Building Materials II

Lecture 8

Timber in Building Construction

First how is **timber used in building construction**? We can majorly classify it into two parts. First part is classified as part of a structure and the second part is where timber is used as an aesthetical member. When you come to timber used as part of a structure, it is used in part of beams, doors, used for flooring, timber roofs, sometimes the whole house is made of timber.

Timber as an aesthetical member is used in wall cladding, exterior wall cladding, interior wall cladding, furniture, and then you have storage units and everything.

When we see these two broad classification, in some areas these classification, the application of timber, for example you see here, the timber floor and wall cladding are also part of a structure and as an aesthetical member.

Now lets see **what are the timber products used in the market**. Majorly two types of timber are available in market. One is **natural solid timber** and the other **one is engineered timber**.

Natural solid timber is basically the timber log is seasoned and converted as it goes to the process of conversion and the final product is used as such. While as in engineered timber what happens is it is a sought of man made timber. Timber pieces are further used and processed. They are engineered to be more structured and stronger than natural solid timber and certain advantages they have over natural solid timber.

So coming to natural solid timber and the different types of natural solid timber available in the market. First is square, board, planks, batten, logs, dowels, posts, strips, reapers and beadings. There are more number of products available in the market, these are the most general types of timber.

So lets know **what is planks, batten and boards**. These are pieces which are sawn , have straight sawn edges , plain surfaces and mostly they are sanded as well. Also their cross section has a rectangular cross section and the cross section when compared to the length have a longer length. So these are the common properties of these 3.

Then **what differentiates planks from battens and boards**. Lets see. Planks are usually thicker. They about 50-150mm in thickness and the width is more than 255mm. the lengths are usually 2.5m to 6.5m. while battens compared to planks are thinner. Their thickness is 30-55mm only and their width if you see at the cross section is less than 175mm. when you see boards , boards are usually the same thickness as battens. They are about less than 50mm, but the width when compared to battens is more than 125mm. if you have a timber piece of 50mm thickness. If it is less than 175mm it is a batten, if it is more than 175mm it is a board.

Next we will see **what are blocks and squares**. **What are squares**?:- squares are natural wood that are supplied in square or rectangular shapes like you see in the image. While blocks which are an extensively huge form of timber are available in a wide range of measurements typically 50 by 50 into 600mm. thes are sought of one and the samething. **Blocks** are also called squares in some regions and we can be confusing of almost one and the same thing.

Now lets see **what are posts**. Posts are a round or square cross section timber piece with a diameter or side varying from175mm to300mm. so when you compare posts to squares or blocks, posts have a longer length and cut a cross section and see section is bigger than the square's cross section.

Application of posts:- posts can be used as a structural element and like I said they have more length compared to blocks or squares. You see in this image, this is a post and this post is being used as a column which is a structural member. Post is also used as a beam which is a structural member.

Now lets see **what are logs?** Logs are part of trunk or a large branch of a tree that has been fallen or been cut off. Usually they are available as seasoned or unseasoned also. Unseasoned meaning green wood. They are not widely preferred. Their applications are not much , they are usually sent for further conversion, where it is turned into planks, battens, squares, posts. Logs are used to construct log houses usually constructed in cold climate.

Lets see **what is dowel**? Dowel is a cylindrical form of timber and is supplied in different sizes. Usually the common range is 6mm diameter to 40mm diameter. These are usually available as dowel rod like you see in the image, these are cylindrical and are quite long. This dowel rod is further cut into shorter portions which are called dowel pins. These dowel pins are cut to required length. Applications are majorly used in wooden joinery where you would have heard of double joints, where 2 pieces are used and dowel pins are used to reinforce the joints.

Next **strips and reapers**.:- Strips , reapers again mean the same thing, the jargon might vary from region to region. Strips or reapers are usually sawn timber pieces of assorted or non-standard sizes those may not confirm to any of the previously mentioned sizes. So if you see in these images the strips that you see, thes strips can only be used as an aesthetical or decorative purposes. They cant be used for any structural member because they don't have much structural stability. They have a vast scope of uses. When you see anything that can be used for decorative purposes, automatically their scope increases. Long strips can be bent to a certain extent which is an advantage since their cross section is very thin and bent to a certain extent and thicker strips are also carved and then used as beading.

Beading or decorative moulding:- Basically they are assorted timber pieces with small thickness with rectangular or square or any designed cross section intended to be used as borders and frames. So you see in this image there are several different types of beadings shown they are also used for decorative purposes. They are available as long strips which can be cut and used as

per the requirement in the interiors. **Broadly 3 types of beadings are available**. One beading which can be applied on **flat surfaces** and two types are one which can be applied **on outer corners and inner corners**. So when you talk about flat surfaces, this is an example. This is a brick wall. Your beading can be something like this. So this beading is attached to flat surfaces. Outer corner means if there is a wall profile like this or any furniture profile which has a corner like this, there used to be a beading there. Then there can be a beading which will protect the corner. In this case this will become the beading or decorative moulding for an outer corner. When we say inner corner, it is exactly opposite of the outer corner. For example this is the floor of the room and this is the wall of the room. This is the skirting and you have a beading here. This is an example of an inner corner beading. So beadings usually have a wide variety of uses. Doors and windows have beadings, walls have beadings. They can be put in the junction of floors and walls or Walls and ceilings, for furnitures. They can be majorly used for photo framing.

