

# Laminated Timber Design Guide



THE SYMBOL OF QUALITY  
IN ENGINEERED TIMBER

# AITC

*American Institute of Timber Construction*

## American Institute of Timber Construction (AITC)

Representing the glued laminated timber industry since 1952, AITC provides technical support to manufacturers and the design community, and third party quality control manufacturing plants. AITC members design, manufacture, fabricate, or erect wood structural systems.

*Boathouse, Boston University, Cambridge, MA.; Architect–Architectural Resources; Structural Engineer–John Born Associates; Contractor–Walsh Brothers Construction.*



## Glued Laminated Timber

Glued laminated timber, often referred to as glulam, permits new uses, enhances the natural beauty and extends the enduring qualities of wood. The laminating process makes possible the production of structural timber in a wide variety of sizes and shapes and allows design creativity. The advantages of using glued laminated timber are as varied as your imagination and your specific applications.

## Product Standards

AITC recommends and establishes standards and specifications that guide building officials and industry professionals in the design or use of laminated timber.

AITC is the sponsor of the American National Standard, ANSI/AITC A190. This includes plant qualifications, a quality control system, inspection, testing, certification and identification.

AITC's certification and quality assurance programs have proven effective for over 40 years.

## Product Identification

Laminated structural members manufactured to the Industry Standard are identified with the AITC Quality Inspection Mark. To assure compliance to the Standard, AITC maintains a staff of highly experienced inspectors.

## Species, Sizes and Grades

**Species:** Laminated timber is manufactured in many species, including softwoods and hardwoods. The most popular softwood species are Douglas Fir/Larch, Southern Pine and Alaskan Yellow Cedar. Hem-Fir, Spruce-Pine-Fir (SPF) and Ponderosa Pine are also frequently used. AITC Standard 117 *Design Specifications for Structural Glued Laminated Timber of Softwood Species*, provides detailed design information.

**Sizes:** Standard widths for Douglas-Fir are 3<sup>1</sup>/<sub>8</sub>" , 5<sup>1</sup>/<sub>8</sub>" , 6<sup>3</sup>/<sub>4</sub>" , 8<sup>3</sup>/<sub>4</sub>" , 10<sup>3</sup>/<sub>4</sub>" , 12<sup>1</sup>/<sub>4</sub>" and 14<sup>1</sup>/<sub>4</sub>". Standard widths for Southern Pine are 3" , 3<sup>1</sup>/<sub>8</sub>" , 5" , 5<sup>1</sup>/<sub>8</sub>" , 6<sup>3</sup>/<sub>4</sub>" , 8<sup>1</sup>/<sub>2</sub>" , 10<sup>1</sup>/<sub>2</sub>" , 12" and 14". Other widths are available upon request.

Depths and lengths of glulam members are limited only by the capability of the individual manufacturer.

**Grades:** There are four appearance grades -- Industrial, Framing (formerly Industrial S), Architectural and Premium. *Industrial grade* is suitable where appearance is not a primary concern, or the members will not be exposed to view. *Framing grade* matches the width of conventional framing for use as window and door headers where appearance is not a concern. *Architectural grade* is suitable for construction where appearance is an important requirement. *Premium* is the highest grade and is specified where appearance is of utmost importance. Appearance grades do not modify design values, grades of lumber used or other provisions governing the manufacture or use of glued laminated timber.

Textured surfaces, such as rough sawn, are also available from most manufacturers. See AITC Standard 110 for detailed specifications.

**Strong, Durable and Beautiful**

Because glued laminated timber is fabricated from dry lumber, the resulting higher dimensional stability reduces checking, twisting, warping and shrinkage. The result is a stable and beautiful installation.

**Easy To Install**

Laminated timbers can be pre-fabricated at a plant so they arrive at the job site ready for immediate installation. Most timbers are installed with mobile construction equipment and connections are made by using conventional power and hand tools.

**Cost Effective**

Laminated timber construction is economical. It does not require the added expense of false ceilings to cover structural framework. Accurate manufacturing reduces the need for on-site fabrication, minimizing waste and installation costs. Equally important, Engineered Timber is more adaptable to construction design changes than are other framing systems.

**Availability**

AITC manufacturing plants are located throughout the country. Many straight beam sizes are available through local building material suppliers. Custom glued laminated members can be obtained from a laminator or a local representative.



*Custom fabrication for assembly with power tools.*



*Glued laminated timber truss.*



*A naturally renewable resource.*

**Energy Efficient**

Wood's natural insulating properties help reduce building heating and cooling expense. Wood has less thermal expansion than steel or concrete, and its insulating value is many times higher. It also has excellent electrical insulating qualities.

**High Resilience**

Wood absorbs shocks and provides high resistance to hurricane force winds and earthquake forces.

**A Renewable Resource**

Only one primary building material comes from a renewable resource; cleans the air and water, providing habitat, scenic beauty and recreation as it grows; utilizes nearly 100% of its resource for products; is the lowest of all in energy requirements for its manufacturing; creates fewer air and water emissions than any of its alternatives; and is totally reusable, recyclable and 100% biodegradable: wood. And it has been increasing in U.S. net reserves since 1952, with growth exceeding harvest in the U.S. by more than 30%.

