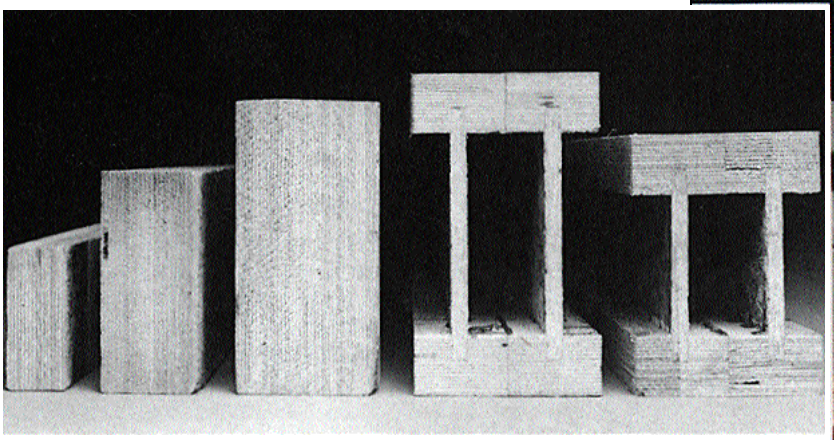
Fabricated wood members support formwork

Engineered sections with good weight:strength ratios offer complete nailability

By M. K. Hurd

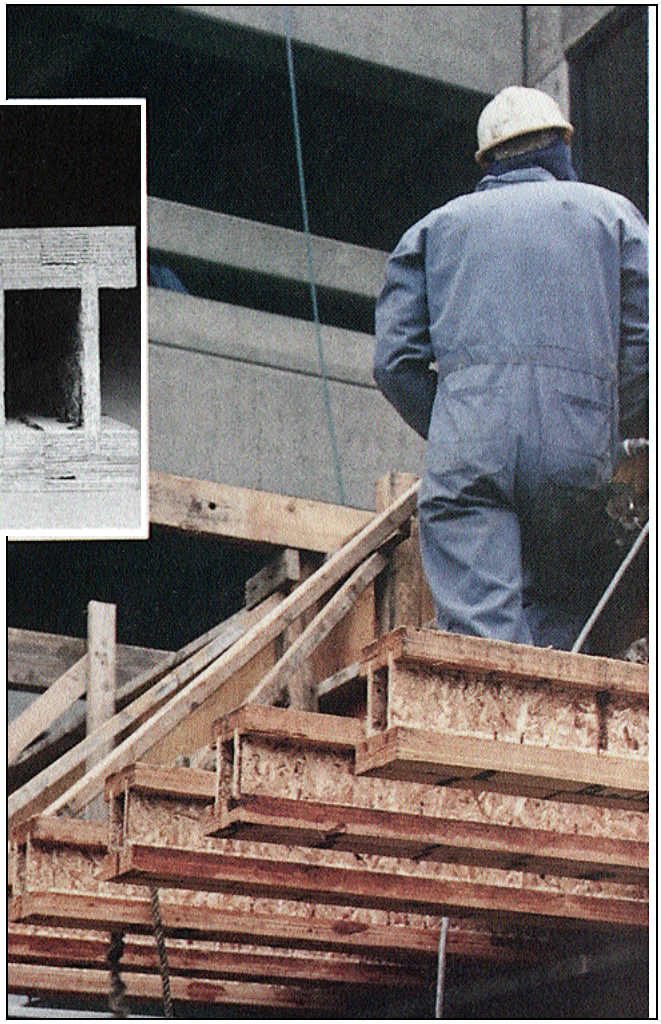
Will manufactured, engineered wood beams and girders revolutionize formwork construction as manufactured plywood panels did in the past? Although this seems unlikely in the near future, there are several products available which offer advantages for specific forming applications.



Laminated wood beams (left) up to 24 inches deep can be ordered in lengths up to 80 feet. The box sections on the right have flanges of laminated wood, with webs of oriented strandboard. Standard box sections, either 6½ or 8 inches deep, come in lengths up to 40 feet.

