
Timber

Timber has been one of the primary materials of engineering construction; it is widely used for structural purpose. The engineering should have some knowledge of the classification of trees and of their growth and structure in orders to understand the fundamentals of the physical and mechanical properties of timbers.

Classification of Trees

For the engineering purposes, trees are classified according to their mode of growth:

- a) Endogenous.
- b) Exogenous.
- c) Soft woods.
- d) Hard woods.

a. Endogenous trees:

This group is confined largely to tropical semitropical regions. Timber from these trees has very limited engineering applications. Example of endogenous trees is:

- Palms: because of their long, straight stems are sometimes locally used as piles.
- Bamboo: Is used structurally to a considerable extent.

b. Exogenous trees:

These trees increase in bulk growing outer bark and annual rings are formed in the horizontal section of such a tree. Timber, which is mostly used for engineering purpose, belongs to this category. This timber can be divided into two groups:

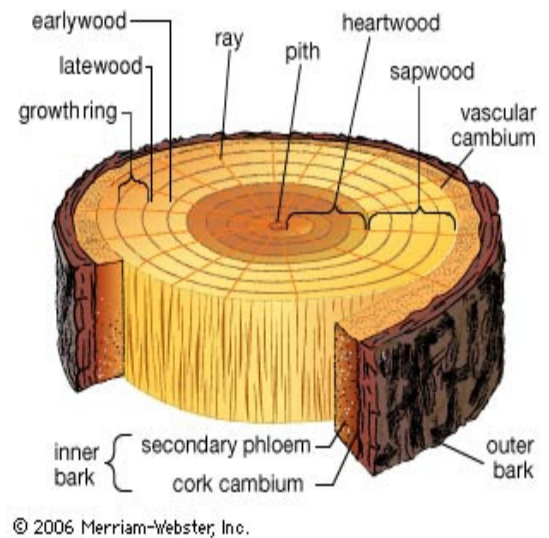
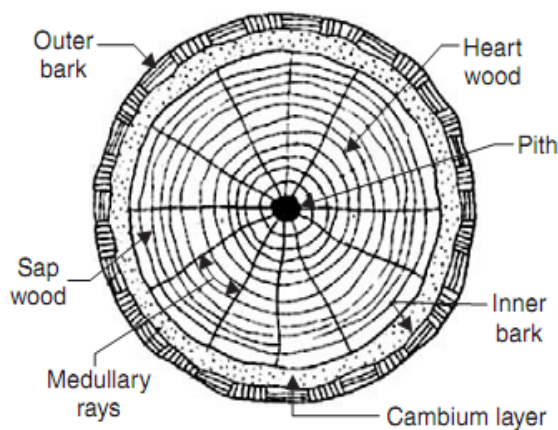
Soft woods: Such as deodar

Hard woods: such as oak and teak.

Structure of Timber

A tree can be divided into three portions, crown-composed of branches and leaves, trunk, and roots. The trunk accounts for about 80 per cent of the total bulk of wood. Figure 1 shows the structure of well grown timber from trunk of the exogenous tree. The structure of timber visible to naked eye or at a small magnification is called macro structure, and that apparent only at great magnifications, the micro structure. Macro structure of the timber can be studied by cutting the trunk in three directions Fig. 1 (a). In the cross-sectional and radial ducts, the following main parts of a tree, e.g. bark, cambium, sap wood, heart wood and pith, become readily apparent Fig. 1 (b). Each of the components has a specific function.

The bark protects the wood against mechanical damage. Its inner layer, called bast conveys the nutrients from the crown downwards and stores them. The function of cambium is to grow wood cells on the inside and smaller bast cells on the outside, The sapwood assists in the life process of tree by storing up starch and conducting sap. The cells in the sap wood are active The heart wood gives a strong and firm support to the tree. With the growth of tree, the cells in the inner older portion of trunk gradually become inactive and lifeless, but do not decay. This portion of the trunk is called heart wood. At the center of the cross-section is the pith, a small area occupied by friable tissues consisting of thin walled, loosely connected cells called pith. In a felled tree, it easily crumbles and rots. In the cross-sectional direction, nutrients pass from bast to the heart through groups of cells running at right angles to the cambium layers and are referred to as medullary rays.



