

GUIDELINES

FOR

AIR-DRYING OF TIMBER

**Low Cost Timber Drying Method
for Sawyers, Merchants and
Other Users**



**Kenya Forestry Research Institute (KEFRI)
Forest Products Research Centre – Karura**

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Guideline No. 6

By
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**Kenya Forestry Research Institute (KEFRI)
Forest Products Research Centre – Karura**

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Glossary

- ▶ **Equilibrium Moisture Content (EMC):** Final moisture content, a piece of wood will reach having remained in an atmosphere of constant relative humidity and temperature.
- ▶ **Fibre Saturation Point:** Level of moisture in wood where the cell walls are well saturated.
- ▶ **Tier:** A piece of strong timber placed on the foundation to bear the weight of timber stack during drying.
- ▶ **Seasoning:** A term referring to controlled timber drying
- ▶ **Green Timber:** Timber freshly sawn with moisture content higher than fiber saturation point
- ▶ **Warp:** Deformed timber due to loss of moisture

1.0 Introduction

Trees contain considerable amount of water, often referred to as sap. When a tree is cut down and sawn into timber the wood immediately begins to lose its moisture. The process of losing moisture from green timber can be very unpredictable due to variations in air temperature and humidity. Low temperature and high humidity slows the process of drying while high temperature and low humidity quickens it. When drying timber is exposed to a combination of the two conditions, the result is usually defects within the timber. A skilled saw miller or timber merchant could control the drying process to minimize such defects and enhance timber quality, a process referred to as seasoning. Seasoning aims to dry timber uniformly with minimum deformation in the shortest possible time to a moisture level similar to the surrounding air. This is called equilibrium moisture content (EMC). Seasoning is done by exposing timber to circulating air and controlled heat over a given period of time.

The most important reasons for seasoning timber are to:

Increase stability: In order to minimize dimensional changes, wood should be dried to the moisture content it will assume in use. The use of green timber in any construction can result in severe deformation as the timber dries.

Reduce inception of decay or stain fungi: Drying timber to a moisture content of less than 20%, or below fiber saturation point prevents the onset of decay and stain fungi.

Reduce weight: The weight of wood is reduced by about 35% or more when seasoned which is of practical importance as it reduces handling and transportation costs.

Increase strength: As the wood dries its stiffness, hardness and resistance to bending increases. Most species of wood increase their strength characteristics by 50% or more when seasoned to a moisture content of 15%.

Allow preservation treatment, gluing and finishing: In order to treat timber with some preservatives proper penetration is only achieved if the timber

is dry. Similarly, the successful gluing or finishing of timber is dependent on timber being dry.

2.0 Methods of Timber Drying

There are many methods of seasoning timber. They include air drying, steam heated, electric heated, solar and the more advanced microwave kilns. In Kenya, the most commonly used methods are electric and steam heated kilns and air seasoning. Heated kilns are expensive and require technical expertise to operate. They are therefore found in very few firms especially where large volumes of seasoned timber are required in a short time. Air-drying is the most applicable for small-scale timber users, saw mills and the construction industry where timber may be arranged in a yard to dry as it awaits use. This method, though cheap to install and operate, is slow.

The main challenge in timber drying is timber stacking. Poor timber stacking could cause serious deformations, while poor air circulation could lead to fungal growth in timber and a longer time for seasoning. Timber is piled in a special way to maximize the surface exposure of all the pieces to the air and at the same time to support each piece so that it can dry straight and minimizing warping. This guideline outlines the procedures for air-drying of timber.

3.0 Procedure for Air-seasoning of Timber

- ▶ Clear and level the ground on which the timber yard will be constructed. The space should be enough to accommodate the desired volume of timber to be seasoned at a time.
- ▶ Construct a strong foundation of 30cm to 60cm above the ground. This can be done using stone blocks, concrete or any material that will deter termites from getting to the timber.
- ▶ Ensure the foundation pillars are arranged close enough to bear the load of timber to be seasoned without causing the timber to bend.
- ▶ Keep the ground beneath the foundation free of vegetation or debris that can hinder air circulation under the pile. Keep this area clean to prevent the possibility of harboring timber-deteriorating agents like fungi, bacteria and termites.

