Engineered Lumber UPDATE

These innovative wood composite products could save you time and money on your next job

by Lee McGinley

Twenty-five years ago, when I first swung a hammer on a framing crew, "engineered lumber" consisted of roof and floor trusses, plywood, and particleboard. Today, the palette of engineered products has broadened considerably, adding not only new materials, but buzzwords such as laminated veneer lumber (LVL), oriented strandboard (OSB), parallel strand lumber (PSL), among others, to our vocabulary. As architects and engineers push the design limits of these manmade beams and boards, carpenters and contractors have had to become familiar with sophisticated construction and fastening techniques

By now, most of us are familiar with wood I-joists and LVLs, and OSB sheathing has become a staple of much residential building. Many of these engineered products found their way into my projects because they solved unique design problems, like the time the homeowner insisted on no more than two basement lally columns to support the engineered floor system as well as the cathedral ceiling of a 1,500-square-foot addition.

Engineered lumber may be more expensive when compared with solid-sawn lumber, but its inherent strength makes it possible to space joists and rafters farther apart, span greater distances, and eliminate or reduce the number of built-up beams, support columns, and concrete pads needed.

New engineered lumber products as well as variations on previously introduced products are appearing all the time. (For a list of previous *JLC* articles on engineered lumber, see "For More Information," at the end of this article.) While it's impossible to keep up with all of them, here's a roundup of some of the new ideas in engineered lumber.

COURTESY GEORGIA-PACIFIC

FiberStrong rim board is an OSB composite that the manufacturer claims has been edge- and end-sealed to improve moisture resistance and enhance dimensional stability. The rim board measures 1 1/8-inches thick and comes in depths of 9 1/2, 11 7/8, 14, and 16 inches, and standard 24-foot lengths.

TRIMMABLE-END OPEN-WEB JOISTS

Open-web joists have several advantages over traditional solid wood joists and solid-web I-joists — they're easier to handle; they create a floor cavity that provides room for ductwork, plumbing, and electrical wires; they eliminate the need for notches, cutouts, and knock-outs; and the wide nailing flanges are more forgiving of layout errors.

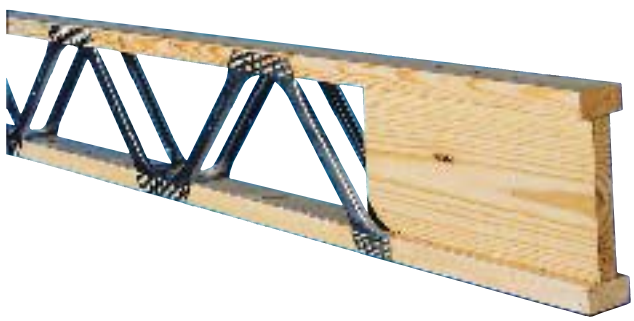
One drawback of open web I-joists has been the need to order exact lengths, then cross your fingers that the building's dimensions don't change before construction starts. Now, open-web I-joists incorporating trimmable ends allow the joists to be cut to length on the job site.

Floors framed with open-web I-joists are typically stiffened with strongbacks rather than the cut, fit, and cut again method of installing solid blocking or fussing with metal bridging. This can be a real time saver. In an all-wood open-web design, 2-by strongbacks are threaded on edge through the floor cavity perpendicular to the joist layout and nailed to vertical web members. With metal web members, placement is the same, but the strongbacks are secured to the bottom chord with nails, screws, or framing anchors. (Check with the manufacturer for recommended strongback sizing and spacing.)

When evaluating manufacturers' span charts, compare loads, on-center spacing recommendations, and web depth to match a product to your need. Some manufacturers use machine stress rated (MSR) lumber, which is stiffer than visually graded materials. Each piece of MSR lumber has been mechanically tested for stress, allowing shallower webs and longer spans.

Remember to follow the manufacturer's guidelines for squash blocks, metal hangers, nailing, and minimum bearing requirements. Some open-web I-joists can be used for rafters as well as floor joists; check with the manufacturer for design criteria, however, before making the substitution on your own.