**Availability**

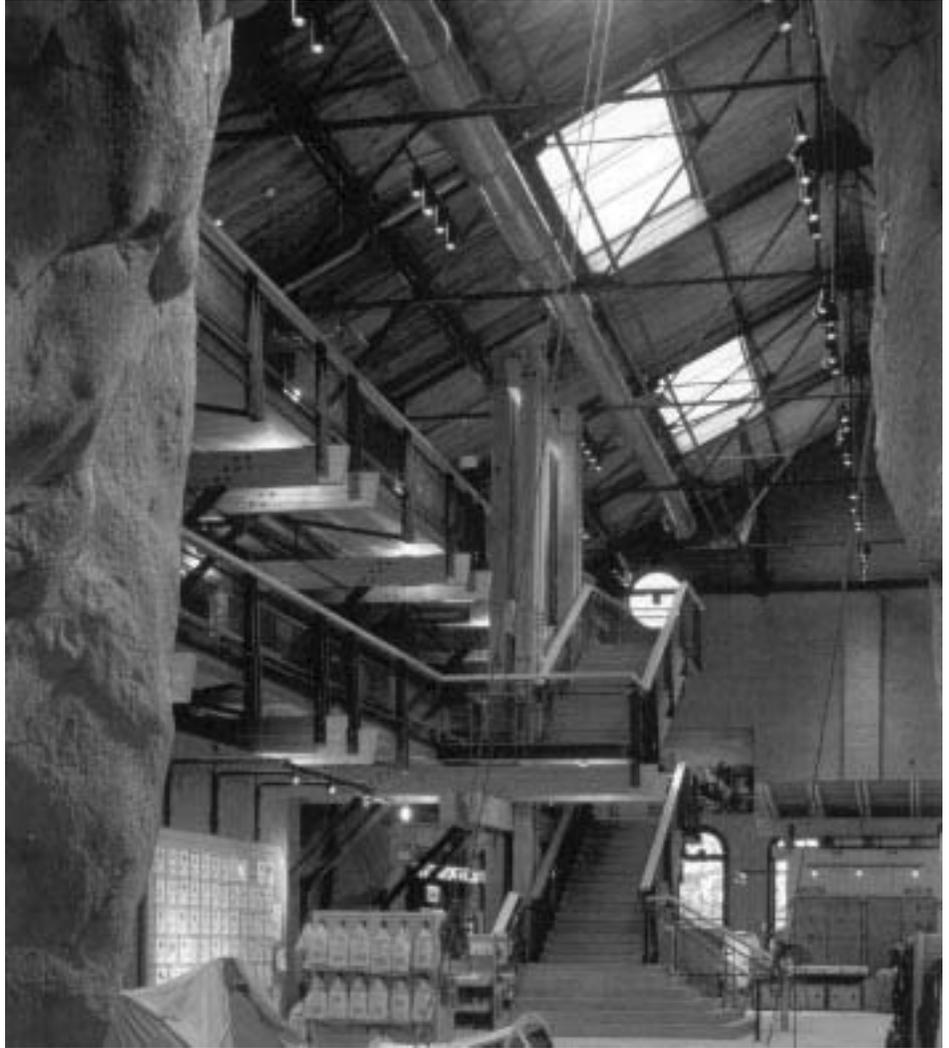
Straight beams in most tabulated sizes are mass produced and readily available at many building products and lumber distribution centers across the country.

Typical structural uses:

- Complete structural systems
- Ridge beams
- Garage door headers
- Door and window headers
- Long span girders
- Stair treads and stringers

Laminated timbers permit large rooms with minimal columns while providing the warmth of wood for living or working environments.

Renovating with laminated timber is easy as beams can be modified at the jobsite to fit existing conditions. Laminated timber can be textured, stained, or painted to match or meet traditional or historic appearance requirements.



*Historic Preservation Award, REI, Denver, CO; Architect—Mithun Partners; Structural Engineer—Skilling Ward Magnusson Barkshire, Inc.*



*Garage door header.*



*Residence, Eagle, ID; Architect—Olsen and Associates; Contractor—Gordon Jensen Construction*

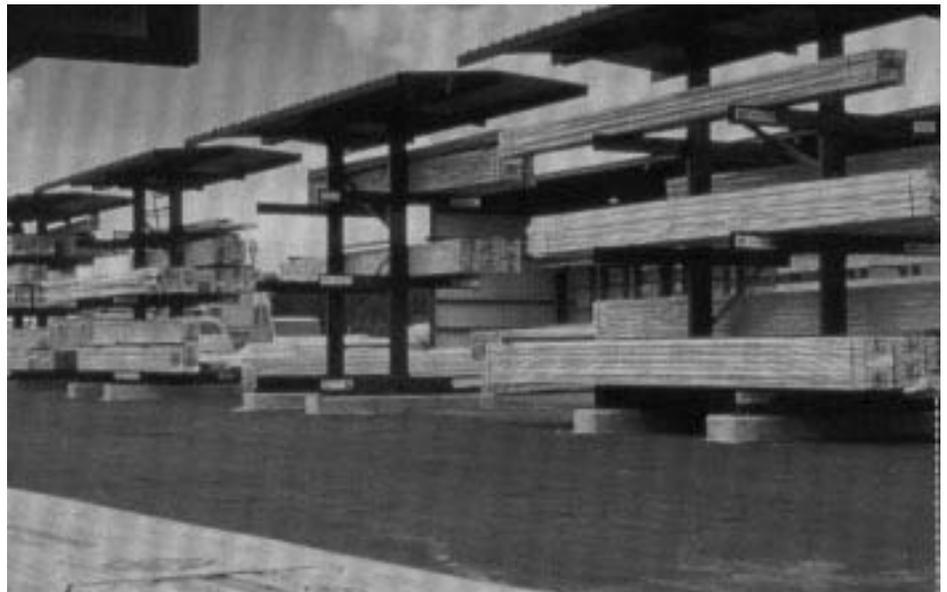
# and Keep Jobs on Schedule



*Residence, Aurora, OR; Architect—Jack Smith F.A.I.A.; Engineer—Bouiss and Associates;  
Contractor—Busic Construction Company.*



