Wood That Reaches New Heights

By HENRY FOUNTAIN
Published: June 4, 2012

LONDON — Among the many apartment buildings in the London borough of Hackney, the nine-story structure on the corner of Provost Street and Murray Grove stands out, its exterior a mix of white and gray tiles rather than the usual brick.

Enlarge This Image

William Pryce

WITH THE GRAIN, AGAINST THE GRAIN At the nine-story Graphite Apartments in London, structural elements involve many layers of spruce fused together.

But it's what's underneath this cladding that makes the 29-unit building truly different. From the second floor up, it is constructed entirely of wood, making it one of the tallest wooden residential buildings in the world.

It was built three years ago using laminated spruce panels, up to half a foot thick and 30 feet long, that were fabricated to precise specifications in Austria, shipped across the English Channel and bolted together on site to form the exterior and interior walls, floors and roof. Even the stairwells and elevator shafts are made from these solid panels, called cross-laminated timber, which resemble supersize plywood.

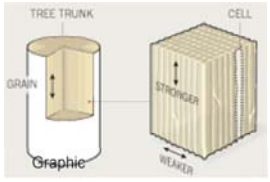
Developed in Europe in the 1990s, cross-laminated timber, or CLT, is among the latest in a long line of "engineered" wood products that are strong and rigid enough to replace steel and concrete as structural elements in bigger buildings. Already popular in Europe, CLT is only beginning to catch on in North America, where proponents say buildings made with the panels could be a cheaper and environmentally friendly alternative to structures made with those other materials.

"This is the way we ought to be building," said Pete McCrone, whose company, Innovative Timber Systems, in Whitefish, Mont., hopes to be the first to produce cross-laminated timber in the United States. So far Mr. McCrone has built one structure, a martial arts studio in Whitefish, with panels imported from Austria. (That country, whose spruce forests have been managed for centuries, produces about 80 percent of the world's CLT panels.)

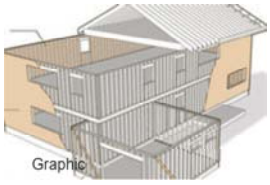
The panels use a lot of wood: A typical eight-foot-high wall can contain more than six times as much as one made with conventional framing using two-by-fours. But with proper forest management, trees are a sustainable resource.

Moreover, the buildings have a low carbon footprint: Because trees remove carbon dioxide from the atmosphere through photosynthesis, the carbon stored in all those panels helps offset the greenhouse gases released in making

Multimedia



Building With Engineered Timber



The Old Way

and hauling the other building materials and in the actual construction.

And by using so much wood, cross-laminated timber buildings might also help solve a vexing problem in North America: what to do with millions of pine trees that have been killed by a widespread beetle infestation but are still standing in Western forests, posing a great fire risk.

But architects, engineers and code-enforcement officials first need to learn more about the product. “Not many engineers in this country understand how to design or construct using CLT,” said Borjen Yeh, technical services director of APA - The Engineered Wood Association.

In Europe, cross-laminated timber has been used mostly for low structures, like two-story apartment buildings or office complexes and schools, in part because building codes in many countries restrict wooden buildings to four stories.

Codes in Britain allow more flexibility, said Anthony Thistleton, partner in the London architectural firm of Waugh Thistleton, which designed the Hackney building, formerly called Stadthaus and now known as the Graphite Apartments. “It’s perhaps the only place that we could have broken this ‘timber ceiling,’ ” he said.

Waugh Thistleton has designed a second CLT structure, a four-story commercial and residential building, now under construction nearby, and an eight-story apartment block is within walking distance, making Hackney a hotbed of cross-laminated timber design.

Last month, construction began on a 10-story CLT apartment tower in Melbourne, Australia. Some proponents think buildings made from the panels could be even taller. “In the U.K., I’m convinced that it will hit 12, 13, 14, maybe 15 within a couple of years,” said Craig Liddell, formerly commercial director with the British division of KLH, the Austrian company that made the panels for the Graphite Apartments. Others say that hybrid structures, perhaps with timber panels built around a concrete core, could reach 30 stories.

A tall wooden structure would seem to be a collapse waiting to happen, but a building made from cross-laminated timber is stronger than a conventional wood-frame structure, in which two-by-fours and other relatively small components are tied together by materials like plywood and plasterboard.

“That’s one of the things we found difficult to get across, that timber panel construction is completely different from timber frame,” Mr. Thistleton said. “It’s got more in common with precast concrete construction.”

The panels are built up from narrow planks, about an inch thick, that are laid side by side to form layers. Like plywood, each succeeding layer — there can be as many as 11 — is laid perpendicular to the preceding one. The layers are glued and the entire sandwich is pressed and trimmed. Then, using computer-guided saws and drills, it is cut to the precise dimensions in the architectural plans, including window, door, plumbing and ventilation openings. Channels for electrical wiring can be cut into the panels.

At the construction site, the panels are hoisted into position and bolted together with metal brackets to build up the structure floor by floor. Construction can proceed fairly quickly — the Graphite Apartments were built in about two-thirds of the time it would have taken to construct a similar building in steel or concrete.

Prefabrication “offers tremendous savings in construction time and cost,” said Frank Lam, a professor of wood building design and construction at the University of British Columbia, where a CLT building that will house a bioenergy demonstration project is nearing completion. Its panels were made by one of three Canadian companies that produce them.

In the Graphite Apartments, even the interior walls are made of CLT panels. These and all the exterior panels are tied together, so the building load — the weight of all the materials, furniture, objects and people — is distributed through most or all of them. “Because the

whole structure acts together," Mr. Thistleton said, "you get this incredibly complex load path through the building."

That complex path also helps protect against progressive collapse, when the loss of one structural element causes others to fail. It is relatively easy to design a CLT building so that if one element were destroyed — through explosion, perhaps — the load it was carrying would be safely carried by others.

Fire is also a major concern — and one reason, no doubt, that codes have limited the height of wooden structures — but solid CLT panels do not ignite as easily as small two-by-fours. "When you're trying to light a fire in your house, you don't start with a log," Mr. Liddell said, by way of analogy. "You start with kindling. You could be hours getting that log to light."

Even if panels do burn, charring on the outside protects the interior wood, leaving the panel structurally sound. Finishing the panels with wallboard or another material will improve fire protection. (Generally the panels are not meant to be left exposed, and at least one side must be finished anyway, to reduce sound transmission.)

In Europe, cross-laminated timber has been around long enough that standards for issues like fire protection and acoustics are being incorporated into building codes. In North America, a more basic understanding of the product is needed first. Mr. McCrone, of Innovative Timber Systems, said that in his experience, such understanding comes relatively quickly.

"Architects and engineers can start out as skeptics," he said. "In a very short space of time they get it, because it's simple — it's large panels held together with large screws."

A version of this article appeared in print on June 5, 2012, on page D1 of the New York edition with the headline: Wood That Reaches New Heights.