Southern Pine Advantages

- Dependable structural species for engineered and framing applications
- High density provides excellent fastener strength
- Cost-competitive choice
- Accepted by building codes
- Readily available from a local building material supplier
- Easy to handle, cut, and install
- Kiln-dried to enhance in-place performance and dimensional stability
- Easily treated with preservatives for high-moisture applications
- Lends warmth and unmatched beauty to any project
- Renewable and sustainable building material

Assumptions for Table Development

The *Size Selection* and *Allowable Load Tables* in this brochure have been developed for Southern Pine lumber and glued laminated timber. Southern Pine lumber sizes are provided with the number of pieces (plies) required shown in parentheses (e.g. (3) 2x10s). For the *Size Selection Tables*, Southern Pine glued laminated timber sizes are only provided in the header tables (Tables 1-12) when (3) 2x12s no longer meet design parameters, and in the beam tables (Tables 13-20) when (4) 2x12s no longer meet design parameters.

General Requirements

These tables only apply to Southern Pine lumber and glued laminated timber used under ordinary ranges of temperature and dry service conditions. The moisture content in use must be a maximum of 19% for lumber, and less than 16% for glued laminated timber.

The quality of wood products and fasteners, and the design of load-supporting members and connections, must conform to the *National Design Specification (NDS)*. All structural members must be framed, anchored, tied, and braced to achieve the required strength and rigidity. Adequate bracing and bridging to resist wind and other lateral forces must be provided.

Loading Conditions

Assumed loading conditions are clearly stated in the heading for each *Size Selection Table*. The range of loads provided accommodates the most common design loads used in the United States, but only gravity loads (i.e. live loads, ground snow loads and dead loads) were considered. Wind and seismic analysis are outside the scope of this publication. Roof live load reductions have not been taken in developing these tables.

The headers and beams in the snow load *Size Selection Tables* (Tables 1-4, 7-10 and 15-18) have been sized using the Design Roof Snow Load shown in the subheading for each table. The Design Roof Snow Load has been derived by reducing the Ground Snow Load listed in each table heading in accordance with the provisions of Section 7.3 in *ASCE 7-10, Minimum Design Loads for Buildings and Other Structures*. This reduction results in an equivalent balanced Design Roof Snow Load of 0.70 times the Ground Snow Load, with a required minimum of 20 psf (pounds per square foot), when using the following factors:

- *Exposure Factor, C_e = 1.0*
- *Thermal Factor, C_t = 1.0*
- *Importance Factor, I_s = 1.0*

These tables do not consider unbalanced snow loads, drifting or rain-on-snow surcharges that may be required by the building code.

Glued Laminated Timber

In general, glued laminated timber headers and beams are stock items that can be purchased from a local building material supplier. Glued laminated timber is available in a variety of standard widths and depths, strength combinations, unbalanced or balanced beam layups, cambered or non-cambered beams, four different appearance grades, and stock or custom members.

Common glued laminated timber combinations use an unbalanced layup of laminating lumber grades. This means there is a distinct top and bottom to the glued laminated header or beam. All unbalanced glued laminated timber stock beams are required to have a "TOP" mark, and must only be used with the "TOP" mark facing up. A strength reduction occurs if an unbalanced glued laminated timber is installed upside down, or in a continuous span across supports. An appropriate balanced beam combination, such as 24F-V5, may be used for either simple-span or continuous-span applications.

The majority of stock glued laminated timber is manufactured with camber, but some stock members – especially balanced layup combinations – are manufactured without camber.

For more information about glued laminated timber, contact APA – The Engineered Wood Association at *www.apawood.org*, or West Coast Lumber Inspection Bureau at *www.wclib.org*.

Grades and Sizes

The Southern Pine lumber headers and beams have been determined using No.1, No.2 and No.3 grades, and net lumber dimensions (actual sizes), provided by the *American Softwood Lumber Standard PS 20* as follows:

Nominal Size (in.)	Actual Size (in.)
2 x 6	1-1/2 x 5-1/2
2 x 8	1-1/2 x 7-1/4
2 x 10	1-1/2 x 9-1/4
2 x 12	1-1/2 x 11-1/4

The Southern Pine glued laminated timber headers and beams in the *Size Selection Tables* are based on a 24F-1.7E stress class (e.g. 24F-V4 combination), and actual widths of 3-1/2" and 5-1/2"; these widths are typical for a Framing Appearance Grade used in applications where appearance is not critical. The depths of the glued laminated timber headers and beams included in the *Size Selection Tables* are compatible with lumber and I-joist depths.

