CENTRAL BUILDING RESEARCH INSTITUTE, ROORKEE-247667 (INDIA)

BUILDING RESEARCH NOTE

B.R.N. 41

WOOD SEASONING

A freshly cut tree contains large amount of water. The greater part of this water exists in the cell cavities as free water and the rest is entrapped in the tissues as bound moisture. In drying of wood, free water is the first to leave. The stage at which it is lost completely is known as "Fibre Saturation Point". At this stage, wood contains 25-30 per cent moisture. Shrinkage starts only from this point and is proportional to the loss in bound-moisture. The shrinkage is not equal in all directions because of its anisotropic nature. Across the grain it is considerable and about twice as much in the tangential as in the radial direction. This inequality in shrinkage in the three directions sets up strains which, if excessive, cause cracking. These can be avoided by seasoning.

The seasoning of wood is always necessary before using it. It should be done to a moisture content in equilibrium with the atmosphere in which the timber has to be used. In addition to checking shrinkage of the material, seasoning also prepares it for finishing. Strength improves as timber dries.

At the time of drying a vapor pressure gradient is developed throughout the material. The gradient is responsible for the movement of moisture from inside to outside layers. The condition for successful seasoning can be achieved by controlling three factors namely (1) Temperatues, (2) Humidity and (3) Circulation of air. A brief description of main seasoning methods is given below :

Air Seasoning

Moisture is removed with the help of air and sun while protecting the timber from the rains. Air inside the seasoning shed gets saturated with the moisture removed from the timber and is continuously replaced by fresh air due to natural circulation A few designs of air seasoning sheds are given in Fig. 1.

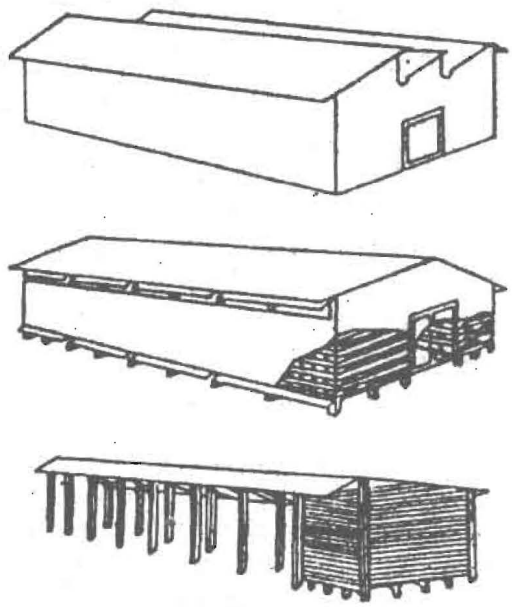

Fig. 1 : Air Seasoning Sheds

In its simplest form a seasoning shed can be a large Dutch barn having a roof. But the best shed to meet the necessary requirements is a long narrow building. It should have openings in the walls at the top and the bottom for free circulation of air through the piles of timber.

The platform used for stacking the timber is made of concrete or brick work. These platforms afford protection to the timber against infection from soil organisms, fungi, and other insects. However, it does not protect the timber from termite for which some anti-termite treatment has to be given.

Kiln seasoning

The advantages of kiln-seasoning are its rapidity, adaptability and precision. In a properly operated kiln every piece of wood inside can be seasoned to a uniform and desired moisture content. The humidity and the temperature at which wood is seasoned have also an injurious effect on the insects or fungus present in the timber. In the kiln the humidity is controlled by regulating the temperature of fresh air being admitted to replace the moisture saturated air. The kiln may be maintained at 54° to 82° C.

Some timbers are difficult to season as they are liable to surface splits and checks due to large tension stresses on outer layers. Such wastages can be reduced by adopting 'Chemical Seasoning' before kiln seasoning. The process of chemical seasoning consists of a treatment to the surface layers of timber with hygrosopic chemicals. The chemicals keep the moisture content of the surface layers high and they do not shrink during drying. Sodium chloride and urea have been used for this purpose.

Solar Seasoning

Solar energy is also used in air-seasoning. Much heat is however lost by radiation from the surface that absorbs it. It could be utilized more effectively if the heat energy could be entrapped inside a chamber. In this way, continuously transmitted heat is available for the drying process. This can be achieved by preparing a chamber with transparent glass plates. Such a kiln has been designed in CBRI. It consists of three main parts, viz. (i) Solar energy collector, (ii) Seasoning chamber and (iii) Chimney (Fig. 2).

