Building Materials - II

Lecture 5

Welcome to the UGC lecture Series **for B.Architecture**. Today we will be seeing **unit 3 lecture 1 timber**.

In this lecture we will be introduce to **what is timber? And where we get timber from? or where do we source the timber from? Different characteristics , uses and properties of timber. And finally we will be seeing , you all know timber we get from wood. So we'll be seeing how you convert wood to timber. Or preparation of timber and that will also include the seasoning of timber.**

So **what is timber**?:- the timber denotes wood which is suitable for building or carpentry or various other engineering purposes and it is applied to the trees measuring not less than 600mm in girth. Girth means the circumference of the trunk. So any tree that has a circumference of less than 600mm we can't use the wood from that tree for timber. So basically timber is any wood that is suitable for building and carpentry. Now we know that we get timber from wood. So why do we have different terms? Why do we have wood? Why do we have timber?

So let's see **the definition of each**. So **What is exactly wood**? Wood is the **organic matter obtained from the tree trunk.** That is called wood. Then **what is timber**? Timber is the **wood prepared for use in building and carpentry. This preparation of the wood includes the treating and seasoning of the wood before it's used for construction.** So you take wood you have to make it undergo a process of treatment and processing which is called seasoning and then it forms timber.

So now you know that you get timber from wood so wood **where do you get wood from**? We get wood from trees. So now wood. We get wood from trees. Yes. So there are so many different types of trees which gives different types of wood. Yes.

So **which wood we can use for timber**, that is which trees we can use for timber we'll see next. So in general there are **two types of classification of trees- exogenous trees and endogenous trees**. So **exogenous trees** are when you cut **the tree trunk you will see in the cross section, you will see many annual rings, or technically that is also called medullary rays. The center one is called pith, the older rays or the older rings are called heartwood, the newer rays or the younger rings are called sapwood and then it has bark. Now bark consists of two portions – the inner bark and the outer bark. So in this wood you see what happens is each year the tree grows a new ray or a new medullary ray forms around the heartwood.**

Now in **endogenous wood** if you see , this is the cross section. You see the darker portion outside and the lighter portion inside. **The lighter portion inside is the younger portion of the tree and the darker portion is the outer portion , the darker portion is the older portion of**

the tree. So you see the difference in this and this is, the younger, **the tree grows outwards in exogenous type while in endogenous type the tree grows inwards.** Not as in inwards but the newer tree comes from the inside. So **which kind of tree can we use for the wood for timber**? We can use only **exogenous trees for giving the wood for timber. Only these types of trees are fit for use in building construction**.

Now in **exogenous trees again there are two classification- one is hardwood and one is softwood**. You see the image here, in soft wood the heart wood or the heart pith what you saw earlier the heart wood the older portion in soft wood is smaller. While in hardwood ,the heartwood is bigger. So this makes the hardwood more dense and the soft wood less denser. Examples of soft wood is spruce, pine tree, fir tree, while examples of hardwood is oak, ash, beech, teak . Now Both of these types – hardwood as well as softwood can be used for timber but the density of the wood that we are going to use should be not less than 500kg per metre cube.

Now what is the **difference between hardwood and softwood**. So we see here few differences. Usually **hardwood we get from deciduous tree** and **softwood is from coniferous or evergreen trees. Hardwood usually grows slowly and mixes with a variety of trees. Soft wood grows fast and spreads**. **Hardwood** as I said earlier is **more dense** while soft **wood is less denser**. **Harwood trees are angiosperms** and **softwood trees are gymnosperms**. And more **examples of hardwood is eucalyptus, black wattle, white and red oak, apple, teak, black and yellow birch.** Well **softwood examples are redwood, sugar and white pine.** Now h**ardwood** like I said it is more dense **it burns at a slow rate**. **Softwood tree burns at a faster rate** since it is less dense.

Now when we take any type of exogenous tree, we cut through, we cut the cross section of the tree we see **different types of grains**. So these are the few of the types of grains that we see in a tree**.- diagonal grain, spiral grain straight grain, wavy grain, irregular grain and interlocked grain**. So you see the images of these grains. Diagonal grain where you can see how the grain is forming here. Spiral grains- while the grains are straight but then it is wavy in pattern. Straight grain is the most commonly preferred type of grain where the grains are straight it is because when you cut the wood and use the wood you will also find the grains straight and it will be more aesthetically pleasing. Then you have wavy grain and you have irregular grain. Because irregular grain might be called because the wood or the tree did not grow regularly or was affected by some external atmospheric forces. And interlocked grain.