Dressed or surfaced lumber for a long time was the only basic support member for job-built formwork, with steel sections added as secondary supports for heavy loads or large ganged form panels. Then lighter weight aluminum sections became economically feasible and came into use both in trusses supporting flying form tables and as studs, wales or stringers for form panels. Now we see increasing availability of manufactured wood sections, offering the nailability of wood with improved strength and stability of shape because the construction resists shrinking, warping, twisting and splitting. Among the different fabricated shapes now available for forming applications are the following:

- *Laminated rectangular beams*, made of thin wood layers or veneers laminated together with glue under heat and pressure



Wide laminated flanges of these box beams resist rollover, present a better supporting surface for forming plywood. The vertical webs are made of oriented strandboard, an engineered product made of layers of thin wood slices glued and pressed into panels.

- *I-beams or joists*, with top and bottom flanges of solid or laminated wood and vertical webs of plywood, waferboard or oriented strandboard
- *Double-I form joists*, in which two wood I-beams are joined longitudinally to create a hollow box section
- *Open-web lattice girders* made of solid wood pieces, resembling small trusses

Fabrication conserves resources, controls properties

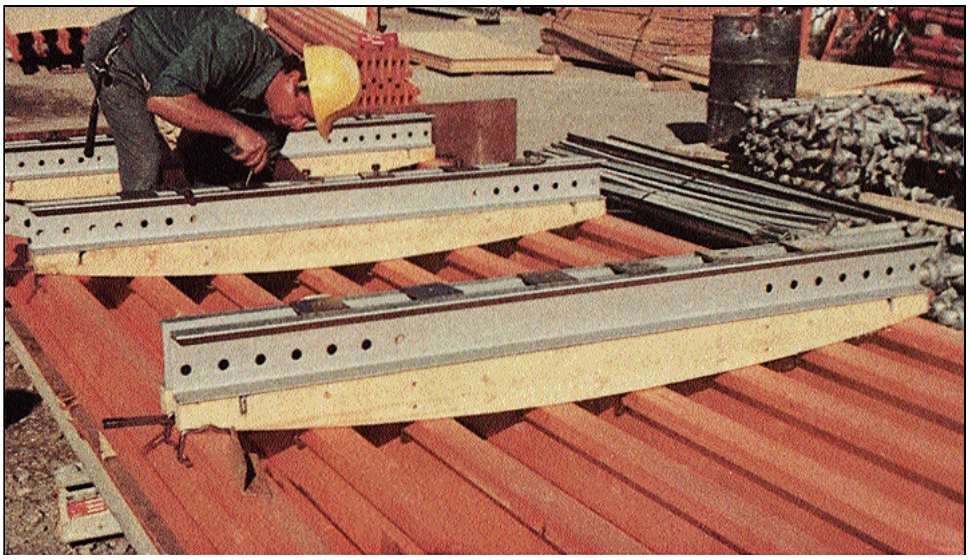
From the conservationist point of view, fabricating these members from smaller pieces of wood makes better use of younger, smaller trees instead of the 30- to 35-inch diameter ones from which solid dimension lumber is cut. According to one industry source, each tree goes two and a half times as far when it's converted to fabricated laminated members instead of 2x10's.

From the engineering point of view, shapes and properties can be controlled to put material in the part of the member where it's needed most to carry loads instead of simply supplying a solid rectangular cross section. This means lighter weight and easier handling—always a plus in form construction. The factory production also assures better standardization of strength.

From the worker's point of view, the wood members can be handled with better comfort than metal in hot and cold weather. They are also readily trimmed or drilled for penetrations. Those with wider flanges don't roll over so easily, and the wider flanges help reduce plywood deflection and make it easier to position plywood sheets with adequate support.

Size, weight and strength of available joists and girders

The laminated veneer lumber and double-I box members in the accompanying photos are sold as separate members for general purpose form construction, while the lattice girders and solid-web I-beams are generally available for lease or purchase as components of total forming systems that include metal hardware and wales or other backup supports. While suppliers of these systems may sell the wood members separately, they are usually used to best advantage as part of the planned systems.