You saw the **various timber forms available in the market**. Now timber conversion is a very important step in preparing the timber or whatever timber is available in the market. It is all because how the conversion was done and what was the analysis before the conversion was done. So first to do the conversion, we have actually seen the process what are the different types of conversion we have seen in the previous lectures. Now I just tell you for example, we have to first analyse what end product is required, what is the order that is required and accordingly the conversion is done. So basically if you see this image, you see one log of wood being exploded into several different smaller pieces which are different types of timber forms. For example the centre one is the timber square. This can be the timber plank. These smaller ones are the timber battens and this can be the timber boards. These smaller ones are the timber strips. The curved ones at the edges are obviously the waste materials that cannot be used. These again can be called as timber battens, little less wide timber battens. So before conversion what kind of timber is required in the market that analysis has to be done. In case for example you want to have teak wood, which is completely have to be made into only planks. Then lets consider this as the cross section of the teak wood log. So now we want only planks. So how the conversion will happen is, we have learnt about through and through conversion in the previous lecture, that is what will be done. The whole piece will be cut like this , through and through. And obviously the end pieces, this portion, this portion which contains curved areas of the wood will be removed. So finally we will get timber planks of square edges and uniform size. So what is the demand of the market according to that how the conversion will be done is analyzed.

Market Forms of Timber

Now let's see the different forms of engineered timber available in the market:- Before that **what is engineered timber?** Engineered wood products are made from the same hardwood and softwood that is used to manufacture natural solid timber. But here what happens is whole logs as well as saw mill scraps are used for engineering the wood composed of wood particles or fibres. Now why do we need engineered timber? Why can't we just keep on using the natural

solid timber? Why do we have to process it further? Engineered timber we use because it provides better stability and better stress performance compared to solid timber. Also it has flawless appearance. Since it is engineered it has no defects, no knots, no splits, no staining, cupping nothing will happen. And most importantly they are available in uniform sizes and the size is quite predictable unlike the natural solid timber. They can be made to order. Because of these conditions they are easy to work with, handle and store. Also application and installation are quite easy. They are time efficient , labour-saving and their assembly is cost efficient .

So timber products available in the market- engineered timber:- You have ply wood, block wood, particle board, fibre board, hard boards , laminates and veneer. When you see these are the most generally available type of engineered timber available in the market. But with the advent of technology and research new types of timber are coming now-a-days. When you see these 7 types, plywood, block board, particle board, fibre board and hard wood are not used for aesthetical purposes. Only veneer and laminates these 2 are used for aesthetical purposes.

Lets see **what is ply wood:-** Ply wood is a composite material made of timber although we often consider it as a traditional working material, while it is not. It is composed of individual plies or veneers of wood. The characteristics of plywood are plywood is very strong due to the way plies are put together. Because of the way it is put together it is less likely to warp and split. Manmade boards of this type are supplied in a range of sizes and thicknesses based on the market requirement. Also this is an advantage when compared to natural woods as man made boards can be manufactured so that they are extremely wide. In natural woods you cannot go beyond a certain length, certain width for the board. There is a limitation to that. While in Man made boards that is not there. As much as wide you can go because you are engineering it. Plywood is the most popular material in the construction industry now.

Lets see **what is the plywood structure**:- It is basically made of individual layers of veneers or plies. Now when I say plies or veneers, this veneers can be confused with the decorative veneers. This veneers used to make ply wood is different from decorative veneers. I'll get into the decorative veneers later. These veneers used to make plywood are 3mm thick or lesser. So each ply or each veneer is grain is running at a 90 degree to the next layer as indicated in the adjoining image. For example in the first layer if the grain runs vertically , the next layer the grain runs horizontally. In this way the panel strength and stiffness in both directions are maximized. Then the plies are glued together with synthetic resin making a very strong composite material. This whole layer of plies are bonded under heat and pressure with durable moisture and adhesives. Plywood is usually constructed so that an odd no. of plies are used. That is because if you use an odd no. there is less likeliness of splitting, bending or warping.