Open Joist 2000 is an all-wood trimmable I-joist manufactured in 9 3/8-, 13-, and 16-inch depths; an 11 7/8-inch depth can be custom ordered. Top and bottom chords are either 2x3 or 2x4 spruce-pine-fir; the webs are 2x2s, while the trimmable ends are sawn lumber. Up to 5 1/2 inches can be trimmed from each end. Finger-jointed lengths are offered to 30 feet.



Posi-Joist combines metal web members with a 12-inch trimmable solid block at each end and, according to the manufacturer, is suitable for both floor joists and rafters. Top and bottom chords are 3 1/2 inches wide, and truss depths are compatible with solid-sawn 2x8, 2x10, and 2x12 joists; a 15 3/4-inch-deep truss is also available. Solid wood vertical members at midspan facilitate attaching strongbacks.

Space Joist TE uses an open metal web system with 12-inch trimmable OSB webs at each end. Top and bottom chords are 2x3 MSR spruce-pine-fir. The joists come in 9 1/4-, 11 1/4-, and 14 1/4-inch depths in plate-spliced lengths to 28 feet.

TrimJoist is fabricated from #1 southern pine 2x4 components held together with metal plate connectors. The OSB ends can be shortened by as much as 12 inches. The manufacturer claims its unique OSB web-to-chord attachment distributes loads better than other wood-to-wood connections. Joists are available in 11 1/4-, 14-, 16-, and 18-inch depths up to 30 feet long; top and bottom chords are spliced with metal plates.

The open-web joists described here are recent introductions to the market. In New England, where I live, these products all cost more than solid-sawn lumber but, for the reasons given above, they are still very competitive — and perhaps even less expensive with labor costs taken into account — on the right project. When compared with 2x12 sawn joists, Open Joist 2000 costs 10% to 40% more than solid-sawn — the smallest cost difference among the products shown below, at least for lengths under 18 feet. The price difference rises quickly as length increases. For open-web trimmable trusses with 2x4 chords and webs, expect to pay 75% to 110% more than for dimension lumber. (By comparison, wood I-joists cost about 75% more than solid lumber, while LVLs cost around 180% more than spruce 2x12s.)

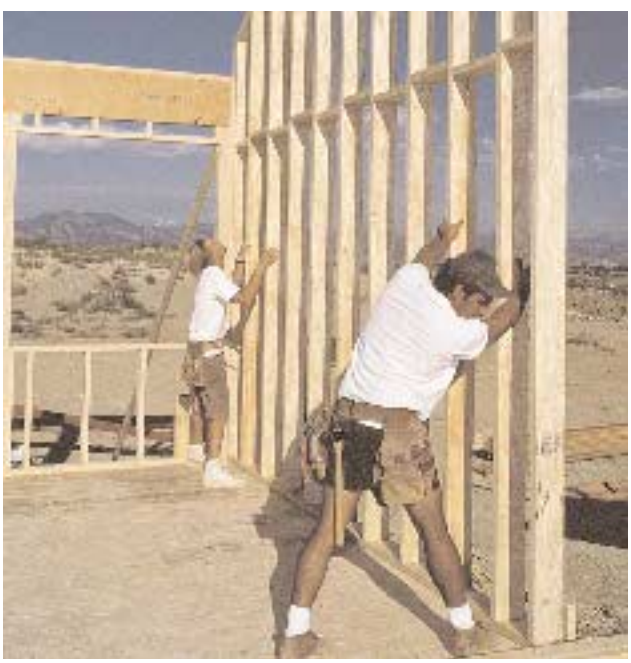
Weight is another issue. Surprisingly, trimmable open-web joists 16 inches deep have the same weight per linear foot as 2x12 dimension lumber. But you'll still need two men to handle long, deep-web trusses.

