

Chapter 7

TIMBER

It is said that as much as 40% percent of Ethiopia was covered with forest as recently as the turn of the century. However much of the trees making this forestland have been consumed either as building material or firewood. Today different types of trees make the source material for the construction of doors, windows, roof trusses, floors, etc.

Wood suitable for building and other engineering use is called timber. Tree trunks and branches that have fallen are cut into logs from which planks or lumbers are sawn.

Hardwoods and Softwoods

Woods used in construction are generally classified broadly as hardwoods and softwoods. The terms are misleading in that there is no direct relationship between these designations and the hardness or softness of wood. South American Balsa, one of the softest woods known, is classed as a hardwood. The designations actually refer to certain growth and foliage characteristics. Softwoods come from trees classed as evergreens or conifers. These trees have needle like leaves, which are generally not shed at the end of each growing season. Hardwoods are obtained from trees **classed as the end of each growing season.**

In general, softwoods are characterized by their straight and regularly arranged fibers, more uniform texture and light color. They are relatively light with densities varying from 350 to 700 Kg/m³ when air dry (15-20% moisture content). Hardwoods consist of a greater variety of fibers; they are generally dark in color and dense, with densities varying from 400 to 1250 Kg/m³ when air dry, and have narrow annual rings. *Softwoods are strong in tension but rather weak in shear, whereas hard woods are capable of resisting all stress equally well.* Because of the minerals they contain, such as silica, hardwoods are at times *difficult to saw*.

Trees may be divided into two classes:

1. Flowering
2. Non Flowering

Flowering trees may be divided into:

- Exogenous – outward growing trees which make the bulk of the commercially available material for building purpose.

- Endogenous – inward growing trees. Such as palms and bamboos which have so far little use in engineering

The exogenous trees are divided in to:

- Conifers – ever green
- Deciduous- hard wood.

Deciduous trees are mostly the source of timber for engineering construction.

Hard timbers are close- grained, dark colored, strong, and heavy, durable and have no distinct annular rings.

All exogenous trees (both conifers and broad leaf trees) grow in diameter as well as in height through the addition of yearly layers of wood, each of which forms immediately under the skin or bark. The fast growth of the wood during the spring produces springwood, which is light-coloured and rather porous. The slow growth during the summer produces summerwood, which is usually darker and denser.

Structure of timber

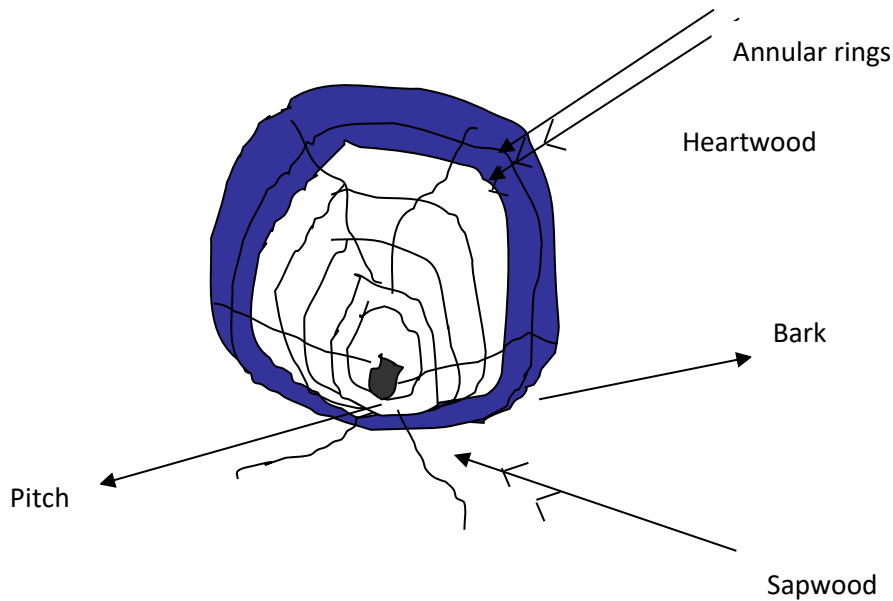


Fig. Transverse section

- The number of annular rings indicates the age of a tree.

- Heart wood is used for engineering construction
- Period of manufacturing of a timber tree ranges from 50 to 100 years.
- In past matured trees the wood becomes brittle and in elastic.
- After attaining full maturity, decay starts in valuable heartwood.
 - ❖ Therefore a timber should be felled immediately after it has attained its full growth as failing before maturity results in more sap wood and less quality of heartwood.

Advantages of Timber construction

1. Can be easily worked, required shape can be obtained.
2. Joints, Joinery works and structural connections can be easily made.
3. Suitable for attractive interior decorations.
4. It is light in weight, strong and durable, if well protected
5. It is resistant to material
6. Economical (when locally available)

Disadvantages of Timber construction

1. Costly if not locally available
2. Subjected to fire risks
3. Not suitable for damp or wet places.
4. Is liable to crack, warp and decay if not properly seasoned or not treated with preservatives
5. Needs regular care and maintenance

Defects in Timber

- could arise from:- irregularities in the growth of grains, or take the form of knots, shakes and splits.

- changes in climatic conditions, nature of the soil where the tree grows

Common Defects include:

- **Heart shake**- caused by heart shrinkage (decay of heart because of accumulated mixture)
 - **Ring shake**: caused due to unequal growth of parts ruptured in heavy wind and sudden increase in supply of moisture by roots after the storm.
 - **Radial shake**: split caused by severe frost or severe heat of the sun.
 - **Knots**: are dark hard pieces occurring as signs of branches broken or cut off.
 - break continuity of timber hence sources of weakness
 - make surface finishing difficult.
- ❖ Timber containing too many knots , shakes or splits should not be used for structural purposes.