Wood I-beams of this system are supported by metal walers. Here a curved plate has been added to establish the shape of circular tank walls. Flanges of the beam are made of selected wood, with the top flange sliced and rejoined together in the horizontal direction to prevent warping and twisting. The laminated wood web has interlocking multiple tongue and groove connections to the flanges, which are glued with waterproof adhesive.

Among the form beam and girder sizes available are the following:

LAMINATED WOOD VENEER BEAMS: Available on order in lengths up to 80 feet. Thicknesses are 1½, 2½ and 3½ inches; beam depths range from 3½ to 24 inches in increments matching the depths of dimension lumber. Typical weights are 2.1 pounds per lineal foot (plf) for a 1½ x 5½ and 8.1 plf for the 3½ x 9¼ member.

TYPICAL SUPPORT SPACING IN INCHES FOR WOOD FORM BEAMS OR GIRDERS, WITH THREE-SPAN LOADING*

Member		2X8 D. FIR, S. PINE	LAMINATED VENEER, SOLID	BOX BEAM (WOOD)	LATTICE GIRDER** (WOOD)
Weight, plf		3.0	2.7	4.6	4.0
Depth, in.		7.25	7.25	6.5	9.5
Width, flange or chord		1.5	1.5	4.6	3.15
EQUIVALENT UNIFORM LOAD, plf	200	115	114	130	186
	400	78	96	107	128
	1000	40	61	67	58
	1400	33	48	49	47
	2000	27	38	37	35
	3000	23	30	27	23
	5000	20	24	16	—

* Based on calculations supplied by manufacturers; No. 2 Douglas fir or Southern pine assumed for 2x8. Allowable deflection is 1/360 of span or 1/4 inch, whichever is less.

** Calculations based on interior support at nodes of truss (girder). Vertical shear considered rather than horizontal shear commonly associated with solid wood members.

DOUBLE-I BOX BEAMS: Available on order in lengths up to 40 feet. These are made with top and bottom flanges 4.6 inches wide, in overall depth of 6½ and 8 inches. The deeper one weighs 5 plf and the shallower one, 4.6 plf.

I-BEAMS OR JOISTS WITH SOLID WEBS: One system has 7.9-inch high beams in lengths of 8, 12, 16, and 21 feet, weighing 3.7 plf. The flanges are 3.15 inches wide. A companion member 12 inches deep, with 3.78-inch flanges, weighs 5.2 plf. A similar member from another manufacturer weighs 3.7 plf and comes in standard lengths from 8 to 20 feet, with special lengths up to 40 feet.

WOOD LATTICE GIRDERS: With top and bottom chords of 3¼-inch-wide wood and 2⅜-inch-wide strut members, a 14-inch-deep girder is available in standard lengths from 8 to 20 feet, with extra lengths up to 60 feet on order. This girder weighs 5.25 plf. A smaller version available at 4 plf is 8½ inches deep.

The table compares load-to-span relationships for some of the fabricated members with calculated allowable spans for a surfaced piece of 2x8 lumber (Number 2 Douglas fir or Southern pine). The other span data in the table are taken from information provided by the manufacturers, with notes showing any special assumptions used in the calculations.

Cost and application data

These engineered wood members are useful for a variety of forming applications in both horizontal and vertical work. Typical uses have been in crane-handled panels for high rise construction. Suppliers report service life of 2 to 4 years, but this is bound to vary depending on the care and maintenance each builder gives his equipment. Steel caps supplied on the ends of the lattice girder chords help prolong their life. Some owners routinely add steel caps to the ends of other members to extend their usefulness.

The cost of fabricated wood members varies regionally as well as with the quantity purchased or the system leased. Factors other than first cost are important in determining whether and how much they can contribute to formwork economy. By improving the rigidity of large panels they may facilitate wider tie spacing and thereby contribute to reduced labor costs (see article on ganged forms, CONCRETE CONSTRUCTION, January 1986, page 21).

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