

SOUTHERN PINE REFERENCE DESIGN VALUES

Based on SPIB Grading Rules
and AF&PA National Design Specification®
Values in pounds per square inch (psi)

Table 1 Dimension Lumber – 2” to 4” thick, 2” and wider

Based on Normal Load Duration and Dry Service (MC ≤ 19%)¹ — See Tables A-1 thru A-4 for Adjustment Factors

Size	Grade	Bending F _b		Tension Parallel to Grain F _t	Shear Parallel to Grain F _v	Compression Perpendicular to Grain F _{c⊥}	Compression Parallel to Grain F _c	Modulus of Elasticity ⁵ E E _{min}	
		Single Member Uses	Repetitive Member Uses ²						
2” to 4” thick, 2” to 4” wide	Dense Select Structural	3050	3510	1650	175	660	2250	1,900,000	690,000
	Select Structural	2850	3280	1600	175	565	2100	1,800,000	660,000
	NonDense Select Struc.	2650	3050	1350	175	480	1950	1,700,000	620,000
	No.1 Dense	2000	2300	1100	175	660	2000	1,800,000	660,000
	No.1	1850	2130	1050	175	565	1850	1,700,000	620,000
	No.1 NonDense	1700	1950	900	175	480	1700	1,600,000	580,000
	No.2 Dense	1700	1960	875	175	660	1850	1,700,000	620,000
	No.2	1500	1720	825	175	565	1650	1,600,000	580,000
	No.2 NonDense	1350	1550	775	175	480	1600	1,400,000	510,000
	No.3 and Stud.	850	980	475	175	565	975	1,400,000	510,000
2” to 4” thick, 5” to 6” wide	Dense Select Structural	2700	3100	1500	175	660	2150	1,900,000	690,000
	Select Structural	2550	2930	1400	175	565	2000	1,800,000	660,000
	NonDense Select Struc.	2350	2700	1200	175	480	1850	1,700,000	620,000
	No.1 Dense	1750	2010	950	175	660	1900	1,800,000	660,000
	No.1	1650	1900	900	175	565	1750	1,700,000	620,000
	No.1 NonDense	1500	1720	800	175	480	1600	1,600,000	580,000
	No.2 Dense	1450	1670	775	175	660	1750	1,700,000	620,000
	No.2	1250	1440	725	175	565	1600	1,600,000	580,000
	No.2 NonDense	1150	1320	675	175	480	1500	1,400,000	510,000
	No.3 and Stud.	750	865	425	175	565	925	1,400,000	510,000
2” to 4” thick, 8” wide	Dense Select Structural	2450	2820	1350	175	660	2050	1,900,000	690,000
	Select Structural	2300	2650	1300	175	565	1900	1,800,000	660,000
	NonDense Select Struc.	2100	2420	1100	175	480	1750	1,700,000	620,000
	No.1 Dense	1650	1900	875	175	660	1800	1,800,000	660,000
	No.1	1500	1730	825	175	565	1650	1,700,000	620,000
	No.1 NonDense	1350	1550	725	175	480	1550	1,600,000	580,000
	No.2 Dense	1400	1610	675	175	660	1700	1,700,000	620,000
	No.2	1200	1380	650	175	565	1550	1,600,000	580,000
	No.2 NonDense	1100	1260	600	175	480	1450	1,400,000	510,000
	No.3 and Stud.	700	805	400	175	565	875	1,400,000	510,000

- (1) Moisture designations KD, KD19, KD15, S-DRY, MC15 and MC19 all have identical design values.
- (2) Repetitive member uses apply to joists, truss chords, rafters, studs, planks, decking or similar members which are in contact or spaced not more than 24” on center, are not less than three [3] in number, and are joined by floor, roof or other load distributing elements adequate to support the design load. The Repetitive Member Factor, C_r = 1.15, has been included in the listed Repetitive Member Use design values.
- (3) For Utility, the F_b, F_t and F_c values apply to 4” wide lumber only.
- (4) For lumber 4” thick and 8” or wider, multiply the F_b value by C_F = 1.1.
- (5) Modulus of Elasticity, E is an estimate of the average for the species and grade of material. E_{min} represents an approximate 5% lower exclusion value on pure bending modulus of elasticity, plus a 1.66 factor of safety, and is used for beam and column stability calculations.