- ▶ Lay strong timber tiers on the foundation pillars to support the timber to be dried. Place the first layer of sawn timber on these supporting tiers. If timber has been crosscut in different lengths, it is best to pile each course so that each board within a layer is well supported and does not protrude at either end of the pile (Figure 1). This system of piling is called "box piling". The outside boards of each tier are full length. This is important to support the pile together and make it less likely to tilt or fall over.
- ▶ Arrange timber of the same thickness in one stack. This ensures uniformity in drying of the whole stack e.g. 6"x1", 4"x1" and not stacking timber of different thickness like 6"x2" or 4"x2" etc.
- ▶ Hardwood species should be arranged in separate stacks from softwoods. Different species dry at varying rates due to their differences in anatomy. Stacking them separately ensures that each stack dries uniformly.

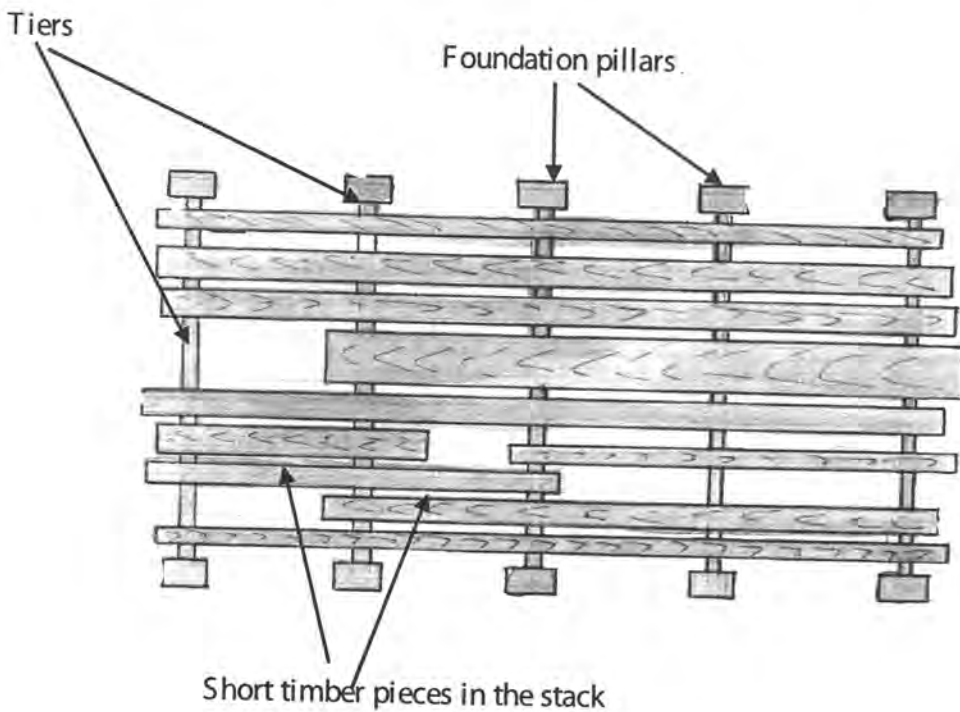


Figure 1: Top view of the first layer of boards, illustrating the system of alternating short lengths in box piling.

- Place wooden sticks (stickers) to separate each layer (Figure 2). It is very important that the spacers are uniform in thickness and dry. Sticks usually are (18.75mm) 3/4-inch thick. Note that the spacers are carefully aligned vertically above the first supporting tiers so that each layer of timber will be supported from the base of the pile (Figure 3 and 5). If the stickers are not properly aligned, forces will be created in the drying timber that will result in permanent warping of timber or the pile may collapse.
- Each sticker should be long enough to run across the stack without a joint. This ensures that each layer of timber is uniformly placed and adequately supported to hold the next layer.

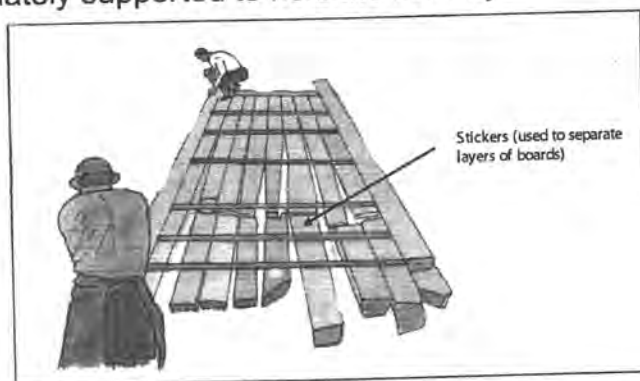


Figure 2; Building a seasoning pile in box with stickers after every layer of boards

- Place heavy objects such as concrete blocks or stones on the top stickers on the timber pile. The weights should be placed at the ends and middle of each top sticker (Figure 3). This will keep timber pieces on the top straight and reduce warping.