*Sports Complex, Coronado, CA; Architect—SHWC Architects; Engineer—Ramirez and Associates Engineers; Contractor—Taylor Ball Contractors, Inc.*



*Inventory readily available from local distributors for prompt delivery to job site.*

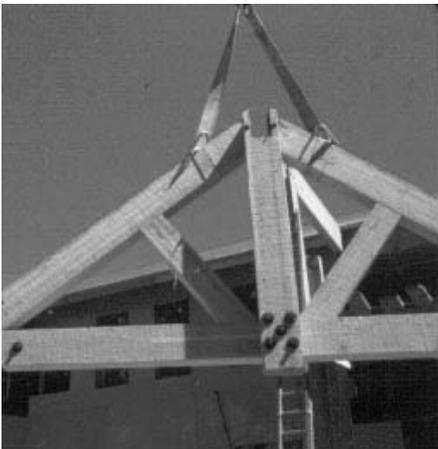
# Laminated Timbers Are Easy to Field



Field cutting a stock beam.



Installing a residential ridge beam.



Saw textured beams add warmth and beauty, and are available from most manufacturers.



Sun Valley, ID Residence; Architect—Jack Smith, F.A.I.A.; Structural Engineer—Purdy and Associates; Contractor—Premier Construction Company.



*Albertson Shopping Center, Jackson, WY; Architect—Jeffrey A. Shneider; Structural Engineer—Rex Harrison Engineering; Contractor—Bateman Hall*



*Airport Terminal, Jackson, WY*



*Ceiling beams compliment rustic design of this McCall, ID home.*



*Office Building Remodel, Jackson, WY.*

**Custom Laminated Timber**

Laminated timber permits long, clear spans, majestic soaring arches -- tudor, radial, gothic, or parabolic, and many special shapes.

Cut to size and framed for connections at the plant to exact specifications and shapes, laminated timber requires less on-site fabrication which minimizes waste and installation costs.



*Great Buddha Hall, Carmel, NY; Architect--Edward A.Valeri; Structural Engineer--Enterprise Engineering Consultants, Ltd.*



*Ross High School, East Hampton, Long Island, NY; Architect--Richard Cook & Associates; Contractor--Telemar Construction.*



*Grant Creek Shopping Mall, Missoula, MT; Architect--Fehlman-Labarre Architects; Contractor--Quality Construction*



*Newport Beach, CA, 30,000 sq. ft. residence; Architect--Brian Jeannete and Associates; Structural Engineer--Omnispan Corporation; Contractor--Buwalda Construction*



*Animal Science Center, 172 ft. span arches, Univ. of Arkansas, Little Rock, AR; Architect--AMR Architect; Structural Engineer--Engineering Consultants, Inc.; Contractor--Harrison Davis Construction*



*St. Anastasia Catholic Church, St. Augustine, FL; Architect—Richard L. San Giovanni; Engineer—C. Louis Structural Engineers; Contractor—Hall Construction Company, Inc.*



*Cabella Outdoor Recreation Store, Owatonna, MN; Architect—Nielsen and Mayne Architects; Engineer—Kirkham Michael Engineers; Contractor—Kraus-Anderson.*

## Custom Shapes

Laminated timber arches or pitched and curved beams can be made in almost any shape. A Tudor type three-hinge arch is favored for many ecclesiastical designs. Radial arches are well suited to large unobstructed clear spans, as are pitched and tapered curved beams.



*North Syracuse Baptist Church, Syracuse, NY; Architect—RSA Architects; Contractor—Butterfield Construction*

**Long Span Structures**

Laminated timber beams, arches and other shapes are widely used to provide efficient enclosure of large areas such as gymnasiums, auditoriums and indoor pools. While indoor pools generate high humidity, pressure treatment is not required when the building is adequately ventilated to control humidity, or where a highly durable species, such as Alaska Yellow cedar is used.



Ross High School, East Hampton, Long Island, NY; Architect—Richard Cook & Associates; Contractor—Telemar Construction.



Wood ceilings and beams were selected for acoustical control. Performing Arts Center, North Texas University, Denton, TX; Architect—KVG Gideon Toll Architects; Engineer—Freese and Nichols, Inc.; Contractor—Huber, Hunt and Nichols, Inc.



Exploration Place, Wichita, KS; Achitect—Moshe Safdie & Associates with Schaeffer, Johnson, Cox, Frey; Structural Engineer—Dudley Williams & Associates; Contractor—Dondlinger & Sons Construction



YMCA Pool, Brewton, AL; Architect—Dampier and Associates; Structural Engineer—Joseph and Spain; Contractor—Stuart Construction



Michigan arch bridge; Engineer—Northwest Design Group, Inc.



Bridge in Nature Park, Portland, OR, pressure treated with environmentally friendly copper naphthenate. Structural Engineer—Ceccacci Associates.



Golf course bridge.

## Water Oriented Installations

Experience shows that wood is one of the materials most suitable for construction in and around the water.

