

Cross-Laminated Timber

CLT, or cross-laminated timber, is a newly engineered material with potential just beginning to be explored. Given Hiruzen's history of timber production and local passion for sustainable development, the city of Maniwa promises to become a major center of Japan's CLT production.

What is CLT?

CLT is a building material made by laminating thin layers of sawn lumber perpendicular to one another to form large panels. These panels retain the attractive grain of natural wood while providing increased stability, heat resistance, and versatility. CLT was developed in Europe during the mid-1990s, but its use has more recently gained traction in Japan.

How is CLT made?

The first step in making CLT is to dry the lumber thoroughly in a special kiln. Wood contracts as it loses moisture, so this process ensures the component lumber does not later change size and create warping in the finished panels. Once dry, each piece is sorted by appearance and strength to determine where best to place it.

Next, the lumber is made into planks up to 12 meters long, connected via interlocking cuts called finger joints. These cuts, which look like a line of narrow spikes, distribute pressure and increase the surface area for gluing, resulting in an extremely strong bond. Such joints can be employed to make much longer planks without the loss of stability, but legal restrictions on the length of truckloads in Japan make 12 meters the upper limit for road transportation.

The planks are aligned and coated with laminate adhesive before being covered with another layer of planks laid perpendicular to it. The process is then repeated, with the final number of layers varying depending on the panel's intended use. Once all the layers are complete, 8 kilograms of pressure per square centimeter is applied to the panel for 40 to 60 minutes (depending on the air temperature) as it sets. The panel is then put aside for 24 hours to finish drying.

The completed panel, called motherboard, is then cut to order. Since everything from joints to openings for windows and light switches is precisely cut at the factory, on-site construction time is dramatically reduced. The pre-cut pieces can simply be snapped together and fixed in place.

What are the advantages of CLT?

The advantages of CLT are manifold in terms of cost, functionality, and sustainability. As a building material, CLT has demonstrated more stability, better fire and seismic resistance, and better insulative capability than standard wood paneling, yet it retains the timber's natural color and grain.

In addition to its aesthetic advantages, CLT has the benefit of a lighter environmental footprint than concrete or steel, but just as much versatility. Concrete has long been a construction staple, but the sand required to make it is becoming increasingly difficult to obtain. Wood materials, however, are renewable and easily obtained domestically. Furthermore, both the use of local raw materials and the lighter weight of the finished product during delivery serve to reduce the carbon output from transport.

CLT also allows for much more efficient use of timber resources. It enables smaller pieces of wood to be amalgamated to make large panels, and also creates a market for wood that has traditionally been considered less attractive. For example, in Japan the uniform paleness of hinoki cypress is prized more highly than the dramatic color differences in the grain of Japanese cedar. However, hinoki grows much more slowly than cedar and is therefore more expensive. A CLT panel can be created with hinoki cypress planks on the outside and less-expensive cedar planks hidden inside, which lowers the price of the finished product. Additionally, this system allows faster-growing tree species to be used in combination with slower-growing trees to better sustain forests.

At the construction site, structures can be quickly assembled from prefabricated CLT panels, as there is no need to wait for concrete to dry. The modular nature of these structures means buildings can also be easily disassembled and moved if needed. Better insulative capability offered by CLT translates to lower heating and cooling costs and a reduced environmental impact over the long term.

Even the waste created in the CLT production process can be put to use. In Maniwa, wood scraps and sawdust are collected and burned for fuel at a biomass plant across the street from the CLT factory. The waste heat generated is in turn sent to the wood-drying kiln at the CLT factory, resulting in a closed production loop.

To see an example of CLT's potential, visit the Maniwa Visitor Center, where a pavilion designed by architect Kengo Kuma and crafted from homegrown timber provides a spot to relax and take in views of the Hiruzen Highlands.