

Bamboo Whitsunday



A Bamboo Future

by Carol Steinfeld
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Super-strong and durable, bamboo is being used for flooring, paneling, furniture, fencing, engineered lumber and even structural elements

The super-material of the future may in fact be the largest variety of grass — bamboo — a traditional construction element in the Pacific that's been used almost solely for decor in the United States.

Now, bamboo is making its way into American homes as flooring, paneling, stair treads, moulding, furniture, fencing, laminates, particle board, oriented strand board, engineered lumber and even structural elements.

Its stability, hardness, flexibility and strength are its most remarkable qualities, says Steen Ostenson of ReSource Fiber International, LLC, which sells bamboo flooring, paneling and other laminated construction materials. "In flooring, hardness translates to durability. [Bamboo] is 23% harder than oak, 13% harder than rock maple. It doesn't dent as readily as hardwoods. And it's just beautiful!"

The Wonder Grass

Fast-growing, quick-maturing, hardy, flexible, strong and renewable, bamboo offers advantages over many conventional building materials. Its high-density strength — in some ways stronger than steel, concrete and spruce — is due to its high content of silicates, essentially the glass-like substance found in sand.

And its reproduction rate is astounding. "Its regeneration rate is so much better than tree forests," says California architect Darrel DeBoer, who designs bamboo buildings. "Bamboo replaces 30% of its biomass in one year; a tree forest only 3 to 5%." In fact, bamboo is the fastest-growing woody plant: Some species can grow up to 3.3 feet a day, and some varieties (there are more than 1,000) can reach heights of more than 100 feet. Harvesting does not harm the plant, which will produce more timbers.

And, according to Ostenson, bamboo fibers can be superior to wood. "It can replace mature fiber every three and a half years — we're dealing with a whole different time cycle. When harvesting soft woods on a 50- to 60-year cycle, what's being harvested is juvenile fiber, so you end up with material that can move around and come apart." And bamboo offers more dimensional stability, he says. "It stays in place.



Paneling and Flooring

Bamboo can be increasingly seen on floors and walls. San Francisco-based Smith & Fong Co. manufactures several products made of “Plyboo,” their laminated bamboo material, including flooring, paneling, heater vents, and gift products. Company president Dan Smith says he uses bamboo imported from China, as well as bamboo from Oregon for some items. Smith says the most notable advantage of bamboo is its stability: “It doesn’t expand and shrink. It has twice the stability of red oak.”

Bamboo is essentially cooked and pressed into shape to make these products.

Tongue-and-groove Plyboo flooring retails for about \$5 per square foot and is installed and maintained the same as hardwood flooring. It is available in up to 6-foot lengths. The company’s tambour-style paneling rolls on to surfaces in 13- x 39-foot sections. It retails for \$5 per square foot.

Flooring is available both finished and unfinished, and in various lengths, depending on the supplier. ReSource Fiber International’s products are made with environmentally sensitive adhesives and are available in 6-foot lengths.

Superior hardness and stability mean that bamboo flooring and paneling resist moisture and stains, according to Danny Sun of Bamboo Flooring International in Walnut, CA. “The price is competitive, and the bamboo knots in the wood give it a unique look,” he says.

Engineering It

Engineered lumber products may soon follow. Researchers at Queen’s University in Ontario, as well as B3 of Atlanta, GA, have produced bamboo particle board to be used as a direct substitute for wood-based panels in furniture, construction and packaging. ReSource Fiber is developing a 23,000-acre bamboo plantation in Guatemala, from which bamboo will be harvested and made into particle board, furniture and laminated products. “More people will be paying attention to bamboo for its ability to produce structurally stable oriented strand board and biomass on a sustainable basis,” Ostenson predicts.

Andy Lee, a professor of wood products at Clemson University, reports that bamboo is a viable material for oriented strand board (OSB), laminated bamboo lumber (LBL) and reinforced material for southern pine OSB. Laminated bamboo lumber offers superior bending strength compared to wood-based laminated lumber, however its elasticity is slightly lower than that of some softwood species. Bamboo OSB shows excellent strength, stiffness, internal bond and dimensional stability compared with commercial standards, Lee says. Bamboo-reinforced OSB beams improve the bending stiffness of the OSB two-fold, and the bending strength 3.4 times.