Wood is resilient enough to resist battering by the ocean and docking ships, and it is naturally resistant to the destructiveness of salt water. It won't rust or spall, and is not affected by corrosion.

Where wood is fully exposed to weather, or where weather protection cannot ensure a moisture content of less than 20%, pressure treatment is required. Buildings housing wet processes, or where wood is in direct contact with the ground or water also require pressure treatment.

See AITC Standard 109 for specific recommendations.



New covered bridge with laminated trusses; Engineer—USDA Forest Service.

**Load Tables**

Span and load tables are available on AITC's web site or may be obtained by calling AITC. See back page.

**Design Properties**

Bending members are typically specified on the basis of the maximum allowable bending stress of the member.

A 24 F designation indicates a member with an allowable bending stress of 2400 psi.

See AITC Standard 117 for allowable design stresses.

**Cantilevered Beams**

Cantilever beam systems are highly efficient for large flat roofs as the continuity across supports permits smaller beams than required for simple spans.

For most residential applications where cantilever lengths are relatively short, a stock unbalanced glulam can be used. Cantilever roof overhangs up to 20 percent of the main span can be accommodated using an unbalanced beam without special layups. For longer length cantilevers, balanced beams should be specified.

**Balanced and Unbalanced Sections**

Glued laminated timbers are manufactured with both balanced and unbalanced layups. Balanced layups are made with identical lumber grades in the outer

**Equivalent Glulam Sections for Dimension Lumber/Timber Beams**

Sawn <sup>4</sup> Sections Nominal Size	Roof Beams <sup>1,2</sup>				Floor Beams <sup>1,3</sup>			
	Select Structural		No. 1		Select Structural		No. 1	
	Douglas Fir/Larch	Southern Pine	Douglas Fir/Larch	Southern Pine	Douglas Fir/Larch	Southern Pine	Douglas Fir/Larch	Southern Pine
3x8	3 1/8x6	3x6 7/8	3 1/8x6	3x5 1/2	3 1/8x7 1/2	3x6 7/8	3 1/8x7 1/2	3x6 7/8
3x10	3 1/8x7 1/2	3x8 1/4	3 1/8x6	3x6 7/8	3 1/8x9	3x9 5/8	3 1/8x9	3x9 5/8
3x12	3 1/8x9	3x9 5/8	3 1/8x7 1/2	3x8 1/4	3 1/8x12	3x11	3 1/8x10 1/2	3x11
3x14	3 1/8x9	3x11	3 1/8x7 1/2	3x9 5/8	3 1/8x13 1/2	3x13 3/4	3 1/8x13 1/2	3x12 3/8
4x6	3 1/8x6	3x6 7/8	3 1/8x6	3x5 1/2	3 1/8x6	3x6 7/8	3 1/8x6	3x6 7/8
4x8	3 1/8x7 1/2	3x8 1/4	3 1/8x6	3x6 7/8	3 1/8x9	3x8 1/4	3 1/8x7 1/2	3x8 1/4
4x10	3 1/8x9	3x11	3 1/8x7 1/2	3x8 1/4	3 1/8x10 1/2	3x11	3 1/8x10 1/2	3x9 5/8
4x12	3 1/8x10 1/2	3x12 3/8	3 1/8x9	3x9 5/8	3 1/8x12	3x12 3/8	3 1/8x12	3x12 3/8
4x14	3 1/8x12	3x13 3/4	3 1/8x10 1/2	3x11	3 1/8x15	3x15 1/8	3 1/8x15	3x13 3/4
4x16	3 1/8x13 1/2	3x15 1/8	3 1/8x10 1/2	3x12 3/8	3 1/8x16 1/2	3x16 1/2	3 1/8x16 1/2	3x16 1/2
6x8	5 1/8x7 1/2	5x6 7/8	5 1/8x7 1/2	5x6 7/8	5 1/8x7 1/2	5x8 1/4	5 1/8x7 1/2	5x8 1/4
6x10	5 1/8x9	5x8 1/4	5 1/8x7 1/2	5x8 1/4	5 1/8x10 1/2	5x9 5/8	5 1/8x10 1/2	5x9 5/8
6x12	5 1/8x10 1/2	5x9 5/8	5 1/8x9	5x9 5/8	5 1/8x12	5x12 3/8	5 1/8x12	5x12 3/8
6x14	5 1/8x12	5x12 3/8	5 1/8x10 1/2	5x11	5 1/8x13 1/2	5x13 3/4	5 1/8x13 1/2	5x13 3/4
6x16	5 1/8x13 1/2	5x13 3/4	5 1/8x12	5x12 3/8	5 1/8x16 1/2	5x15 1/8	5 1/8x16 1/2	5x15 1/8
6x18	5 1/8x15	5x15 1/8	5 1/8x13 1/2	5x13 3/4	5 1/8x18	5x17 7/8	5 1/8x18	5x17 7/8
6x20	5 1/8x18	5x16 1/2	5 1/8x16 1/2	5x15 1/8	5 1/8x19 1/2	5x19 1/4	5 1/8x19 1/2	5x19 1/4
8x10	6 3/4x9	6 3/4x8 1/4	6 3/4x9	6 3/4x8 1/4	6 3/4x10 1/2	6 3/4x9 5/8	6 3/4x10 1/2	6 3/4x9 5/8
8x12	6 3/4x10 1/2	6 3/4x9 5/8	6 3/4x10 1/2	6 3/4x9 5/8	6 3/4x12	6 3/4x12 3/8	6 3/4x12	6 3/4x12 3/8
8x14	6 3/4x12	6 3/4x12 3/8	6 3/4x12	6 3/4x11	6 3/4x13 1/2	6 3/4x13 3/4	6 3/4x13 1/2	6 3/4x13 3/4
8x16	6 3/4x13 1/2	6 3/4x13 3/4	6 3/4x13 1/2	6 3/4x12 3/8	6 3/4x16 1/2	6 3/4x15 1/8	6 3/4x16 1/2	6 3/4x15 1/8
8x18	6 3/4x16 1/2	6 3/4x15 1/8	6 3/4x15	6 3/4x13 3/4	6 3/4x18	6 3/4x17 7/8	6 3/4x18	6 3/4x17 7/8
8x20	6 3/4x18	6 3/4x16 1/2	6 3/4x16 1/2	6 3/4x16 1/2	6 3/4x19 1/2	6 3/4x19 1/4	6 3/4x19 1/2	6 3/4x19 1/4
8x22	6 3/4x19 1/2	6 3/4x17 7/8	6 3/4x18	6 3/4x17 7/8	6 3/4x22 1/2	6 3/4x22	6 3/4x22 1/2	6 3/4x22

