

SOUTHERN PINE REFERENCE DESIGN VALUES

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

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

Effective June 1, 2013

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



Effective June 1, 2013

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 E	E _{min}	
2" to 4" thick, 2" to 4" wide Includes: 2x2 2x3 2x4 3x3 3x4 4x4	Dense Select Structural	2700	1900	175	660	2050	1,900,000	690,000	
	Select Structural	2350	1650	175	565	1900	1,800,000	660,000	
	Non-Dense Select Structural . . .	2050	1450	175	480	1800	1,600,000	580,000	
	No.1 Dense	1650	1100	175	660	1750	1,800,000	660,000	
	No.1	1500	1000	175	565	1650	1,600,000	580,000	
	No.1 Non-Dense	1300	875	175	480	1550	1,400,000	510,000	
	No.2 Dense	1200	750	175	660	1500	1,600,000	580,000	
	No.2	1100	675	175	565	1450	1,400,000	510,000	
	No.2 Non-Dense	1050	600	175	480	1450	1,300,000	470,000	
	No.3 and Stud	650	400	175	565	850	1,300,000	470,000	
	Construction	875	500	175	565	1600	1,400,000	510,000	
	Standard	475	275	175	565	1300	1,200,000	440,000	
Utility ¹	225	125	175	565	850	1,200,000	440,000		
2" to 4" thick, 5" to 6" wide Includes: 2x5 2x6 3x5 3x6 4x5 4x6	Dense Select Structural	2400	1650	175	660	1900	1,900,000	690,000	
	Select Structural	2100	1450	175	565	1800	1,800,000	660,000	
	Non-Dense Select Structural . . .	1850	1300	175	480	1700	1,600,000	580,000	
	No.1 Dense	1500	1000	175	660	1650	1,800,000	660,000	
	No.1	1350	875	175	565	1550	1,600,000	580,000	
	No.1 Non-Dense	1200	775	175	480	1450	1,400,000	510,000	
	No.2 Dense	1050	650	175	660	1450	1,600,000	580,000	
	No.2	1000	600	175	565	1400	1,400,000	510,000	
	No.2 Non-Dense	950	525	175	480	1350	1,300,000	470,000	
	No.3 and Stud	575	350	175	565	800	1,300,000	470,000	
	2" to 4" thick, 8" wide Includes: 2x8 3x8 4x8 ²	Dense Select Structural	2200	1550	175	660	1850	1,900,000	690,000
		Select Structural	1950	1350	175	565	1700	1,800,000	660,000
Non-Dense Select Structural . . .		1700	1200	175	480	1650	1,600,000	580,000	
No.1 Dense		1350	900	175	660	1600	1,800,000	660,000	
No.1		1250	800	175	565	1500	1,600,000	580,000	
No.1 Non-Dense		1100	700	175	480	1400	1,400,000	510,000	
No.2 Dense		975	600	175	660	1400	1,600,000	580,000	
No.2		925	550	175	565	1350	1,400,000	510,000	
No.2 Non-Dense		875	500	175	480	1300	1,300,000	470,000	
No.3 and Stud		525	325	175	565	775	1,300,000	470,000	
2" to 4" thick, 10" wide Includes: 2x10 3x10 4x10 ²		Dense Select Structural	1950	1300	175	660	1800	1,900,000	690,000
		Select Structural	1700	1150	175	565	1650	1,800,000	660,000
	Non-Dense Select Structural . . .	1500	1050	175	480	1600	1,600,000	580,000	
	No.1 Dense	1200	800	175	660	1550	1,800,000	660,000	
	No.1	1050	700	175	565	1450	1,600,000	580,000	
	No.1 Non-Dense	950	625	175	480	1400	1,400,000	510,000	
	No.2 Dense	850	525	175	660	1350	1,600,000	580,000	
	No.2	800	475	175	565	1300	1,400,000	510,000	
	No.2 Non-Dense	750	425	175	480	1250	1,300,000	470,000	
	No.3 and Stud	475	275	175	565	750	1,300,000	470,000	
	2" to 4" thick, 12" wide³ Includes: 2x12 3x12 4x12 ²	Dense Select Structural	1800	1250	175	660	1750	1,900,000	690,000
		Select Structural	1600	1100	175	565	1650	1,800,000	660,000
Non-Dense Select Structural . . .		1400	975	175	480	1550	1,600,000	580,000	
No.1 Dense		1100	750	175	660	1500	1,800,000	660,000	
No.1		1000	650	175	565	1400	1,600,000	580,000	
No.1 Non-Dense		900	575	175	480	1350	1,400,000	510,000	
No.2 Dense		800	500	175	660	1300	1,600,000	580,000	
No.2		750	450	175	565	1250	1,400,000	510,000	
No.2 Non-Dense		700	400	175	480	1250	1,300,000	470,000	
No.3 and Stud		450	250	175	565	725	1,300,000	470,000	

(1) For Utility, design values apply to 4"-wide lumber only. (2) For lumber 4" thick and 8" or wider, multiply the F_b value by C_F = 1.1. (3) For lumber wider than 12", multiply these 12"-width design values for F_b, F_t and F_c by C_F = .90, and use these 12"-width design values for the other properties.