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One company is considering producing a bamboo truss and joist product. And bamboo is being explored for its value in composites, fibers, resins and even telephone poles.

Bamboo Buildings

Bamboo homes are traditional in Asia, the Pacific islands and in South and Central Americas, but now large-scale buildings made of whole bamboo are popping up worldwide. In Colombia, architect Simon Velez has designed one of the world's largest bamboo structures, a polo clubhouse. It is one of many of Velez's bamboo buildings, ranging from private residences to lodges, some of which feature roof cantilevers extending as far as 28 feet.

In California and the Southwest, builders of strawbale homes are increasingly using bamboo superstructure and pinning.

But bamboo houses won't soon fill mainstream American subdivisions: "Right now, you'd have a hard time finding a structural engineer willing to sign off on any sizeable structure in the U.S.," says DeBoers, who conducts workshops on building with bamboo. (An exception, he says, is Hawaii, where bamboo is plentiful and trees are not.) DeBoer's bamboo projects are small buildings that don't require extensive permits, such as garden structures and a rest area planned for a zoo in San Francisco.

As bamboo's technical construction qualities become better documented, permitting may become easier. "Bamboo will be accepted more and more as a building material as building codes change from prescriptive requirements and proprietary manufactured systems to performance based, much the way the Pacific Rim operates," DeBoer says.

Building with whole bamboo is challenging. For one thing, it is round; its cylindrical shape requires special joinery considerations. Bamboo culms (timbers) have size and surface variabilities, as well as their characteristic segmentation and nodes. Bamboo must be properly cured and treated for many applications. And most notably, bamboo is in limited supply in the United States, despite ideal growing conditions in some regions. Much is imported at significant expense from China and Vietnam—usually a thick-walled variety called "Moso," which is typically 4 to 6 inches in diameter with very thick walls. The dearth of bamboo in the U.S. is likely due to the plant's reputation as an invasive plant; however, that reputation is changing as growers discover varieties that grow in clumps that advance slowly and can be controlled.

"It's a matter of getting enough material and getting enough education," says DeBoer. "For now, the thing to emphasize is using it in places that are really visible, like flooring and roof structure. Its real strength is in its ability to span distances and look good."



How Strong Is It?

Measurements of the strength and construction qualities of bamboo are becoming increasingly well documented thanks to the work of Dr. Jules J. A. Janssen in Holland. Janssen's Bamboo Laboratory at the Eindhoven University of Technology measures the properties of bamboo. The laboratory is working to develop grading systems and building codes for bamboo, just as there are for steel and timber. The aim is to provide this critical information to engineers, architects and builders.

Janssen's research shows that, compared on a mass-per-volume basis to concrete, steel and wood, bamboo is second to concrete for strength, and ranks first for stiffness. According to his book, *Building with Bamboo*, a short, straight column of bamboo with a top surface area of 4 square inches can support an 11,000-pound elephant.

The Bamboo Laboratory also designs bamboo construction programs for developing countries. In the late 1980s, the lab designed 30 three-bedroom homes for Costa Rica that were constructed from thick bamboo pole frames covered with a woven mesh of split bamboo coated with mortar.

In 1992, the homes withstood an earthquake that registered 7.5 on the Richter scale and crumpled all the buildings around them. As a result, the government of Costa Rica decided to subsidize the construction of 1,000 bamboo homes annually.

Cleaning Up with Bamboo

Bamboo, which is a voracious consumer of nitrogen, will also soon be part of an effort to prevent pollution. An ecological engineering firm in Concord, MA, Sustainable Strategies, has designed a bamboo plantation system that will essentially eat, drink and transpire away waste from a North Carolina piggery. Animal waste currently pollutes both surface and groundwaters, particularly in the South, choking off waterways and causing diseases such as Pfiesteria. The firm also employs bamboo in its household graywater garden system, which diverts water from sewers.

Others are looking at bamboo plantations as a way of sequestering the carbon dioxide gases that may be causing global warming.

In a land of dwindling wood sources, the potential of super-strong bamboo can't be ignored. "The lumber industry is tremendously subsidized, keeping the price of wood lower than it should be, and that may change," DeBoer says. "It's going to take some education to do something different, but the results may well be worth it."