Next **classification of timber**.:- so timber can be classified in several different ways to give more structural classified based on **durability, seasoning characteristics and grading**. So **durability** you have **highly durable timber , moderate durable and low durable**. While **seasoning** characteristics **high refractory , moderately refractory and non refractory**. And **grading is select grade 1 and grade 2.** So **grading also depicts the quality of timber.**

Physical properties of timber . So what are the physical properties of timber ? The first one you see that is **COLOUR.** A **darker colour** in wood indicates **greater durability**. You saw the hardwood the hardwood is more darker colour in centre. The first thing you see in a wood is its colour. A darker colour in wood indicates greater durability. So automatically when you say a darker colour hardwood comes to our mind. So hardwood has a larger portion of hardwood so it becomes automatically it becomes more durable than softwood.

Then **ODOR.** Odor it is present only in freshly cut trees. Once it is air dried and seasoned the odor should not be present in a tree. A very mild odor can be present. But strong odor is not present in a very seasoned timber.

Next is **HARDNESS**: Hardness is the **ability of wood to withstand indentations caused by harder bodies.** Next **DENSITY** .Densest woods are generally the strongest. So automatically it makes hardwood more stronger than softwood and thus it is more preferable also.

GRAIN:-- Depending on the actual alignment , the grain may be straight, spiral, interlocked, wavy or irregular or diagonal like we saw before. So grain is another physical property of the timber.

And lastly we have **TEXTURE**:-In **hardwoods** the texture depends upon **the size and distribution vessels** and rays. In **softwoods** it is determined by the **size and distribution of trachea**.

Next what is **THE USES OF TIMBER?:-** The most commonly known use of timber is in **building construction.** Not only in the construction of the building shell but also in the interior. Also some structural elements like **beams, rafters, posts and poles** were also made of timber. Like you see in the image at the back, this house is completely constructed out of timber. You see even the floor , the roof, all the poles even the staircases everything is are constructed out of timber. The **doors and windows, frames shutters of doors and windows, roofing material etc**. can also be made out of timber. Even if timber is not used in the making of the shell of the building it can also be used to do **the form work for cement, concrete, centering of an arch and scaffolding**. And obviously it is also used **for furniture.** Timber is also used to **manufacture veneer, plywood and other many timber products**. Apart from the building industry where else is timber used?. Timber is used to make **temporary bridges and in boat construction, packaging cases , agriculture elements, toys, musical instruments**, etc. so timber has a variety of uses in daily life.

Now we will see **PREPARATION OF TIMBER**:- **How wood is converted to timber?** So **The first sta**ge for the preparation of timber is the **felling of trees**. Obviously to get timber you have to go to a collection of trees or a forest where you have to fell the trees. Next **transporting the felled trees to a mill or a processing unit. t**hird is the **conversion of the wood into smaller pie**ces next where it can be sent for seasoning. So the last one is **seasoning**. Now there is one more step that we can add into this process and that is called **preservation.** Preservation is

done when the timber is being used in the manufacturing process, but we will also see preservation in this preparation of timber.

Stage one FELLING OF TREES:- Now this process of **downing individual trees an element of the task of logging. The person cutting the trees is called a feller.** Now usually to fell the tree or cut down the tree winters are preferred over summer because winters are considered more drier and at that time there is lesser moisture in the wood. When you want to cut a lesser number of trees you can use manpower and individually a feller can go and cut the trees. But If there is a large amount of trees that is going to be cut, then machines like tractors or grabbers are used. More sustainable option now-a-days that is being considered is when you fell a tree or when you cut down a tree it is replaced by a sapling. Now this **felled trees are called logs**. So trunks are **logs stacked in a clearing**. Sometimes logs are stored in the forest until they are needed at the saw mill. So as soon as they cut the tree they have to be stacked in a clearing. Now this **clearing is usually a plain ground cleaned of any top soil, garbage or any organic matter** and then all the logs as they are cut are stored there. Now when they are stored like this before sending to the sawmill, when they are stored like this, this also allows the tree to naturally dry or naturally season itself to a certain extent. So this allows some of the **trees water content to evaporate, reducing the weight of the tree or log**. So the next step where it is being transported the weight of the tree is lesser than when it was being felled.

