Trends in Wood Buildings

Innovative wood products and increasing recognition of wood's cost effectiveness, versatility and light carbon footprint are driving its expanded use in non-residential and multi-family buildings.

Longer spans, taller walls, faster construction

Innovative technologies have made wood a viable choice for applications such as arenas, gymnasiums and lobbies which require tall walls and large open spaces with minimal intermediate supports. For example, engineered wood products such as glued laminated timber (glulam) can be manufactured to achieve spans as long as 100 feet and walls up to 20 feet.

A significant advantage of wood is speed of construction, which is now further improved with the use of prefabricated components and panelized roof and wall sections. In panelized wood roof construction, sections of the roof are assembled on the ground with commonly available products and lifted into place. In addition to speed, this makes the construction process safer, greatly minimizing the risk of falls.

Taller wood buildings

Cost savings, design flexibility, readily available product, aesthetics and the ability to engineer floor, wall and roof systems for superior strength and seismic resistance are among the reasons architects and engineers specify structural wood products in multi-story building designs.

Modern building codes allow four and five-story wood-frame construction in many U.S. states. In Canada, the province of British Columbia recently increased the allowable height of residential wood buildings from four stories to six. In Europe, wood buildings up to eight stories are being built with cross laminated timber (CLT), which is now also creating possibilities for taller wood buildings in North America.

CLT is a multi-layer wood panel made from lumber. Layers of board (also known as plies) are placed cross-wise to adjacent layers and glued over their entire surface, creating a product with exceptional strength and dimensional stability.

In the U.S., the first non-residential CLT building was a 78-foot bell tower in North Carolina, and a two-story CLT structure was recently built in Montana. In British Columbia, a four-story CLT building is underway (among others) and a CLT home has been designed to meet the strict Passive House requirements for energy efficiency.

Advances in wood design

In addition to innovative products and technologies, greater efficiencies are being realized through design techniques such as Optimum Value Engineering (OVE). Although gaining popularity as part of today's green building movement, OVE was introduced to the home building industry more than 20 years ago by the U.S. Forest Products Lab and NAHB Research Center. Also known as advanced framing, the idea is that, through additional engineering, the amount of wood framing typically used in a building can be reduced without sacrificing structural integrity. Benefits include lower material costs, increased energy efficiency (because there's room for extra insulation), and less waste.

Wood schools: lower cost, lighter carbon footprint

In the U.S., wood schools are prevalent on the West Coast because of (among other things) wood's demonstrated ability to perform well in seismic events. They are becoming increasingly popular in the U.S. South as more people understand that wood structures can be effectively designed for durability and to meet all safety and code requirements—while potentially saving millions of dollars in construction costs. For example:

- The 63,000-square-foot Fountain Lake School in Arkansas saved $2.7 million by switching from a masonry and steel design to wood construction.
- For the 320,000-square-foot El Dorado High School, changing 40 percent of the design to wood also saved $2.7 million.

In addition to the cost savings, architects cite several key benefits of wood in school designs: exposed wood beams and columns add warmth that enhances the learning environment; school districts are particularly sensitive to environmental considerations, and wood is recognized as coming from a sustainable resource; engineered wood products such as glulam meet both the structural and aesthetic requirements for large open spaces in school gyms, cafeterias and libraries.

El Dorado High School saved $2.7 million by switching to wood.

School districts are also embracing the light carbon footprint of wood buildings. For example, the wood products in the new El Dorado High School store an estimated 3,660 metric tons of carbon dioxide equivalent (CO_2e)—which the trees absorbed from the atmosphere during their growing cycle. By using wood instead of steel or concrete, which require large amounts of fossil fuel energy to manufacture, the school avoided another 7,780 metric tons of greenhouse gas emissions. Based on the EPA Greenhouse Gas Equivalencies Calculator, this equates to the annual emissions from more than 2,100 cars.

Green building codes and rating systems

In the U.S., there is a trend toward the inclusion of life cycle assessment (LCA) in green building codes and rating systems.[1] LCA is an internationally standardized methodology for quantifying the environmental impacts of materials, assemblies or whole buildings over their entire lives—from extraction or harvest of raw materials through manufacturing, transportation, installation, use, maintenance and disposal or recycling. Typically, LCA is included as an alternative approach to material selection that allows building designers to compare materials and designs based on their quantified environmental impacts.

As more building codes and standards recognize LCA, designers will be encouraged to consider the environmental impacts of their material choices—and to discover that, when viewed over its life cycle, wood is better for the environment than steel or concrete in terms of embodied energy, air and water pollution and carbon footprint.[2]

Photos (in order): APA, Matt Todd, W.I. Bell, Dennis Ivy courtesy WoodWorks

[1] LCA is included in the *Draft California Green Building Code*, the Green Globes environmental assessment and rating system, and as a pilot credit in the Leadership in Energy and Environmental Design system. Internationally, it features in the Building Research Establishment's Environmental Assessment Method, the SB Tool, and Japan's CASBEE system.

[2] *Life Cycle Environmental Performance of Renewable Building Materials in the Context of Building Construction,* Bowyer, J., D. Briggs, B. Lippke, J. Perez-Garcia, J. Wilson, Consortium for Research on Renewable Industrial Materials, 2005