDING RESEARCH INSTITUTE, ROORKEE-247667 (INDIA)

BUILDING RESEARCH NOTE

B.R.N. 20

FLUSHDOORS

With the advent of water resistant synthetic resin adhesives in the 1930s, it became possible to replace the traditional panelled and battened doors by flush surfaced doors known as flushdoors. These doors are now much favoured for their simplicity, pleasing appearance, clean and beautiful finish. In contrast to this, battened and panelled doors with their many nooks and ledges collect dust and dirt which are not easily removed. Flushdoors are ideally suited for air-conditioned buildings where better thermal and acoustic comforts are required. The absence of nooks and joints confer on the flushdoors a comparatively greater fire resistance. Panelled and battened doors involve a lot of joinery work and wastage of timber in cutting and planning. Use of unseasoned timber often creates problems in the maintenance and repairs of these types of doors. Flushdoors make the most economical use of decorative timbers as they require only a thin veneer of less than 1 mm thickness for their faces whereas panelled doors require planks about 50 times thicker and even then fail to achieve a similar decorative effect. Secondary timbers are normally used for the core of flushdoors made on the blockboard principle, thus leading to the conservation of primary timbers and better utilization of the available resources.

The manufacture of flushdoors which started in the country about three decades ago has been closely linked with the plywood industry for the obvious reason that the door skins are usually made of veneers of plywood and some production equipment, particularly hydraulic hot press, is common to both industries.

Flushdoors are classified into two major groups depending upon the type of core: (a) solid core and

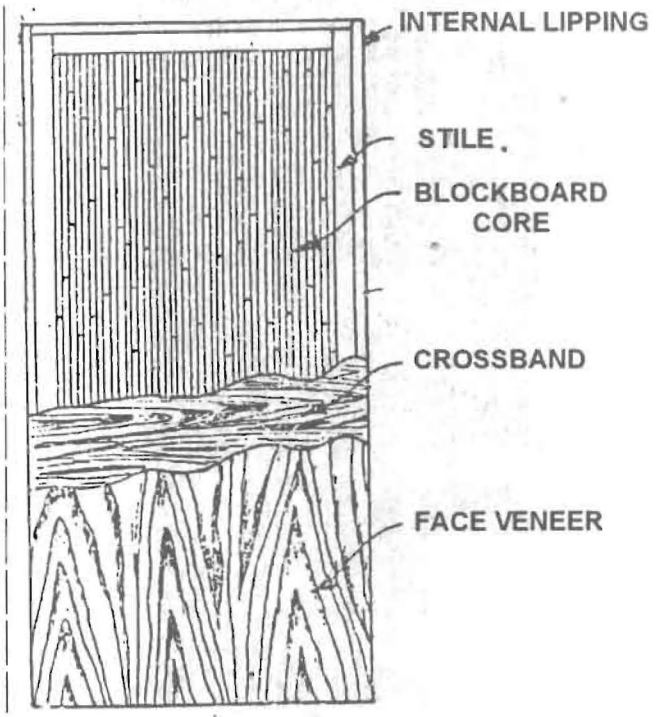

Fig. 1 : Typical Blockboard Core Flushdoor Shutter.

(b) hollow or cellular core. The simplest solid core flushdoor would be a piece of blockboard. Such a door requires no special frame or reinforcement for

lock and hinges. It is however the general practice in the country to have a frame of stiles and rails all around the core for holding the core battens for giving smooth edges to the door and also for strengthening the edges for fixing hinges and locks (Fig. 1).

By placing the core battens at some distance from each other so that only a part of the core consists of solid material, a hollow core door is obtained. The battens are arranged in such a way that the void area in any segment is less than 500 cm (Fig. 2). In cellular core doors, the core space is divided into segments not more than 25 cm by the use of horizontal and vertical battens. Battens may be replaced by suitable