TIMBERSTRAND

One of the forces driving the development of engineered lumber has been the increasing scarceness and expense of high-quality wide-dimension solid-sawn lumber. Trus Joist MacMillan, the inventor of the wood I-joist, has been a leader in the quest for new ways to turn smaller pieces of wood into long, strong structural members. TJM's TimberStrand typifies the trend.

Generically referred to as laminated strand lumber (LSL), TimberStrand is made from lower quality wood fibers from trees like aspen and poplar. The finished product is like OSB, but with a difference: The strands are much longer than OSB strands — about 12 inches on average — and are oriented in the same direction, layer by layer, unlike the alternating grain direction of plywood and OSB. The result is an increased strength beyond that of ordinary OSB.

TimberStrand's original use was as a rim board for TJM's wood I-joist floor system. But because of its unique manufacturing process, TimberStrand has greater strength than the typical engineered rim board — a fact that TJM has been using to advantage in several new products. TimberStrand is now made into studs and 3 1/2-inch-thick headers, and is used for the members of the bolt-together SpaceMaker truss. It's also used for the flanges of TJM's new Pro 120 TS I-joist. Because the extra strength of TimberStrand is not typically needed in rim boards, TJM is introducing a new rim board product, TJ-Strand, which is a hybrid OSB but, according to the company, is much stronger. TJ-Strand is a full 1 1/4 inches thick and meets the code-required strength values for diaphragm construction in high-wind and seismic areas.



TimberStrand studs are an attractive alternative to dimension lumber for tall walls or where absolute straightness is an issue. But be prepared to pay a premium.

The SpaceMaker Truss, a ready-to-assemble roof framing system, uses TimberStrand LSL components. Truss parts are precut, notched, and predrilled for bolted connections. Hardware is included in the delivered package, which the manufacturer claims can be assembled with a socket wrench.

WOOD-I HEADERS & RIM JOISTS

According to recent NAHB surveys, more than 50% of builders have used wood I-joists, and almost a third of new housing starts include a wood I-joist floor system. First marketed by Trus Joist MacMillan, I-joists are now made by all the major lumber producers, as well as some smaller companies. Superior Wood Systems, for instance, has used I-joist technology to create double-webbed insulated headers.

When I-joists first came on the scene, it was common to use dimension lumber or ripped plywood as rim joists. But dimension lumber shrinks more than the I-joists, and ripping plywood is extra work. So many manufacturers introduced engineered rim joists — now called rim boards — as companions to their wood I-joist systems. Fabricated from wood chips or veneers, rim boards substitute for traditional sawn-lumber rim joists, and can also be used for cantilever enclosures, as "starter joists," or to enclose I-joists. Engineered rim boards may also eliminate the need for squash blocks at I-joist ends (check with the manufacturer for installation details).

But here's a warning: Rim boards are not designed for use as beams or headers. Since sizing varies among manufacturers, it's best to use rim boards and I-joists made by the same company. Also, not all rim boards are equal. For example, Boise-Cascade's Versa-Rim 98 is an LVL-plywood hybrid, while Trus Joist MacMillan's new TJ-Strand is a hybrid OSB product. If you're building in a high-wind or seismic zone, where attachments of the floor diaphragm to the framing is critical, check with the I-joist manufacturer to make sure their rim board achieves the lateral nail capacity required by the design.

Pre-Insulated Headers. Superior Wood Systems sandwiches insect-resistant expanded polystyrene insulation between a twin-web I-joist to achieve R-19, which the company markets as a header for windows, entrance doors, and garage doors. SWII is manufactured in 3½ and 5½ inch widths and depths of 7¼, 9¼, and 11¼ inches. Clear spans to 24 feet are possible.

Versa-Rim 98 is a companion to Boise Cascade's BCI joist. Made of 100% Douglas fir, the plywood-LVL hybrid measures 1 1/16 inches with depths of 9½, 11⅞, 14, and 16 inches. Standard lengths are 8 feet 2 inches and 20 feet.