laminations, placed symmetrically about the neutral axis. Consequently, balanced layups have equal bending strength for both positive and negative bending. Balanced layups are recommended for beams that are continuous across supports and for cantilevered beams.

Unbalanced layups utilize higher grade lumber in the bottom (tension) side of the beam and are stamped with the word "TOP" on the upper surface. This unsymmetrical configuration results in higher strength for positive bending (tension on bottom) than for negative bending. Unbalanced layups are primarily intended for simple span beams, but can also be used for short cantilevers.



AITC mark of quality. The word "TOP" identifies beams with unbalanced sections.



AITC is approved for inspection under this Japanese Agricultural Standard. Laminated timber exported to Japan is identified with this label.

# Sawn, Steel, LVL and PSL

## Equivalent Glulam Sections for Steel Beams

Steel <sup>5</sup> Section	Roof Beams <sup>1,2</sup>		Floor Beams <sup>1,3</sup>	
	Douglas Fir/Larch	Southern Pine <sup>8</sup>	Douglas Fir/Larch	Southern Pine <sup>8</sup>
W 6x9	3 1/8x10 1/2 or 5 1/8x9	3x11 or 5x8 1/4	3 1/8x10 1/2 or 5 1/8x9	3x11 or 5x9 5/8
W 8x10	3 1/8x12 5 1/8x9	3x12 3/8 5x9 5/8	3 1/8x13 1/2 5 1/8x12	3x13 3/4 5x11
W 12x14	3 1/8x16 1/2 5 1/8x13 1/2	3x16 1/2 5x13 3/4	3 1/8x18 5 1/8x15	3x17 7/8 5x15 1/8
W 12x16	3 1/8x18 5 1/8x13 1/2	3x17 7/8 5x13 3/4	3 1/8x19 1/2 5 1/8x16 1/2	3x19 1/4 5x16 1/2
W 12x19	3 1/8x19 1/2 5 1/8x16 1/2	3x20 5/8 5x15 1/8	3 1/8x21 5 1/8x18	3x20 5/8 5x17 7/8
W 10x22	3 1/8x21 5 1/8x16 1/2	3x20 5/8 5x16 1/2	3 1/8x19 1/2 5 1/8x16 1/2	3x20 5/8 5x17 7/8
W 12x22	5 1/8x18 6 3/4x15	3x22 5x17 7/8	5 1/8x19 1/2 6 3/4x16 1/2	5x19 1/4 6 3/4x16 1/2
W 14x22	5 1/8x18 6 3/4x16 1/2	3x23 3/8 5x17 7/8	5 1/8x21 6 3/4x18	5x20 5/8 6 3/4x17 7/8
W 12x26	5 1/8x19 1/2 6 3/4x18	5x19 1/4 6 3/4x16 1/2	5 1/8x21 6 3/4x19 1/2	5x20 5/8 6 3/4x19 1/4
W 14x26	5 1/8x21 6 3/4x18	5x20 5/8 6 3/4x17 7/8	5 1/8x21 6 3/4x19 1/2	5x22 6 3/4x19 1/4
W 16x26	5 1/8x21 6 3/4x19 1/2	5x20 5/8 6 3/4x17 7/8	5 1/8x22 1/2 6 3/4x21	5x23 3/8 6 3/4x20 5/8
W 12x30	5 1/8x21 6 3/4x19 1/2	5x20 5/8 6 3/4x17 7/8	5 1/8x21 6 3/4x19 1/2	5x22 6 3/4x19 1/4
W 14x30	5 1/8x22 1/2 6 3/4x19 1/2	5x22 6 3/4x19 1/4	5 1/8x22 1/2 6 3/4x21	5x23 3/8 6 3/4x20 5/8
W 16x31	5 1/8x24 6 3/4x21	5x23 3/8 6 3/4x20 5/8	5 1/8x25 1/2 6 3/4x22 1/2	5x24 3/4 6 3/4x23 3/8
W 14x34	5 1/8x24 6 3/4x21	5x23 3/8 6 3/4x20 5/8	5 1/8x24 6 3/4x22 1/2	5x24 3/4 6 3/4x22
W 18x35	5 1/8x27 6 3/4x24	5x26 1/8 6 3/4x22	5 1/8x27 6 3/4x25 1/2	5x27 1/2 6 3/4x24 3/4
W 16x40	5 1/8x28 1/2 6 3/4x25 1/2	5x27 1/2 6 3/4x23 3/8	5 1/8x27 6 3/4x25 1/2	5x27 1/2 6 3/4x24 3/4
W 21x44	5 1/8x33 6 3/4x28 1/2	5x31 5/8 6 3/4x27 1/2	5 1/8x33 6 3/4x30	5x33 6 3/4x30 1/4
W 18x50	5 1/8x34 1/2 6 3/4x30	5x33 6 3/4x28 7/8	5 1/8x31 1/2 6 3/4x28 1/2	5x31 5/8 6 3/4x28 7/8
W 21x50	5 1/8x34 1/2 6 3/4x31 1/2	5x34 3/8 6 3/4x28 7/8	5 1/8x34 1/2 6 3/4x31 1/2	5x34 3/8 6 3/4x31 5/8
W 18x55	5 1/8x36 6 3/4x31 1/2	5x34 3/8 6 3/4x30 1/4	5 1/8x33 6 3/4x30	5x33 6 3/4x30 1/4
W 21x62	6 3/4x36	6 3/4x34 3/8	5 1/8x37 1/2 6 3/4x34 1/2	6 3/4x34 3/8