Stage 2 TRANSPORTATION:- Transportation is **where the logs are transported to the sawmill using vehicles equipped with lifting gear.** Now in the tropics large number of logs are transported by floating them in rivers and allowing them to be carried down the stream by the current to the sawmills. Usually this was **a very ancient and traditional way of transporting logs.** What happens is, where they are felling the trees will be somewhere located up stream. As they fell the tree they stack it in a place, when it is ready to be sent to the saw mill, these logs will be tied and then they would be put into the water. And with the stream water speed these logs will travel downstream and downstream the saw mill will be located where It will collect these wood or logs and then further process it.

The Stage 3 is called **CONVERSION**:-This is a **process of turning a log into a pile of boards or plank**s. At the saw mill, the logs are cut into boards or planks using equipment such as circular saws and band saws. Now conversion usually consists of two stages –first is the rough sawing. Second is the resawing. Rough sawing basically t**he wood which is in circular the log which has circular cross section is just cut or sliced through. A**nd in the second stage that **is resawing, more accurate and more precise cutting is done. The board or plank is finished as well, finished using machines such as plaining ,and further sawing, sanding etc.** So you see in this image, now you see in this image, there are different techniques to cut a wooden log into boards and planks. **Few methods** we see here. First is **through and through sawn where you see the wooden log which is completely cut like in one direction** and the final product you get is something like this. Then there is something called **quarter sawn where the wooden log is cut first vertically and the rest of the portion is cut horizontally and then the quarter**

portions are also cut diagonally. So the final product you get is something like this. You get Bigger planks that are vertical and half of the bigger planks that are in the horizontal portion and then smaller smaller planks from the quarter portion. So these two types of sawing through and through sawing and quarter sawing is the most widely used type of conversion. Usually for conversion what happens is **first the log of wood the ends are trimmed off so that they are the final piece is straight at the ends. Then each trimmed log is cut into boards** like we saw earlier it will be through and through or quarter sawn. So now again these boards are passed through a circular saw where earlier when the board will be like this after passing through the circular saw these edges are cut off, and it will be a perfect rectangular piece. Like I explained, large circular saws are then used, to further process the boards removing the curved edges. Each piece of, the processed piece of wood now looks like a board. Now these boards further go through machines where it is plained, where the surfaces are plained off or made more straighter and are also sanded .

Now the **fourth step** in the processing of timber is **SEASONING**:-**Seasoning is a very important step in the processing of timber. When a tree is felled it contains a large proportion of water or moisture. Many felled trees have around 40- 50 % of water content. This water content or moisture which is also called sap is harmful for the life of the timber. So this is where seasoning comes in. Seasoning of natural wood is a process through which this excess water content or sap is removed leaving typically around 15- 20% 0f sap.**

Now is **seasoning really necessary**?:- Yes it is very necessary because, water that has wood. Now is seasoning necessary? Yes seasoning is very necessary because **wood that has not been seasoned and still has a high water content is called green wood.** Now this **green wood easily attracts all kinds of insects, fungi, moisture and can be easily affected by atmospheric factor**s. So this wood has to be properly seasoned to get a seasoned wood. We can only seasoned wood is fit for use in construction and also furniture.

Advantages of seasoning:- **Seasoning reduces weight , the moisture is removed. The weight from moisture is removed so automatically the weight is reduced. Seasoning the wood makes the wood or the timber very strong and durable. The timber's resistance to decay and rot increases. The timber can also take high polish when it is properly seasoned. Well seasoned timber is easily workable and has a longer life.**

Now **seasoning of timber**. There are many different processes to season timber. Majorly we can classify the processes in **3 different types- natural seasoning, artificial seasoning and water seasoning**. Under artificial seasoning we have 3 again commonly different **types of seasoning. One is kiln seasoning, chemical seasoning and electrical seasoning.**

Now let us see what is **natural seasoning of timber**;- Natural seasoning as the name suggests is basically **to let the timber dry out in air, under wind and sun. Pieces are arranged or stacked one above the other keeping some space in between them so that the air can**

circulate between them. Usually these timber pieces are kept on a clean ground or more preferably on a wooden large piece of wooden plank which is raised of the ground to protect it from dampness in the ground. So like you see in this image, This is the timber stacks that are to be seasoned and it is placed on a larger wooden plank which is again raised from the ground. So if there is any ambient moisture in the ground it will not affect the timber. Usually it is dried under shade also which in case if there is a sloped roof on top of it , the slope roof to keep of the rain, if there is any rain it won't stagnate on top of it and it will slope of. So it is usually kept under a sloped roof in case the timber is being seasoned in dry in under. Timber is also , natural seasoning is also sometimes done under shade in which case there will be sloped roof on top of it , sloped roof such that the water will drain off and not stagnate the rain water will not stagnate on the roof and seep through the roof to affect the timber stacks below. So like you see in this image the timber stacks are arranged under a sloped roof. Usually this type of seasoning the duration may takes around few months to a year to properly season the timber.