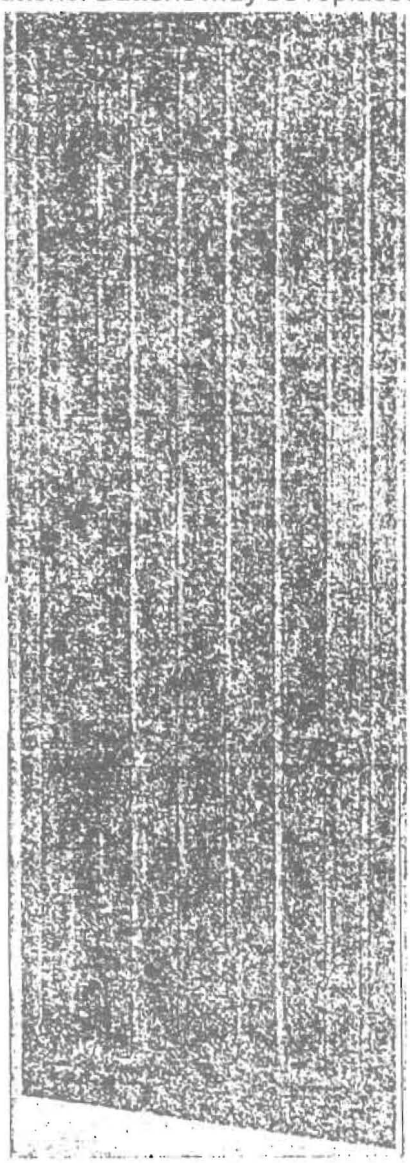

Fig. 2 : Core Assembly of a Hollow Core Flushdoor.

strips of plywood, . hardboard, insulation board, particle board, veneers specially prepared undulated veneer strips, veneer spirals, etc., in hollow and cellular core flushdoors (Fig. 3). The pattern and arrangement of core materials depend in part on the thickness of the facings. The core should provide sufficient support to the facings to eliminate objectionable depressions or irregularities in the faces of the finished door/shutter.

Battens for the core of a flushdoor should preferably be of the same species to reduce unequal shrinkage and swelling. The use of quarter sawn or flat sawn battens all arranged with the radial or tangential face parallel to the face of the door and the edge gluing of battens in solid core doors will also favour a smooth even finish. These are however seldom practised.

The use of particle board as a core material should also result in a smooth surfaced door provided a stable board is used. Strength and screw holding properties of the board are important considerations in the absence of an adequate core frame.

Battens for core of flushdoors should not exceed 25 mm in width and should be well seasoned. They are arranged with the core frame and helds in place by a few corrugated g.i. clips between adjacent battens and between battens and core frame or by any other suitable means to facilitate handling prior to the bonding of face skins. Battens which do not extend to the full length of the door, and usually most of them do not, are placed end to end taking core to stagger these end joints.

In doors with solid batten or panel core the role of the frame is comparatively unimportant but doors whose cores are light require strong frames. It may also be necessary to provide intermediate stiles for properly holding the core strips. The width of flushdoor frame is 50-100 mm for solid core doors but a minimum of 75 mm is specified for hollow and cellular core doors. If the stiles are not wide enough in hollow and cellular core doors, blocks are glued to the inside of the stiles at mid-point to provide support for locks and catches. The thickness of stiles, rails and core depends upon the total thickness of the door and

upon the thickness of the face skins.

The most common face skin for flushdoors is a two ply assembly of crossband and face veneer but 3-ply plywood panels are also used. In hollow core

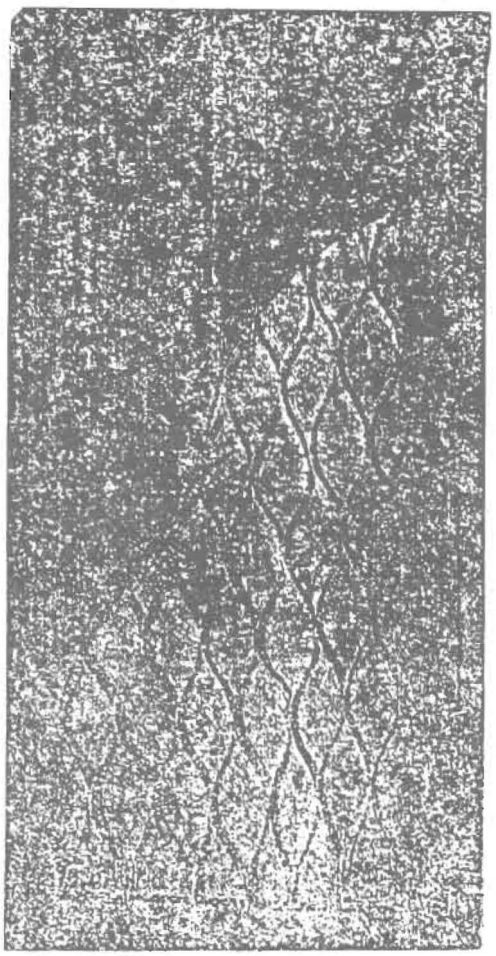

Fig. 3 Cellular Core Flushdoor with Part of face skin cut off to Show the Special Cellular Core.