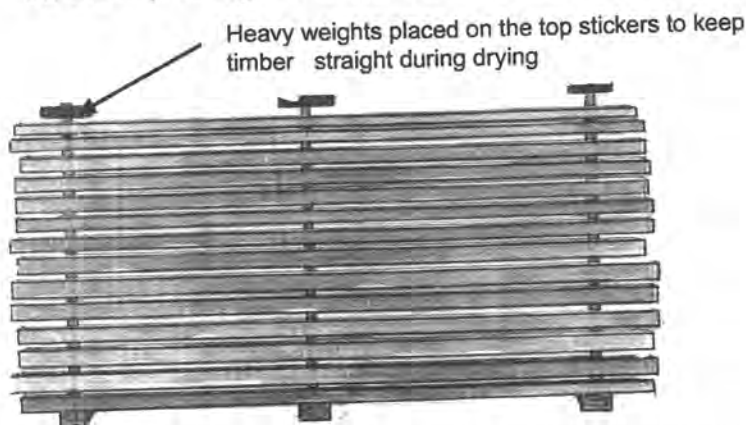


Figure 3: A complete air-drying stack

- Always leave at least 1-meter path between timber stacks. This is to allow movement during observation and removal of timber from the stacks. In very high stacks, large planks can be used to reinforce the upper timber pieces (See figure 4.).



Figure 4. Inspection paths between timber stacks

- Build a roof overhanging the timber stacks (Figure 5). The roof should be at least 15cm (6 inches) above the top most layer of timber to ensure good flow of air from the timber pile. It should also overhang at least 60cm (2 feet) on all sides to protect the timber from rain.