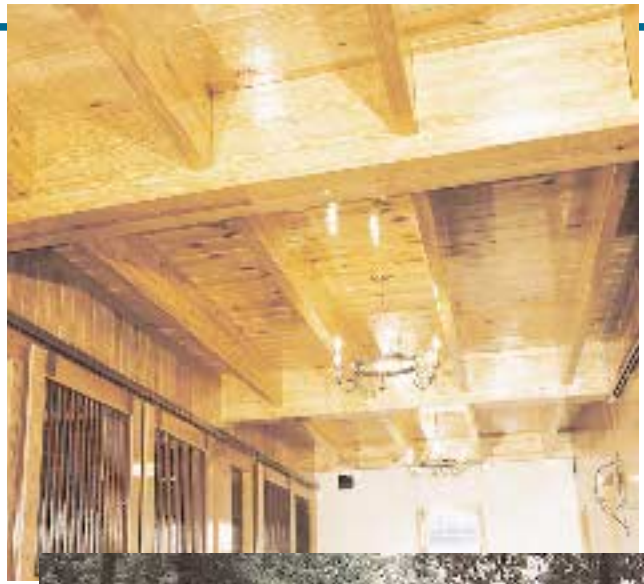
GLULAMS

Structural glued laminated timbers — or glulams — have been around for decades. In fact, they're the original engineered lumber beam. Glulam manufacturers will tell you that their product has several advantages over solid sawn lumber: Glulams resist warping, checking, cupping, shrinking, and twisting because of multiple plies of kiln-dried lumber. Another advantage is that they can be custom made to job specs. But there are other considerations to weigh before deciding to use glulams. They're big, heavy, awkward to handle and often require the assistance of a crane to set in place. And ready-made engineered connectors may be hard to come by, necessitating engineering and fabricating custom fasteners with through-bolts, which may appear unsightly.

For exposed timber ceilings, though, glulams are often the best choice. They can span long distances, and are available in appearance grades. Glulams can also be manufactured with camber, and are available as curved beams.

Engineered Veneer Beams. If you need the structural strength of a glulam but want an exotic skin, Green Mountain Precision Frames starts with engineered Douglas fir glulams and applies a 1/4-inch veneer on three or four sides. They've also made beams with pine veneer and can lay up other veneers on a custom basis. Differential shrinkage between the Douglas fir substrate and veneer finish is not a problem, according to the company.

Classic Laminated Columns. Gruen-Wald glues up several laminated columns, the most unusual of which is a structural post of two lumber species. Multiple CCA-treated Southern pine planks are laminated together for the ground contact portion of the post, finger-jointed to untreated Southern pine for the top portion. The company claims that the hybrid column is popular in agricultural construction like dairy barns, farm shops, and the like. The product is also suitable for residential uses where ground-contact protection is necessary yet above-grade appearance also counts. The company also offers full-treated and untreated columns; all columns are available in lengths up to 60 feet.



Rigidply laminates a raft of products, from heavy timber trusses to wood beams, tudor arches, and complete pavilions. The manufacturer will engineer, cut, drill, stain, and seal entire systems and supply all components, right down to the powder-coated-steel or galvanized framing connectors. Industrial, architectural, and premium appearance-grade glulams are offered for many products. Available wood species include Douglas fir, poplar, treated and untreated Southern pine, and cedar.

Power Beam. Anthony Forest Products claims that their glulam, the Anthony Power Beam LSL (laminated structural lumber), is the stiffest and strongest engineered wood product on the market today and a direct substitute for LVL and Parallam in most standard applications. Fabricated from fast-growth southern pine, Power Beams are available in 3 1/2-, 5 1/2-, and 7-inch widths, depths from 7 1/4 to 16 inches, and lengths to 60 feet. The industrial grade is suitable for headers, girders, ridge beams, and commercial post-and-beam construction. Field modifications such as notching, cutting, or drilling should be undertaken only after consultation with Anthony.