Because there are other common glued laminated timber strength combinations, widths and depths available in the marketplace, there are three sets of *Allowable Load Tables* included in this publication. The first set (Tables 24, 30 and 36) is based on the same 24F-1.7E stress class, widths and depths included in the *Size Selection Tables*. The second set (Tables 25, 31 and 37) is also based on a 24F-1.7E stress class, but with actual widths of 3-1/8" and 5-1/8" and depths based on actual 1-3/8"-thick laminations. The third set (Tables 26, 32 and 38) is based on a 24F-1.8E stress class (e.g. 24F-V3 combination), actual widths of 3-1/8" and 5-1/8", and depths based on actual 1-3/8"-thick laminations.

Spans

The headers and beams provided in these tables have been computed using Allowable Stress Design and standard engineering design equations for simple span beams with uniformly distributed gravity loads. Uplift loads caused by wind have not been considered, nor have concentrated loads.

Values in these tables have been limited to the minimum number calculated for the following four design parameters:

- *Bending (flexure)*
- *Deflection*
- *Compression perpendicular-to-grain*
- *Shear parallel-to-grain (horizontal shear)*

Reference Design Values

The following table lists reference design values in pounds per square inch (psi) for Southern Pine glued laminated timber and lumber grades included in this publication. The glued laminated timber values are from *ANSI 117* and *APA EWS Y117*. The Southern Pine lumber values are new design values effective June 1, 2013 from the *SPIB Grading Rules*.

Southern Pine Glued Laminated Timber and Lumber Reference Design Values

Property	Glulam 24F-1.7E	Glulam 24F-1.8E	Lumber Size	No.1	No.2	No.3
F_b	2400	2400	2 x 6	1350	1000	575
			2 x 8	1250	925	525
			2 x 10	1050	800	475
			2 x 12	1000	750	450
E	1,700,000	1,800,000	All	1,600,000	1,400,000	1,300,000
$F_{c\perp}$	740	740	All	565	565	565
F_v	175/140*	300	All	175	175	175

*Used F_v = 175 psi for 3-1/8" and 3-1/2"-wide glulam, and 140 psi for 5-1/8" and 5-1/2"-wide glulam.

Adjustment Factors

Reference design values must be multiplied by all applicable adjustment factors to determine adjusted design values. The adjustment factors used to develop these tables are described below. Note that reference design values have not been adjusted for buckling. To use these tables, therefore, the compression edge of the header or beam must be laterally supported at intervals of 24" or less. In addition, lateral support must be provided at bearing points.

For more complete information on reference design values and adjustment factors, refer to the *NDS*.

Load Duration Factor, C_D – Wood has the property of carrying substantially greater maximum loads for short durations than for long durations of loading. The following load duration factors have been used to adjust the reference design values for bending and shear.

Load Duration	C_D
Ten years (occupancy live load)	1.00
Two months (snow load)	1.15
Seven days (construction load)	1.25

Repetitive Member Factor, C_r – The repetitive member factor applies to three or more like bending members in contact and properly connected together for load sharing.

Volume Effect Factor, C_V – The volume effect factor equation for Southern Pine glued laminated timber bending members is:

$C_V = (5.125/b)^{1/20}(12/d)^{1/20}(21/L)^{1/20} \leq 1.0$, where:

b = width of bending member in inches

d = depth of bending member in inches

L = length of bending member between points of zero moment in feet

Bending

Reference design values for bending have been adjusted with the load duration factor shown for each table. For the three- and four-ply lumber members, reference design values for bending have been multiplied by the repetitive member factor, $C_r = 1.15$. For glued laminated timber, reference design values for bending have been multiplied by the volume effect factor, C_V.

Deflection

Deflection may be the controlling factor in determining the member size required when appearance or rigidity is important. Deflection limits are expressed as a fraction of the span length (ℓ) in inches. Building codes have traditionally required certain deflection limits for floor and roof members, but designers must also evaluate other deflection criteria, such as long-term deflection under sustained loads (including creep) and serviceability issues (including vibration). Some structural members, such as headers for wide garage doors, may require more stringent deflection limits. The following deflection limits have been used in the development of the tables in this publication:

Tables	Total Load	Live Load
1-6: Headers	ℓ/180	ℓ/240
7-12: Headers	ℓ/240	ℓ/360
13-14: Floor Beams	ℓ/240	ℓ/360
15-20: Roof Beams	ℓ/180	ℓ/240
21-26: Allowable Floor Loads	ℓ/240	ℓ/360
27-38: Allowable Roof Loads	ℓ/180	ℓ/240

The *Allowable Load Tables* (Tables 21-38) may be used to calculate allowable live loads based on different deflection limits. For example, to determine allowable live loads for a deflection limit of ℓ/360 in the *Allowable Roof Load Tables* (Tables 27-38), multiply the tabulated live-load (LL) values by the ratio of 240/360 = 0.67. The result must not exceed the corresponding total-load (TL) value for the same clear opening and product.

Compression Perpendicular-to-Grain

The required bearing lengths for headers and beams in both the *Size Selection* and *Allowable Load Tables* have been based on the compression perpendicular-to-grain design value for the product indicated. The *Size Selection Tables* require a minimum 3.0" bearing length, with the products marked with an asterisk (*) requiring a 4.5" bearing length.