Characteristic of Good Timber

Following are the characteristics of good timber:

1. It should have a uniform colour.
2. A freshly cut surface should give a sweet smell.
3. It should have regular annular rings.
4. It should be sonorous when struck.
5. It should have straight and close fibres.
6. It should be heavy in weight.
7. It should be free from shakes, flaws, dead knots or blemishes of any kind.
8. There should be firm adhesion of fibres and compact medullary rays.
9. The cellular tissue of the medullary rays should be hard and compact.
10. When planed, its surface should present a firm bright appearance with a silky lustre.
11. A good timber should be durable. It should be capable of resisting the actions of fungi insects, chemicals, physical agencies and mechanical agencies.
12. A good timber should possess the property of elasticity. The timber is elastic when it regains its original shape and size when the load

is removed. This property of timber would be essential when it is to be used for bows, sports goods, carriage shafts etc.

13. It should be fire-resistant, Wood having dense texture offers great resistance to fire. It should not contain resins and other inflammable oils which accelerate the action of fire.
14. A good timber should be hard (i.e. it should offer resistance when it is being penetrated by another body). The chemicals present in heart wood and density of wood impart hardness to the timber.
15. A good timber should be strong for working as structural member such as joint, beam, rafter, etc. It should be capable of taking loads slowly or suddenly.

Note: The heavier and dark coloured timber is usually strong.

Advantage and Disadvantage of Timber

Advantages: The advantages of timber are:

- 1- It is relatively easy to handle and can be planed, sawn and jointed with simple carpenter's tools.
- 2- It is easily available and can be quickly transported by simple means.
- 3- It is light in weight yet strong.
- 4- The floor joints in an average dwelling weighs less than rolled-steel beams of equal strength.
- 5- The individual units of wooden dwelling are light enough so that they may be assembled by a small crew of men without special machinery.
- 6- Boards may be cut rapidly by a saw and fastened firmly together with nails.
- 7- It is a good insulator of heat and sound.
- 8- When properly protected timber structures may give good service for hundred of years.
- 9- It stands shocks and bumps, a good deal better than iron and concrete.
- 10- On account of its light weight, timber is generally preferred for building works in earthquake regions.

-
- 11- Repairs, additions and alterations to timber construction are easy.
 - 12- It is considered to be an ideal material of construction in sea water or marine works as it can resist corrosion.

Disadvantages:

The disadvantages of timber are few, but serious. There are:

- 1- The greatest disadvantage is its ready combustibility, which can be diminished but not eliminated even by expensive treatment.
- 2- Frame buildings built closely together present a serious conflagration hazard.
- 3- Timber is destroyed by decay induced by fungi, and by insects that feed upon the timber under favorable considerations. Decay may, however, be prevented by various methods that produce an environment unfavorable for the growth of the causative organisms.
- 4- Timber swells and undergoes shrinkage with changing atmospheric humidity.

Seasoning Wood:

As a result of daily and seasonal fluctuations in relative humidity and temperature, most wood in service continually gaining or losing moisture. The most practical means of minimizing trouble some variations in moisture content is by seasoning timber prior to its fabrication finished products or used structurally so the object of seasoning is to lower the moisture content of the wood a point at which the swelling and shrinkage is reduced a minimum for given conditions.

Seasoning Process:

There are two principle methods of seasoning timber:

- 1- **Natural seasoning:** This consists of stacking the timber the air, and allowing it to dry naturally, the water being expelled gradually and shrinkage occurring informally. This process takes

from two to four years to complete. It is necessary to stack the timber with intervals between each so that the air can circulate all around.

- 2- **Artificial seasoning:** A very large proportion of commercial timber is now dried by the kiln methods more particularly in the case of hardwoods. The advantages of kiln drying lie in the rapidity of the process and in the possibility of controlling the various factors influencing the correct seasoning results.

The three principle factors concerned in these methods are:

- a. The temperature of the process.
- b. The moisture.
- c. The circulation.
- d. Proper kiln can control the rate and degree of drying, that the tendency during drying to warp and split is reduced minimum. Uneven shrinkage may occur when the loss of moisture from the surface is greater than that from the interior. This shrinkage can be controlled by supplying moisture inside the kiln which assists in keeping the surface soft until the heat has penetrated to the interior, so that warping and cracking are prevented. In artificial drying, temperatures of 70 to 82°C are useful employed for a period depending on the type of wood.