ENGINEERED LUMBER HARDWARE

If you're planning on using engineered structural members, forget about running down to the local lumberyard for framing connectors. Engineered lumber requires engineered hardware. And engineered connectors allow architects and engineers to take better advantage of the design possibilities of engineered lumber. Connectors are available for most any wood-to-wood, wood-to-steel, and wood-to-masonry connection. Follow the manufacturer's specs for loads and fastening schedules when matching their connector to your application; when in doubt, speak with the manufacturer's technical services department.

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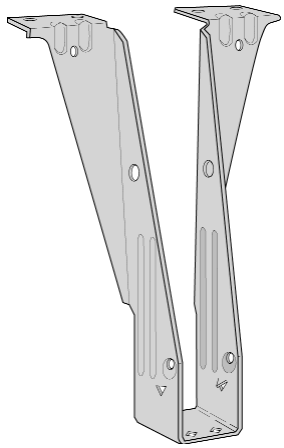

USP's new Seat Cleat I-joist hanger features dimpled guides which direct nails downward as they penetrate the bottom I-joist chord. The manufacturer claims that downward nailing eliminates joist movement in the hanger, leading to a squeak-free floor. And downward directed nails have no opportunity to slip between the plies of a laminated chord, causing them to separate. The hangers work with solid framing members, too.

Manufacturers of Engineered Lumber

Anthony Forest Products Co.
P.O. Box 1877
El Dorado, AR 71731
800/221-2326
Anthony Power Beam LSL

Boise Cascade Corporation
P.O. Box 50
Boise, ID 83728
800/237-4013
Versa-Rim 98

Georgia-Pacific Corp.
133 Peachtree St.
Atlanta, GA 30303
800/284-5347
FiberStrong Rim Board

Green Mountain Precision Frames
P.O. Box 293
Windsor, VT 05089
802/674-6145
Veneered Engineered Beam

Gruen-Wald Engineered Laminates
220 S. Marion Rd.
Sioux Falls, SD 57107
605/338-8004
Classic Laminated Columns

Louisiana-Pacific Corp.
111 SW Fifth Avenue
Portland, OR 97204-3601
800/223-5647
Solid Start Rim Board

Lumber Specialties
1301 3rd Avenue N.E.
Dyersville, IA 52040
800/228-0290
SpaceJoist TE

MiTek Industries
P.O. Box 7359
St. Louis, MO 63177-1359
314/434-1200
Posi-Joist

Open Joist 2000
1970 St. Naurice Nord
St. Marthe, Quebec G8T 1V9
800/567-8644
Open Joist 2000

Superior Wood Systems
1301 Garfield Ave.
Superior, WI 54880
715/392-1822
SWII Headers

Rigidply Rafters
701 E. Linden St.
Richland, PA 17087
717/866-6581
Laminated Arches & Beams

TrimJoist
P.O. Box 2286
Columbus, MS 39704-2286
601/327-7950
TrimJoist

Trus Joist MacMillan
200 E. Mallard Dr.
Boise, ID 83706
800/628-3997
TimberStrand

Willamette Industries
P.O. Box 907
Albany, OR 97321
541/926-7771
E-Z Rim, Willamette Glulam

Engineered Lumber Connectors

Cleveland Steel Specialty Co.
14400 S. Industrial Ave.
Cleveland, OH 44137
800/251-8351

Simpson Strong-Tie Co.
2600 International St.
Columbus, OH 43228
614/876-8060

United Steel Products Co.
(formerly Kant Sag)
703 Rogers Dr.
Montgomery, MN 56069
800/328-5934

For More Information

Articles on engineered lumber previously published in the *Journal of Light Construction* include:

"Engineered Studs for Tall Walls," 2/97
"Roof Framing with Wood I-Joists," 1/97
"Working with Laminated Veneer Lumber," 6/96
"On Site With Parallam," 12/95
"Wood I-Joist Do's and Don'ts," 9/95
"Building With Glulams," 6/95
"Floor Framing With Wood I-Joists," 2/94
"Framing With Floor Trusses," 4/93