For the *Allowable Load Tables*, the required bearing lengths have been used to determine the design span, which is defined as the distance from inside face to inside face of supports (i.e. the clear opening) plus one-half the required bearing length at each end. The required bearing lengths have been converted into the minimum number of 1.5"-wide members needed to support the header or beam. Nominal 2"-thick vertical lumber trimmers or shoulder studs are most often used for this application. The 1.5” trimmers are assumed to provide full support across the width of the header or beam. Column buckling has not been considered and may need to be checked depending on the grade, species and height of the trimmers. If bearing occurs on a wall plate, check for compression perpendicular-to-grain for the species and grade of that plate.

Shear Parallel-to-Grain

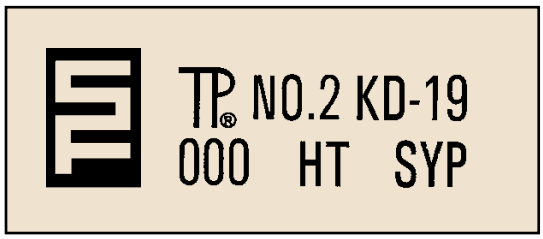
In accordance with *NDS* provisions, loads within a distance from supports equal to the depth of the members have been ignored when calculating the design shear force.

Identification

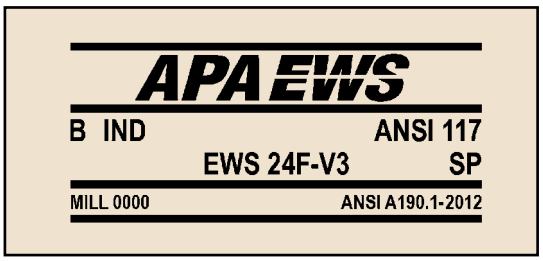
The tables in this brochure apply to properly identified material. Lumber must be identified by the grade mark of an agency certified by the Board of Review of the American Lumber Standard Committee, and manufactured in accordance with *Product Standard PS 20* published by the U.S. Department of Commerce. A certified grade mark on Southern Pine dimension lumber indicates that the lumber has been properly seasoned by the manufacturer, and that it meets the structural and appearance requirements established for the grade.

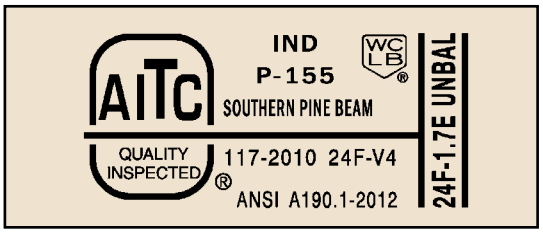
Glued laminated timber must be identified with a quality mark or trademark indicating conformance with *ANSI A190.1, American National Standard for Wood Products – Structural Glued Laminated Timber*. These marks indicate the manufacturer is committed to a rigorous program of quality testing and product verification.

Typical Lumber Grade Marks:



Typical Glued Laminated Timber Marks:



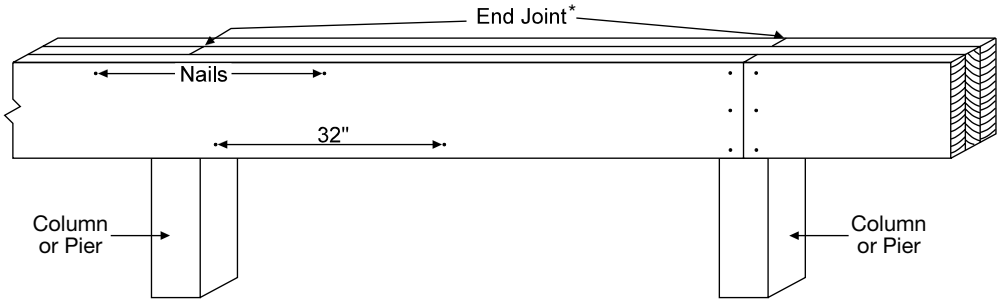


Fabricating Multiple-Member Headers and Beams

Headers and beams can be built-up with multiple pieces (plies) of nominal 2"-thick lumber nailed together with the wide faces positioned vertically. According to AWC's *Details for Conventional Wood Frame Construction*, multiple plies should be nailed together with two rows of 20d nails – one row near the top edge of the header or beam, and the other near the bottom edge. Nails in each row are spaced 32 inches apart.

End joints of the nailed lumber should occur over the supporting column or pier. Beams and girders that are not continuous should be tied together across supports. This is most often accomplished by nailing a steel strap or tie to both beams, but other methods are acceptable.

A nominal 1/2" (15/32") wood structural panel filler is often used to fill out two plies of a nominal 2"-thick lumber header to match a 3-1/2" wall width.



*Beam continuity is maintained by staggering end joints of adjacent plies.