Seasoning of Timber

The process of removing or drying surplus moisture from freshly converted timber is known as seasoning of timber. In this process, the moisture content in the timber is reduced to such an extent that moisture content of seasoned timber corresponds to the prevailing atmospheric moisture where the timber is to be used.

Merits of seasoning timber

1. Seasoned timber is light in weight and hence easy to transport.
2. Improves strength and other mechanical properties
3. Less liable to be attacked by fungus and insects.
4. Reduce the tendency of timber to shrinkage, warp and crack.
5. Seasoned timber is easy to be worked, is suitable for impregnation (treatment with preservatives), sawing, gluing, polishing and painting.

Methods of seasoning

Two methods of drying are generally used

1. Air seasoning → Normal seasoning
2. Kiln drying or artificial seasoning

1. Air drying –timber is stacked in the shade (under a roof) for several weeks or months in such away that there is afresh air all around each piece. Here,
 - The stack is prepared by laying layers of sawn pieces in cross-wise direction in alternate layers .
 - For a successful seasoning the freshly converted timber should not be exposed to direct sunrays or severe wind.
 - No skilled supervision is needed
 - Cheap & simple method of seasoning.
 - strong and durable timber is obtained
 - Split of log at ends may happen.
2. Artificial seasoning
 - a. Boiling
 - b. Kiln seasoning –Done on a heated, ventilated an humidified kiln
 - c. Chemical seasoning
 - d. Seasoning by streaming
 - e. Smoke drying (bone fire of straw)

- ***Advantages***

- rate of drying can be regulated (there is good control of air , temp. and moisture)

- 0- no chance to be attacked by insects & fungus.

- takes a short time.

- no split of longs at the ends(uniform drying)

- thus it gives better seasoned timer in relatively short time.

- ***Disadvantages***

- more expensive(as it involves longer initial investment and running cost.)

- skilled man power needed

- relatively weaker timber is obtained

Preservation of Timber

Timber used for construction purposes should be preserved and protected from:

- Bacterial and fungal attack

- Termites and insects such as pole-borers, worms
- Fire

Proper seasoning, natural or artificial, is most effective means of preservation.

The resistance to decay and preservation of seasoned timber is further improved by:

- Impregnation with preservative chemicals
- Brush treatment with paint or varnish
- Damp proofing when appropriate
- Providing free circulation of air.

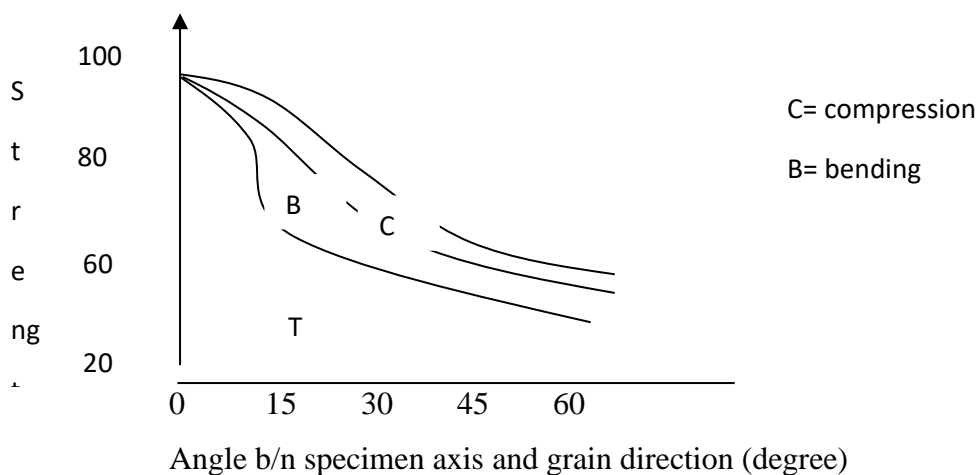
Strength properties of timber

- Generally, strength property varies widely among species even between trees in a particular species. Strength increases with the density of species and more particularly with in a given species.
- Among the factors that seriously affect strength, **moisture content** takes the prominent place.
- Variation in strength also occur b/n different parts of a tree: with temp, size and shape of specimen, amount of defects.
- Strength of timber varies according to the type of loading, direction of loading as it is isotropic material.

E.g.: tensile strength along the grain may be = 2 to 4 X compressive strength.

= as much as 30X that across the grain.

Compressive strength along the grain may be several times that across the grains.



Conversion of Timber

Besides its usage as structural member in buildings, timber can be used to *prepare architectural or finishing materials* such as veneers, ply wood, etc.

Cutting of logs in to suitable cross section or pieces is called conversion of timber.

Examples of converted timber:

- Planks, purlins, ceiling battens, various types of floor finish
- Veneers – are thin sheets of wood 0.5-5mm thick peeled off, sliced, cut or sawn from log of wood.
 - used : - as finishing material or cover to timber surface of inferior quality
 - in making ply wood, lamin board, black board.
- Ply wood – veneers used for making ply wood are known as plies.
 - an odd number of plies is used to make a ply wood and gluing is done under pressure.
 - thickness can be 3-6mm
- Chip wood - produced from saw mills, inferior timber or small logs converted in to fibers. Then mixed with binders (synthetic resins) and pressed in to 10 to 25 mm thick boards in hydraulic press.
 - used as ceiling boards, partition walls etc.