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Table 1 Dimension Lumber – 2” to 4” thick, 2” and wider

Based on Normal Load Duration and Dry Service (MC ≤ 19%)¹ — See Tables A-1 thru A-4 for Adjustment Factors

Size	Grade	Bending F _b		Tension Parallel to Grain F _t	Shear Parallel to Grain F _v	Compression Perpendicular to Grain F _{c⊥}	Compression Parallel to Grain F _c	Modulus of Elasticity ⁵ E E _{min}	
		Single Member Uses	Repetitive Member Uses ²						
2” to 4” thick, 10” wide Includes: 2x10 3x10 4x10 ³	Dense Select Structural.	2150	2470	1200	175	660	2000	1,900,000	690,000
	Select Structural.	2050	2360	1100	175	565	1850	1,800,000	660,000
	NonDense Select Struc.	1850	2130	950	175	480	1750	1,700,000	620,000
	No.1 Dense.	1450	1670	775	175	660	1750	1,800,000	660,000
	No.1.	1300	1500	725	175	565	1600	1,700,000	620,000
	No.1 NonDense.	1200	1380	650	175	480	1500	1,600,000	580,000
	No.2 Dense.	1200	1380	625	175	660	1650	1,700,000	620,000
	No.2.	1050	1210	575	175	565	1500	1,600,000	580,000
	No.2 NonDense.	950	1090	550	175	480	1400	1,400,000	510,000
	No.3 and Stud.	600	690	325	175	565	850	1,400,000	510,000
	2” to 4” thick, 12” wide⁴ Includes: 2x12 3x12 4x12 ³	Dense Select Structural.	2050	2360	1100	175	660	1950	1,900,000
Select Structural.		1900	2190	1050	175	565	1800	1,800,000	660,000
NonDense Select Struc.		1750	2010	900	175	480	1700	1,700,000	620,000
No.1 Dense.		1350	1550	725	175	660	1700	1,800,000	660,000
No.1.		1250	1440	675	175	565	1600	1,700,000	620,000
No.1 NonDense.		1150	1320	600	175	480	1500	1,600,000	580,000
No.2 Dense.		1150	1320	575	175	660	1600	1,700,000	620,000
No.2.		975	1120	550	175	565	1450	1,600,000	580,000
No.2 NonDense.		900	1040	525	175	480	1350	1,400,000	510,000
No.3 and Stud.		575	660	325	175	565	825	1,400,000	510,000

- (1) Moisture designations KD, KD19, KD15, S-DRY, MC15 and MC19 all have identical design values.
- (2) Repetitive member uses apply to joists, truss chords, rafters, studs, planks, decking or similar members which are in contact or spaced not more than 24” on center, are not less than three [3] in number, and are joined by floor, roof or other load distributing elements adequate to support the design load. The Repetitive Member Factor, C_r = 1.15, has been included in the listed Repetitive Member Use design values.
- (3) For lumber 4” thick and 8” or wider, multiply the F_b value by C_F = 1.1.
- (4) For lumber wider than 12”, multiply these 12” width values by C_F = .90 for F_b, F_t, and F_c values.
- (5) Modulus of Elasticity, E is an estimate of the average for the species and grade of material. E_{min} represents an approximate 5% lower exclusion value on pure bending modulus of elasticity, plus a 1.66 factor of safety, and is used for beam and column stability calculations.

Table 2 Timbers – 5” x 5” and larger

Based on Normal Load Duration and Dry or Wet Service — See Tables A-1 and A-3 for Adjustment Factors

Size	Grade	Bending F _b ¹	Tension Parallel to Grain F _t	Shear Parallel to Grain F _v	Compression Perpendicular to Grain F _{c⊥}	Compression Parallel to Grain F _c	Modulus of Elasticity ² E E _{min}	
		Single Member Uses						
5” x 5” and larger	Dense Select Structural.	1750	1200	165	440	1100	1,600,000	580,000
	Select Structural.	1500	1000	165	375	950	1,500,000	550,000
	No.1 Dense.	1550	1050	165	440	975	1,600,000	580,000
	No.1.	1350	900	165	375	825	1,500,000	550,000
	No.2 Dense.	975	650	165	440	625	1,300,000	470,000
	No.2.	850	550	165	375	525	1,200,000	440,000

- (1) When the depth, d, of a timber exceeds 12”, the tabulated bending design value, F_b, shall be multiplied by the following size factor:
$$C_F = \left(\frac{12}{d}\right)^{1/9}$$
 where d is the actual depth of the member.
- (2) Modulus of Elasticity, E is an estimate of the average for the species and grade of material. E_{min} represents an approximate 5% lower exclusion value on pure bending modulus of elasticity, plus a 1.66 factor of safety, and is used for beam and column stability calculations.