How **plywood is manufactured**?:- this is a general lay out of ply wood manufacturing process. A log of wood is brought. An optical scanner centres the log of wood into the rotating veneer cutter machine. The rotating veneer cutter machine inserts a knife, then starts peeling of the veneer from the log while its rotating. After the veneer is taken, the veneer is passed through a

dryer where it is compressed and all the moisture from the dryer is removed. This is sought of like seasoning the veneer. Then like you saw before plywood consists of several layers of veneer. The veneer on top is called face veneer and the veneer at the bottom is called back veneer and the veneers in between are called core veneers. Now you can have face veneer and back veneer as the same veneer if you want a good finish on both sides. But if you do not worry what kind of finish is going to be at the bottom, then the back veneer need not be of the same quality as the face veneer. Face veneer basically looks good and has a good grain texture. So face veneer, core veneers and back veneers are taken and adhesive is applied between each layer or urea formula is the resin that is applied between each. And then the whole thing is sent to a hot compressor. You see this compressor tower, in reality it is also something like this. Compressor can compress up to 10-12 ply woods at the same time. So the layers of veneers are inserted and then the compressor compresses them under pressure and heat. This bonds the different layers of veneers together. Then what you get out of the compressor is the ply wood piece. Then still you have raw edges and so this ply wood goes under trim saws where the edges are cut off and you get fine square edges. After that the ply wood is sent under a belt sanding machine, where both the sides of the plywood are sanded. Then you get a uniform plain. Finally this plywood is stamped and sent to the site or to the market. The plywood can be finished with a decorative layer of veneer or laminate for aesthetical purposes. So if it is a predecorated board also commonly known as pre laminated board, then a decorative finish of laminate is inserted along with the other layers of veneer into the hot press. So the plywood which comes out of the hot press is the end product which does not require any end finish.

Now **plywood types** can be broadly classified into 2 **based on the wood** it uses and based on the usage. We can use **hardwood** as well as s**oftwood** for making ply wood. In hard wood examples like teakwood , gurjan wood or birch wood. ply woods made of hard woods are usually used in kitchen units and furniture because they are of better quality when compared to softwood. When it comes to soft wood you can use cedar, mango wood and all. Usually it is used for walls , roofs and floors.

Based on usage it has **regular plywood** that we use for your residence. You have **commercial plywood** or moisture resistant. **Moisture resistant** it does not mean that it is water proof , it just resists water. This plywood can withstand some amount of moisture, dampness and humidity. then another type is water proof plywood. **Water proof plywood** are exterior grade or BWR or boiling water resistant plywood. They are used in furniture that is likely to get wet. Example kitchen furniture or any furniture that is placed in the bathroom.

There are many different types of plywood available, this is just a few **special types of plywood**. **Flexi plywood** also called flexiply, this can easily be rolled up. Usually used to create round and curved shaped furniture. Then FR ply wood or fire retarded plywood, these are used in places where fire has to be reduced, surface is treated with fire resistant materials. Again this is not fire proof, this is fire resistant plywood.

Termite resistant or bore proof ply wood – usually offers protection from external pests that can destroy the wood. Though plywood has better resistance to termites and other insects compared to natural solid timber.

Structural plywood- usually suitable for structural application where structural stability is required.

And another special type of plywood is **concrete shuttering plywood**. Concrete shuttering plywood has exclusive use only for scaffolding, concreting and all. These have a shiny phenolic film over the surface, the surface that touches the concrete, shuttering or scaffolding. This is used to create wooden moulds for concrete casing.

Now **ply wood size and thickness**. What are the different thicknesses available in the market?:- Moisture resistant grade plywood is available from 3mm to 25mm. while Boiling water resistant plywood area available from 4, 6,9, 12, 16,19,25mm and shuttering plywood is available from 6, 12, 15, 18, 21, 25mm thicknesses. Sizes available are 8 into 4 feet ; 8 into 3 feet; 7 into 4 feet; 7 into 3; 6 into 4 feet and 6 into 3 feet. Now the largest size of ply wood available is 8 into 4 feet. Now why do you think That is the largest size since it is engineered you can go to a large size as you require it. Why do we have to limit 8 into 4 feet is the largest size available in ply wood? This is because consideration is given to the transportation of plywood . Maximum 2 people can easily carry this plywood that's why this is the largest size of available plywood. Can you tell how these sizes are arrived ?

Some **facts about plywood** :- leading brands of plywood in India are:=- Century plyboards, Greenply, national plywood, sarada plywood, Mayur plywood and kitply. Some Indian standards to control plywood quality are IS303 for MR; 710 for Marine plywood; 10701 for structural plywood and 4990 for shuttering plywood.

Now what is the **future for plywood and is it a sustainable material**?:- even though plywood makes rarely efficient use of trees, essentially taking them apart and putting them back together in a stronger more triple configuration, it is still considered waste inherent in the manufacturing process. So in most cases only about 50 – 75 % of the usable volume of wood is converted into plywood. To improve this figure, several new products are development. So one of these products are called oriented strand wood, because it is made by shredding the entire log into strands rather than peeling a veneer from a lof and discarding the core. The strands are mixed with adhesive and compressed into layers with the grain running in one direction. So these compressed layers are then oriented at right angles to each other like plywood. Now this plywood is called oriented strand. One of this product is called oriented strand board which is made by shredding the entire log into strands rather than peeling a veneer from a log and discarding the core. Oriented strand board is as strong as oriented ply wood.