door it is difficult to bridge the gap between battens or strips of the core without the "telegraphing" of their edges as lines to the face veneers. In fact the whole face skin may buckle into the gaps resulting in an undulated surface especially if the face skin veneers are pressed on to the core in one operation. It may therefore be necessary to use crossbands as much as 4 mm thick depending on the rigidity of the veneer which is a characteristic of the species. For solid core doors thicker crossbands are advantageous especially for thickers core battens. The face veneer of decorative flushdoors is one millimeter or less thick so that surface checking is reduced to a minimum. Other sheet materials such as hardboard, which has a very smooth surface, particle board, decorative plastics laminates, asbestos cement panels and aluminimum are sometimes employed as face skins for flushdoors.

The edges of fulshdoors, including the frame and face skins, are sometimes protected by a strip of wood called lipping which is glued on, lipping gives a neat appearance to the door and can be used along with suitable face veneers to protect the core and crossband from insect attack in certain situations. It is, however, not the general practice to provide lipping to flushdoors although an "internal lipping" which is an extension of the core frame is often given.

The serviceability and life of a flushdoor depends to a very large extent upon the quality and permanence of the glue bonds. Consequently the glue selected for flushdoor manufacture should be suitable for the intended services. Indian Standard Specifications stipulate boiling water resistant (BWR) grade of adhesive for face skins and also for bonding face skins to the core. Phenol-formaldehyde is specifically mentioned in certain situations. BWR adhesive based on P.F. resin is the best adhesive for flushdoor shutters. In the absence of any extender, this adhesive will give excellent service in conditions of severe exposure to outdoor weathering. Melamine-urea resin blends and urea resin adhesives are unsuitable for exterior grade doors.

The requirement of adhesive stated above calls for the use of a hydraulic hot press. It is therefore obvious that flushdoors conforming to IS specifications cannot be manufactured except in a fully equipped factory. Flushdoor shutters made by local craftsman would not conform to Indian Standards with respect to the adhesives employed.

It is difficult to lower the specifications for door shutters for interior use because conditions inside buildings are often quite severe. The humidity is high during the monsoon and very low during the hot summer and dry winter. Morever, it is customary to

wash the floor of houses and to splash water about in both rooms. The alternate wetting and drying of doors in such situations results in a heavy strain on the adhesive bond, especially at the bottom of the doors. While urea resin adhesive cannot stand this strain for long, a melamine-urea resin blend may prove suitable. No definite data is available on the use of melamine-urea resin bonded flushdoors in such situations. Phenolic resin bonded doors are of course quite satisfactory.

Knowledge about the performance of hollow and cellular core doors in our climate conditions is limited. The general practice in overseas countries is to use such doors in interior locations only.

Flushdoor shutters may be of the decorative or commercial type depending upon the type of face skin. Decorative veneers are used for decorative doors and are generally given a clear finish. Decorative paper laminate faced doors are not suitable for exposure to weather. Commercial type doors made with veneers, plywood, hardboard and particle board usually require painting.

One of the difficulties of the large scale productions of flushdoor shutters is the demand for doors in a great number of different sizes. Recent standardisation of a limited number of sizes have not yet improved the situation because users have not entirely given up the old dimensions. The demand for these non-metric sizes, in addition to the new metric sizes, continues. Unless the few standard sizes and thickness specified in Indian Standards are widely adopted, production cannot be speeded up and the cost brought down. Additional advantages would be the possibility of providing the doors with external lipping and housing for fittings during manufacture.

For optimum performance of flushdoors it is imperative to follow the manufactures' instructions regarding installation and subsequent maintenance.

The provision of a suitable finish to all surfaces and to the bottom edge in particular, the rounding of sharp edges and corners to reduce chipping, the use of door stoppers of correct design and fixing them so that they bear on the hinges and the drilling of proper sized pilot holes for putting in screws for hinges are some of the important provisions to be kept in mind. With due attention to these details and proper emphasis on quality, flushdoors should give a life time trouble free service.

Readers are requested to send to the Institute their experience of adopting the suggestions given in this publication.

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