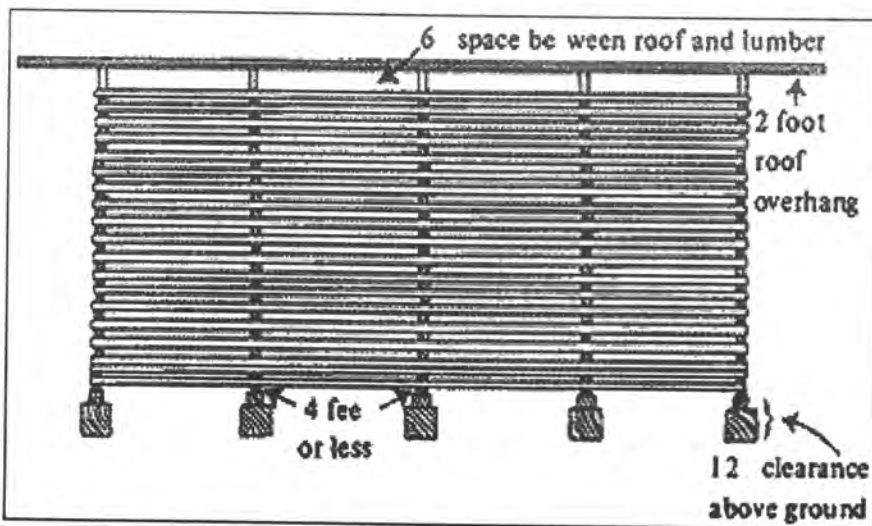


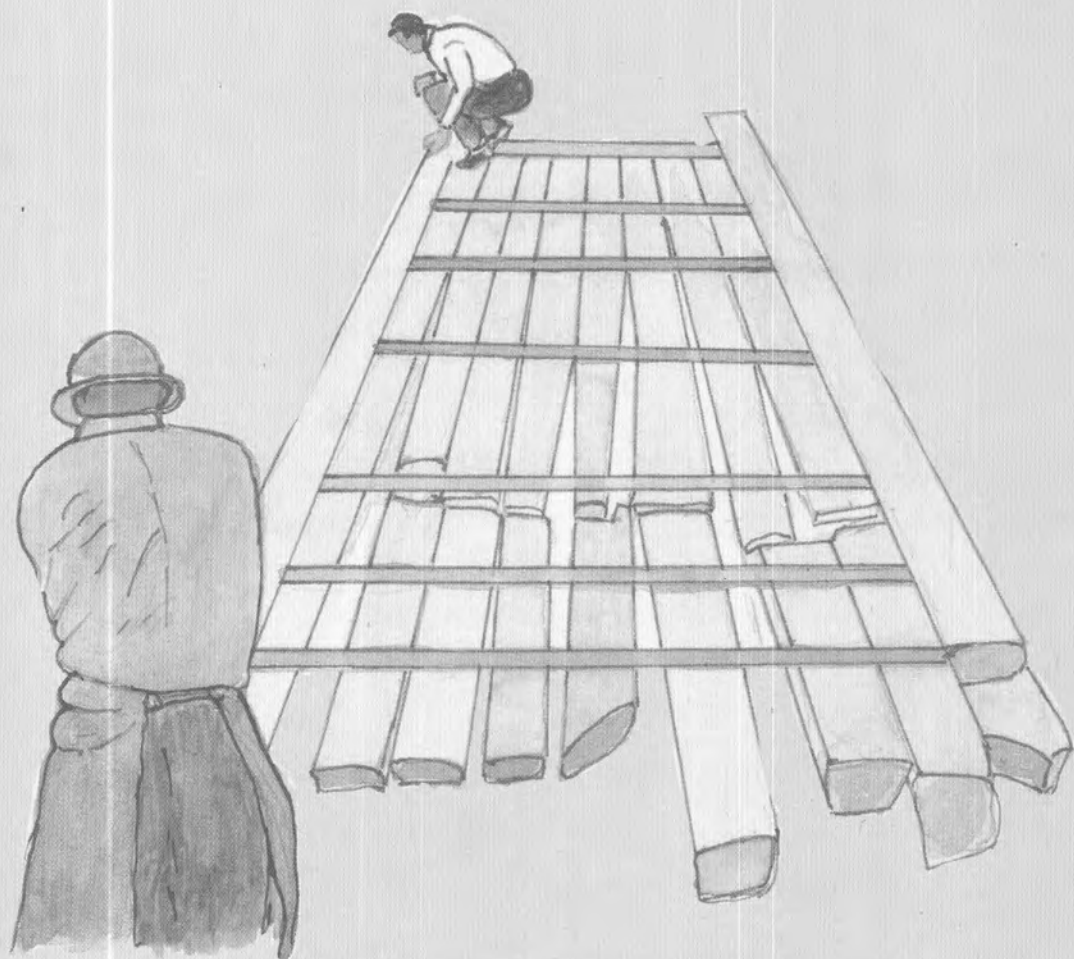
Figure 5. Overhanging roof above timber stacks

4.0 Drying Time

- ▶ In warm weather, with mean temperature ranging between 25 and 30°C, 1-inch thick boards can be dried to 15 - 20% moisture content in 45 to 60 days while 2-inch thick boards could take 60 - 90 days. Hard wood boards of equivalent thickness may take 60 -90 and 90 -120 days respectively.
- ▶ Timber at 15% to 20% moisture content is adequate for building unheated structures such as garages, house trusses etc.
- ▶ If the wood is to be used inside a heated structure like sauna, which has a lower EMC, further drying in a commercial kiln is necessary to attain 6% percent to 8% moisture content.

5.0 Further Reading

- Desh H. E. and Dinwoodie, J. M. 1968. Timber; Its structure and Properties. 6th Edition, Macmillan Education Publishers, Hong Kong. Pg 155-172.
- Hiram L. Henderson, 1947. The Air Seasoning and Kiln Drying of Wood. Department of Forest Utilization, New York State College of Forestry, Syracuse, N.Y. 332 pp.
- Marra A. A., 1992. Technology of wood: Principles in Practice. Van Nostrand Reinhold, New York.
- Panshin A. J. and Carl de Zeeuw, 1980. Text Book of Wood Technology, Fourth Edition. MacGraw-Hill Publishing Company. New York, USA. Pg. 329-343.
- Tsoumis G., 1991. Science and Technology of Wood; Structure, Properties and Utilization. Van Nostrand Reinhold. New York.
- USDA Forest Service, 1987. Wood Hand Book: Wood as an Engineering Material. Agri. Handbook 72. Washington, DC. Rev. 1987. Pg. (14-6)- (14-11).
- Simpson, W. T., 1991. Dry Kiln Operator's Manual. United States Department of Agriculture, Forest Products Laboratory, Madison, Wisconsin. Pg 103-113.



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