## Equivalent Glulam Sections for Laminated Veneer Lumber (LVL)

LVL <sup>6</sup> Sections	Roof Beams <sup>1,2</sup>		Floor Beams <sup>1,3</sup>	
	Douglas Fir/Larch	Southern Pine <sup>8</sup>	Douglas Fir/Larch	Southern Pine <sup>8</sup>
2pcs 1 3/4x9 1/2	3 1/8x10 1/2 or 5 1/8x9	3x11 or 5x8 1/4	3 1/8x10 1/2 or 5 1/8x9	3x11 or 5x9 5/8
2pcs 1 3/4x11 7/8	3 1/8x13 1/2 5 1/8x10 1/2	3x13 3/4 5x11	3 1/8x13 1/2 5 1/8x12	3x13 3/4 5x11
2pcs 1 3/4x14	3 1/8x16 1/2 5 1/8x12	3x16 1/2 5x12 3/8	3 1/8x16 1/2 5 1/8x13 1/2	3x16 1/2 5x13 3/4
2pcs 1 3/4x16	3 1/8x18 5 1/8x15	3x17 7/8 5x13 3/4	3 1/8x18 5 1/8x15	3x17 7/8 5x15 1/8
2pcs 1 3/4x18	3 1/8x21 5 1/8x16 1/2	3x20 5/8 5x16 1/2	3 1/8x19 1/2 5 1/8x16 1/2	3x20 5/8 5x17 7/8
3pcs 1 3/4x9 1/2	3 1/8x13 1/2 5 1/8x10 1/2	3x13 3/4 5x11	3 1/8x12 5 1/8x10 1/2	3x12 3/8 5x11
3pcs 1 3/4x11 7/8	3 1/8x16 1/2 5 1/8x13 1/2	3x16 1/2 5x13 3/4	3 1/8x15 5 1/8x13 1/2	3x15 1/8 5x13 3/4
3pcs 1 3/4x14	3 1/8x19 1/2 5 1/8x15	3x19 1/4 5x15 1/8	3 1/8x18 5 1/8x15	3x17 7/8 5x15 1/8
3pcs 1 3/4x16	3 1/8x22 1/2 5 1/8x18	3x22 5x17 7/8	3 1/8x21 5 1/8x18	3x20 5/8 5x17 7/8
3pcs 1 3/4x18	3 1/8x25 1/2 5 1/8x19 1/2	3x24 3/4 5x19 1/4	3 1/8x22 1/2 5 1/8x19 1/2	3x23 3/8 5x19 1/4

