REPORT

FCLT PROJECT | GENERAL INFORMATION ABOUT WOOD

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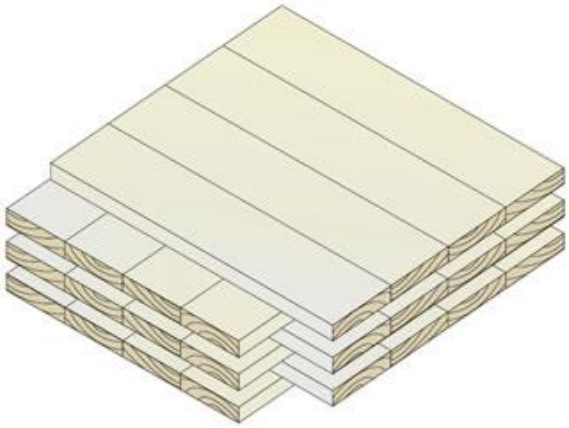
What is CLT?

Cross Laminated Timber (CLT) is a massive timber product which can be used as floors, walls and roofs in building construction. The wood panel is made of several layers of dried lumber boards which are stacked perpendicular to each other. Therefore, the swelling and shrinkage of the wood can be reduced to a minimum. The panels are glued and pressed and therefore have exceptional strength, dimensional stability and rigidity. The glue which is used to bond the layers together is formaldehyde-free, environmentally-friendly and makes up less than 1% of the entire product. The panel usually consist of an odd number of layers of wood, like three, five or seven. The thickness of the panel which can vary between 50 mm and 500 mm, depends on the requirements of the customer and the application area. The typical maximum panel dimensions for commercial use, which are mostly limited by transportation restrictions, are 18 meters in length and 3 meters in width. The finished pre-cut CLT panels are mostly delivered directly to the construction site and can be set up very quickly.



It is of huge importance that the CLT has a wood moisture of 12% (+/- 2%), because it eliminates the risk of pest or fungal infestation and insect attacks. Otherwise the long life expectancy of the house cannot be guaranteed and the health of the humans living inside the building is endangered.

The wood panels are produced largely from Norway spruce timber, but can also be manufactured from White fir, Scots pine, European larch, Douglas fir, and Swiss stone pine.

General information about wood

Wood is a sustainable resource, if the used amount does not outstrip the renewable amount. In whole Europe exists a huge stock of wood, especially in Finland and Sweden the forest area covers three quarters of the whole state area. The country with the biggest area of wood is Germany followed by Sweden and France.

Wood often outperforms other materials in terms of energy usage and air pollution, because its' workability is very easy. You do not need much energy to fell trees and the used machines do not emit as much CO_2 as for example in the steel industry. Furthermore, wood safes carbon dioxide and has therefore a huge impact on the climate change. If we substitute more materials like concrete, brick or steel with wood, the CO_2-emissions can be reduced.

Wood is one of the oldest building materials, but fell in oblivion during the 20th century, when concrete buildings were more popular. Now in times of climate change, wood experiences a revival and more and more building companies offer the possibility to use wood inside and outside the building. Nowadays, in Europe and Canada multi-storey houses are built with heights of 50 to 60 metres.

Additionally, due to its low density and its high stability, wood is a universal building material which can cope up with nearly every requirement. Concerning the low weight, it can also be used to solve space problems in big cities by adding an additional floor to already existing buildings.

The use of wood indoors can lower blood pressure, heart-rate, psychological stress, susceptibility to illness, and lead to a better ability to focus attention. Wooden surfaces spread warmth and make you feel comfortable and calm.

Hygroscopic properties

Wood has the tendency to absorb or emit humidity from its environment. Due to that fact, it can balance fluctuations in indoor climate such as change of humidity or internal temperature. Thus, you feel very comfortable inside a wood building.

Wood usually contains some water. This moisture may be chemically bound within the cell walls, or be present as liquid or water vapor in the cell cavity. Moisture content of wood is defined as the weight of the water as a percentage of the oven-dry weight of the wood. Timber will sustain damage, if its moisture content remains at over 20% for long periods of time. The relative humidity of the surrounding air is then usually about 80-90% or more. Wood begins to go mouldy within a few months if the relative humidity of its surrounding air remains at more than 80% during this time. The 70% relative humidity of air can be considered as a critical value. When the relative humidity of the air exceeds 90%, wood begins to rot. Although in sub-zero temperatures the relative humidity of air may be more than 85% for long periods, wood does not suffer damage, because the temperature is insufficient for fungus and decay to develop. Fungus cannot penetrate deeper than the surface of the wood, so it is not harmful to the strength of the wood. The spores spread by the fungus are, however, harmful to health, because they can give people different allergic reactions and mild symptoms of poisoning, such as a continually runny nose, dizziness and headaches.

Especially cold weather can affect wooden buildings. When the temperature drops, most people intend to close their windows and doors, and cranking up their heating systems. This tends to cause the internal air to dry out and has the knock-on effect of drawing moisture from the timber. Exaggerated effects like cracking and shrinking in wood placed near heaters or vents can be noticed. To slow down the movement of moisture in timber, finishes can be applied and treated products can be used. When transporting or storing timber, it is important to give it a chance to acclimate to the surrounding climate.

Thermal properties

The thermal conductivity of wood is relatively low because of the porosity of timber and declines, as the density, moisture and temperature of the wood decreases. Air pockets within timber's cellular structure create a natural barrier to heat and cold. Therefore, it can be used as thermal insulation in construction, which balances the movement of moisture in the structures. In the direction of the grain, the thermal conductivity of wood is about twice as high as it is perpendicular to the grain. Additionally, if the temperature of wood decreases, its strength will usually increase, but at a temperature less than 0°C, wood may start to crack as water in the cell lumens expands as it freezes. Furthermore, repeated variation in temperature decreases the strength of wood. Those properties can often be critical in cold areas, where the difference of temperature from the inside to the outside is very high.

Fire properties

When thinking about wood as a building material the fear of a fire might occur. But towards every expectation fire progresses slowly and in a predictable and measurable way in a solid wood product. When exposed to the heat of a fire, timber goes through a process of thermal breakdown into combustible gases. During this process a layer of carbon is created. It acts as an insulator, protects the wood, and slows down the increase in temperature of the wood’s inner parts and thus the progress of the fire. In glued laminated wood, the speed of carbonisation is less than 0.7 mm/min. The ignition sensitivity of wood increases as its density and moisture content decrease, and as the thickness of an individual piece of wood decreases. If the timber has sharp corners, rough surface, flaws and cracks, it will be more likely that it burns quicker and the fire expands faster. The ignition temperature of wood is affected by how long it is exposed to heat. Wood usually ignites at 250 - 300°C.