Now we will see **artificial seasoning** :- Under Artificial seasoning- **Kiln seasoning**:- so as the name suggests **timber is again placed in stacks with gaps in between them for proper circulation of air**. Now this stack of timber **is placed inside the chamber with special heating arrangement**. Now this heating arrangement should be in control. You **should not heat too much so that the timber might get overheated, or it should not be less such that the sap is not properly removed from the timber. Inconsistent seasoning will lead to crack and warping**. In this after the timber is placed in the chamber, the chamber is sealed off, and then the whole chamber is heated to remove off the sap. Now **duration of this kind of seasoning takes around 3- 12 days for getting properly seasoned t**imber. Now you see here this is a section of a kiln compartment, the central thing is the timber stacked here. It is again placed on a platform and then hot air is circulated, amongst circulated within the timber stacks so that is why we have when the hot air circulates within the kiln the timber pieces, to have gap in between them, it is very important for these timber pieces to have gap in between them, such that the hot air can pass through the timber stack. Usually in most kiln there is a fan provided which will extract moist air out of the kiln.

Next the type **of artificial seasoning is chemical seasoning**:- The **chemical seasoning is nothing but a chemical is applied on the timber and this chemical drives out the sap from the timber. So usually the chemicals used are carbon dioxide, ammonium carbonate and urea. This chemical is applied in dry state** . Timber usually in this case timber dries from inside. Next type of artificial seasoning is chemical seasoning:- usually what happens is chemicals are applied on top of the timber and these chemicals draw out the moisture from the timber. The chemicals used are carbon dioxide, ammonium, ammonium carbonate and urea. These chemicals are usually applied in dry state. Timber dries from the inside that is first the core of the timber dries, then the outer portion or the edges of the timber dries. So this ensures uniform drying or uniform seasoning of timber. Now what happens in this chemical seasoning is timber **stacks are put into a chamber. The chamber is closed and sealed off. Then the whole**

chamber is vaccumised. All the air is removed off. Then from the tank which contains the chemical, it is poured into the tank. So the whole tank is filled with chemical. Then After the timber it is made sure that all the timber is covered with the chemical. The chemical tank removes the chemical from the chamber. Then After it is made sure the whole timber is covered with chemical, the tank removes the chemical from the chamber. Then the pressure is released that it is devaccumised, then the timber which is covered with the chemical is taken out and left to dry. So this chemical like I said before draws out the sap. Now the duration of this type of seasoning is about 30 – 40 days after which we get the properly seasoned timber.

Last type of **artificial seasoning is electrical seasoning:- electrical seasoning** is nothing but where the timber **is an electrical current is passed through the timber**. **This current removes the sap from the timber. Duration of this is the lowest which is just 5- 8 hours** you can expect a well seasoned timber. But when you are passing the electrical current it should be well in control so that it does not crack the timber or it does not form any defects in the timber.

Now the **Water seasoning**:- Water seasoning is nothing but where **timber logs are kept immersed whole in flowing water.** So flowing water is most important to consider in this type of seasoning because flowing water for example water is flowing in this direction and **the same direction the timber logs are kept such that the water flows will remove the sap from the timber logs or the sap present gets washed away.** Now after certain period the timber is immersed the whole logs are removed out off the water and kept in open air for drying. **This type of seasoning takes about 2-4 weeks** , to give a properly seasoned timber.

Now lets see what we have learnt from this video: - **We tried to define timber, what is timber and what is wood and what is timber. Then we saw what are the different types of wood from which we get different types of timber and which wood is good for timber and which wood is not to use for a timber. Then we saw the different properties , characteristics , physical properties and uses of timber. Finally we saw how you prepare timber, the different steps that is the felling of trees ,transportation, conversion and seasoning. Four steps for preparing timber and finally in seasoning what are the different types of seasoning of timber.**

So from what you have learnt in this video try to use it in your practical life also by **finding some example of hardwood furniture in your home and identifying the type of wood to make the furniture .And Can you also try to find the different types of grains available or try to research about the different types of grains available in timber and how these grains are used aesthetically in interior design , furniture and all. Can you tell the length of logs usually preferred for transportation? And finally can you answer what are the chemicals used for chemical seasoning of timber?**