## Equivalent Glulam Sections for Parallel Strand Lumber (PSL)

PSL <sup>7</sup> Sections	Roof Beams <sup>1,2</sup>		Floor Beams <sup>1,3</sup>	
	Douglas Fir/Larch	Southern Pine <sup>8</sup>	Douglas Fir/Larch	Southern Pine <sup>8</sup>
3 1/2x9 1/2	3 1/8x10 1/2 or 5 1/8x9	3x11 or 5x9 5/8	3 1/8x10 1/2 or 5 1/8x9	3x11 or 5x9 5/8
3 1/2x11 7/8	3 1/8x13 1/2 5 1/8x10 1/2	3x13 3/4 5x11	3 1/8x13 1/2 5 1/8x12	3x13 3/4 5x11
3 1/2x14	3 1/8x16 1/2 5 1/8x12	3x16 1/2 5x12 3/8	3 1/8x16 1/2 5 1/8x13 1/2	3x16 1/2 5x13 3/4
3 1/2x16	3 1/8x18 5 1/8x15	3x17 7/8 5x13 3/4	3 1/8x18 5 1/8x15	3x17 7/8 5x15 1/8
3 1/2x18	3 1/8x21 5 1/8x16 1/2	3x20 5/8 5x16 1/2	3 1/8x19 1/2 5 1/8x16 1/2	3x20 5/8 5x17 7/8
5 1/4x9 1/2	3 1/8x13 1/2 5 1/8x10 1/2	3x13 3/4 5x11	3 1/8x12 5 1/8x10 1/2	3x12 3/8 5x11
5 1/4x11 7/8	3 1/8x16 1/2 5 1/8x13 1/2	3x16 1/2 5x13 3/4	3 1/8x15 5 1/8x13 1/2	3x15 1/8 5x13 3/4
5 1/4x14	3 1/8x19 1/2 5 1/8x15	3x19 1/4 5x15 1/8	3 1/8x18 5 1/8x15	3x17 7/8 5x15 1/8
5 1/4x16	3 1/8x22 1/2 5 1/8x18	3x22 5x17 7/8	3 1/8x21 5 1/8x18	3x20 5/8 5x17 7/8
5 1/4x18	3 1/8x25 1/2 5 1/8x19 1/2	3x24 3/4 5x19 1/4	3 1/8x22 1/2 5 1/8x19 1/2	3x23 3/8 5x19 1/4
7x9 1/2	5 1/8x12 6 3/4x10 1/2	5x12 3/8 6 3/4x11	5 1/8x12 6 3/4x10 1/2	5x12 3/8 6 3/4x11
7x11 7/8	5 1/8x15 6 3/4x13 1/2	5x15 1/8 6 3/4x13 3/4	5 1/8x15 6 3/4x13 1/2	5x15 1/8 6 3/4x13 3/4
7x14	5 1/8x18 6 3/4x16 1/2	5x17 7/8 6 3/4x15 1/8	5 1/8x16 1/2 6 3/4x15	5x16 1/2 6 3/4x15 1/8
7x16	5 1/8x21 6 3/4x18	5x20 5/8 6 3/4x17 7/8	5 1/8x19 1/2 6 3/4x18	5x19 1/4 6 3/4x17 7/8
7x18	5 1/8x22 1/2 6 3/4x21	5x22 6 3/4x19 1/4	5 1/8x21 6 3/4x19 1/2	5x22 6 3/4x19 1/4

### Footnotes For All Tables:

1. Glued laminated timber beam sizes are based on a span to depth ratio, L/d of 21. When the span to depth ratio is different, sizes should be determined by engineering calculations.
2. Roof beam sections are compared on the basis of equivalent bending resistance only. These sizes use a dry service condition and a 1.15 increase for duration of load (as for snow loading) as applicable to wood members. Sizes shown should also be checked for shear, deflection, and other applicable strength properties and design considerations. For determining glulam roof beam sections, the bending design value,  $F_b$ , was adjusted by the volume factor.
3. Floor beam sections are compared on the basis of equivalent stiffness (EI) only, using a dry service condition for the wood members. Sizes shown should also be checked for shear, bending, and other applicable strength properties and design considerations.
4. Solid sawn sections are shown for select structural or No. 1 grade. Design values used are from the 1997 NDS.
5. Steel sections were selected as the most economical from the "Manual of Steel Construction," AISC, 9th Edition. Design values used were:

$$F_y = 36 \text{ ksi,}$$

$$F_b^y = 0.66 \times F_y$$

$$E = 29,000 \text{ ksi.}$$

6. LVL sections are based on the following design values:

$$F_b = 2350 \text{ psi (adjusted for } C_f = (12/d)^{1/7.5} \text{ for depths greater than 12 in.)}$$

$$E = 2,000,000 \text{ psi.}$$

7. PSL sections are based on the following design values:

$$F_b = 2900 \text{ psi (adjusted for } C_f = (12/d)^{1/9.0} \text{ for depths greater than 12 in.)}$$

$$E = 2,000,000 \text{ psi.}$$

8. 3 1/8" width Southern Pine beams are also available.

Glulam beam sections are based on the following design values:

$$F_{bx} = 2400 \text{ psi (dry service conditions)}$$

$$E_x = 1,800,000 \text{ psi}$$

30F, 3000 psi beams are also available.

While these design conversions have been prepared in accordance with recognized engineering principles, and are based on accurate technical data available, conversions should not be used without competent professional examination and verification of the accuracy, suitability, and applicability by a licensed design professional.

**Any user of this information assumes all risks and liability arising from such use.**

# Connection Details and Other Applications

## Posts and Columns

Laminated posts and columns are available in long length members, eliminating the need to splice short timber sections.

Due to its dimensional stability and close manufacturing tolerances, a glued laminated timber column will remain straight and square. Other framing members, such as beams, can easily be attached with simple connection detailing.

## Other Applications

The use of laminated stair stringers is a good choice when long stringers are required, or when the stair framing will be exposed. Custom curved members are an option when special architectural considerations need to be met.

Stair stringers should not be notched for installation of risers, because it could compromise the stringers structural performance. Steel angles or ledgers may be used to support risers.

## Connection Details

Some typical connection details are shown on this page. For more information, request AITC Standard 104, Typical Construction Details.

## Corrosion Resistance

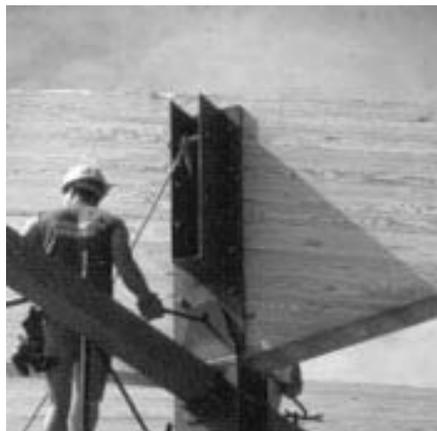
Wood has excellent chemical and corrosion resistance and is used in installations such as fertilizer storage buildings.