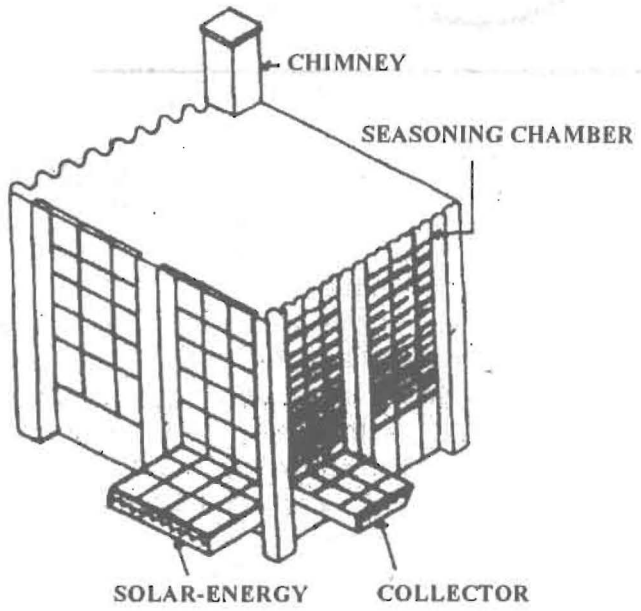

Fig. 2 : Solar Timber Seasoning Kiln

Black painted G.I. sheet of 22 SWG is used as solar energy collector. With the help of a wooden frame a transparent glass sheet is fitted around the collector leaving an air gap of 5 cm for the movement of fresh air. It is attached to the bottom of the south wall of the seasoning chamber an angle of 30° with the horizon.

A double wall chamber is constructed with transparent glass except for the north wall which is of brick masonry. Black painted aluminium fins of 24 SWG are fitted in the east, west and south walls at an angel of 45° with the horizon. The roof is made of black painted corrugated G.I. sheet and has a slope of 1 in 3.

To provide stack effect inside the seasoning chamber a chimney (30 × 30 × .80 cm) is fitted vertically over an opening provided in one of the corners of the roof of the seasoning chamber.

Sawn timber is stacked in the kiln horizontally. The stack of timber is kept about 15 cm above the ground by means of two rows of pillars which can be of brick. Top of the pillars should be in the same horizontal plane. All members in one layer should be of the same thickness, since even a small difference will result in the timber becoming warped and cracked. In order to allow uniform circulation of air on all sides of the stacked timber, different layers should be separated by sound and seasoned crossers of the size 5 × 5 cm. Care should be taken to keep the crossers in vertical alignment. The spacing of the crossers depends upon the thickness of sawn material. Closer spacing is required for planks to prevent distortion during seasoning.

Performance of the Solar Kiln

Performance of the solar kiln was studies by seasoning various species of wood, e.g. Mango (Mangifera indica), Haldu (Adina cardifolia), Deobar (Cedrus deodara) Teak (Tactona grandis), Jamun (Eugenia jambolana) Shisham (Dalbergia sissoo) and Sal (Shorea robusta).

The seasoning of mango, jamun and haldu, timbers was carried out in the months of August and September. The time taken in seasoning from green stage to 10 per cent moisture content for the above three of thickness 3.75 cm in solar kiln was found to be 17, 27 and 18 days respectively, while in the shed it was 35, 62 and 40 days. Teak, deodar and shisham timber was seasoned in the month of February and March and the thickness of the planks was 5.0 cm. Time taken in seasoning by the respective woods in the kiln was found to be 20, 14 and 28 days, while in shed they took 42, 25 and 69 days. Sal wood is considered highly refractory from seasoning point of view and is generally used in the form of scantling. Therefore, the size taken for study was 7.5 × 15 cm and study was carried out from November to January. It was found that in the kiln it took 67 days while in the shed the seasoning was completed in 4 months. On average it can be concluded that time taken for seasoning in the kiln was about half of that taken in air seasoning.

High temperature inside the kiln helped in lowering its relative humidity. However, in the initial stages it was somewhat more than the prevailing atmospheric relative humidity due to quick decrease of moisture content. During rainfall the moisture content of the planks kept inside the shed increased due to high relative humidity of the atmosphere. However, in the kiln there was no appreciable change as the entry of fresh air was prevented. The maximum difference of temperature inside and outside the kiln was 15° C.

Normal practice in air-seasoning is to keep the timber without proper stacking on an uneven platform in the field or under a tree or shed. In these situations the material can not be protected properly from sun rays and rain showers and direction of air flow can also not be regulated. Thus no proper air seasoning can be achieved in this manner besides increase in time of seasoning. The seasoning losses such as warping, cracking or shrinkage are also high in such a situation and sometimes the material is not of any use except as fire wood.

Capacity and cost of construction of Solar Kiln

The kiln is designed in two different capacities viz. 10 and 15 cubic metre of wood. The cost of construction of a smaller kiln is about Rs. 2,00,000/- while that of the bigger one is about Rs. 5,00,000/-.

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