*Beam hangers.*



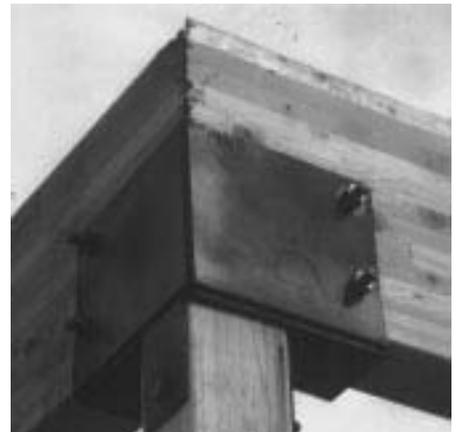
*Cantilever connection.*



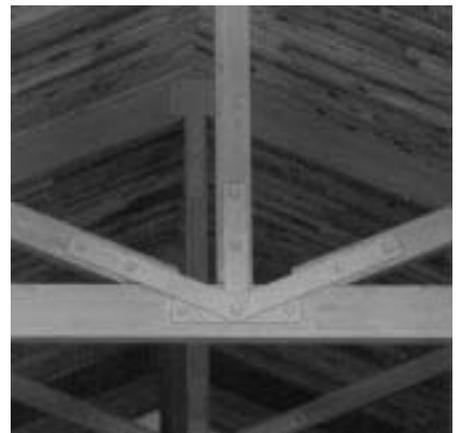
*Column connection.*



*Beam Intersection connection.*



*Corner support.*



*Truss connection.*

### Heavy Timber Construction

Heavy timber construction has long been recognized by the model building codes as fire resistant. To receive building code acceptance as “heavy timber,” limitations are placed upon size and thickness or composition of all load carrying wood members. Heavy timber also avoids concealed spaces under floors and roofs and requires the use of approved fastenings, construction details and adhesives.

The performance of heavy timber construction under fire conditions is markedly superior to most unprotected non-combustible structures. Fire fighting is simpler and safer due to elimination of concealed spaces and the inherent structural integrity of large glued laminated timbers.

Unprotected metals lose their strength quickly and collapse suddenly under extreme heat. Steel weakens dramatically as its temperature climbs above 450° Fahrenheit, retaining only 10% of its strength at about 1380°F. The average building fire temperatures range from 1290°F to 1650°F.

Wood retains a significantly higher percentage of its original strength for a longer period of time, losing strength only as material is lost through surface charring.



*Heavy timber construction.*

### Fire Resistance

The fire resistance rating is the time a member can support full design load without collapsing or spreading fire, either directly or indirectly through heat transfer. For example, a one-hour rating means the assembly should be capable of supporting its full load without collapsing for at least one hour after the fire starts.

### Fire Design Method

Fire tests jointly sponsored by the American Forest & Paper Association and AITC led to a fire design methodology which allows the designer to calculate a specific fire rating for a glulam member. See AITC Technical Note No. 7.



*A typical glulam beam following a fire test. The outer surface of the beam has charred, while the inner areas remain unburned. The charred outer material acts as an insulator during fire, reducing the rate at which the inner material burns.*

### Quality Control and Inspection

As a service to the construction industry, AITC provides a quality control and inspection system based on three elements:

1. **Licensing of manufacturers.** AITC licenses qualified laminators whose personnel procedures and facilities have complied with the requirements of ANSI/AITC A190.1.
2. **Quality control maintenance.** Each licensee agrees to accept responsibility for maintaining a quality control system which is in compliance with ANSI/AITC A190.1, AITC standards, and AITC 200--Inspection Manual.
3. **Periodic plant inspection.** AITC’s Inspection Bureau, a nationwide team of qualified inspectors, conducts frequent, unannounced inspection and verification checks of laminators’ in-plant quality control system, procedures and production.



## AITC Publications

- *Timber Construction Manual* – This 904 page handbook for timber design includes design methods and examples for laminated beams, columns, arches, trusses, single and double tapered beams, curved beams, and pitched and tapered curved beams.
  - *Bridge Systems Manual*
  - *Structural Glued Laminated Timber in Religious Structures*
  - *Glued Laminated Timbers for Residential Construction*
  - *Glulam—Superior Fire Resistance*
  - *Pitched and Curved Glulam Beams*
  - *Pitched and Tapered Curved Beams*
  - *WoodWorks® Sizer for AITC Software*
- See our web site for publication prices.

## AITC Standards

- AITC 104-84 Typical Construction Details.  
AITC 109-98 Standard for Preservative Treatment of Structural Glued Laminated Timber.  
AITC 110-97 Standard Appearance Grades for Structural Glued Laminated Timber.  
AITC 111-79 Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection.  
AITC 113-93 Standard for Dimensions of Structural Glued Laminated Timber.  
AITC 117-93 (Design) Standard Specifications for Structural Glued Laminated Timber of Softwood Species, Design Requirements.  
AITC 119-96 Standard Specifications for Structural Glued Laminated Timber of Hardwood Species.

A number of Technical Notes cover subjects such as checking, drilling, notching and fire performance. These are available through our web site.

*Cover Photo—Poynter Institute, St. Petersburg, FL; Architect—Jung/Brannen & Assoc.; Structural Engineer—Weidlinger Assoc. Consulting Engineers; Contractor—Federal Construction Co.*



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