The Southern Forest Products Association (SFPA) does not test lumber of establish design values. Neither SFPA, nor its members, warrant that the design values are correct, and disclaim responsibility for injury or damage resulting from the use of such design values.

Reference design values are for normal load duration under the moisture service conditions specified. Because the strength of wood varies with conditions under which it is used, reference design values should only be applied in conjunction with appropriate design and service recommendations from the *National Design Specification® (NDS®) for Wood Construction* published by the American Wood Council. The latest connection design information is also provided in the *NDS*.

Reference design values (F_b , F_t , F_v , $F_{c\perp}$, F_c , E , E_{min}) in Tables 1 thru 3 shall be multiplied by all applicable adjustment factors to determine adjusted design values (F_b' , F_t' , F_v' , $F_{c\perp}'$, F_c' , E' , E_{min}').

Table A-1 is excerpted from the *NDS* and summarizes the applicability of adjustment factors for solid-sawn lumber.

Table A-1 Applicability of Adjustment Factors for Sawn Lumber

Adjusted Design Value	Reference Design Value	ASD only		ASD and LRFD										LRFD only				
		Load Duration Factor	Wet Service Factor	Temperature Factor	Beam Stability Factor	Size Factor	Flat Use Factor	Inclining Factor	Repetitive Member Factor	Column Stability Factor	Buckling Stiffness Factor	Bearing Area Factor	Format Conversion Factor	Resistance Factor	Time Effect Factor			
$F_b' = F_b * C_D * C_M * C_t * C_L * C_F * C_{fu} * C_i * C_T$	F_b	C_D	C_M	C_t	C_L	C_F	C_{fu}	C_i	C_T							K_F	ϕ	λ
$F_t' = F_t * C_D * C_M * C_t * C_F * C_i$	F_t	C_D	C_M	C_t		C_F		C_i								K_F	ϕ	λ
$F_v' = F_v * C_D * C_M * C_t * C_i$	F_v	C_D	C_M	C_t				C_i								K_F	ϕ	λ
$F_c' = F_c * C_D * C_M * C_t * C_F * C_P$	F_c	C_D	C_M	C_t		C_F		C_i		C_P						K_F	ϕ	λ
$F_{c\perp}' = F_{c\perp} * C_M * C_t * C_i * C_b$	$F_{c\perp}$		C_M	C_t				C_i			C_b					K_F	ϕ	λ
$E' = E * C_M * C_t * C_i$	E		C_M	C_t				C_i										
$E_{min}' = E_{min} * C_M * C_t * C_i$	E_{min}		C_M	C_t				C_i			C_T					K_F	ϕ	λ

ASD – Allowable Stress Design; LRFD – Load and Resistance Factor Design

Tables A-2 thru A-4 highlight the most common adjustment factors as they apply to Southern Pine. In addition, Table 1 and 3 footnotes provide information about the Size Factor, C_F . For complete information on adjustment factors, see the *NDS*.

Table A-2 Wet Service Factor, C_M

For lumber 2" to 4" thick

Applies to all values

When dimension lumber is used under conditions where the moisture content of the wood in service will exceed 19% for an extended time period, reference design values shall be multiplied by the appropriate wet service factors to the right.

F_b	F_t	F_v	$F_{c\perp}$	F_c	E	E_{min}
0.85 ¹	1.0	0.97	0.67	0.8 ²	0.9	0.9
(1) When $F_b \leq 1150$ psi, $C_M = 1.0$			(2) When $F_c \leq 750$ psi, $C_M = 1.0$			

Table A-3 Load Duration Factor, C_D

For all solid wood products – Allowable Stress Design Only

Applies to F_b , F_t , F_v , and F_c values
Does not apply to $F_{c\perp}$, E , and E_{min} values

Wood has the property of carrying substantially greater maximum loads for short durations than for long durations of loading. Reference design values apply to normal load duration, meaning a load that fully stresses a member to its allowable design value by the application of the full design load for a cumulative duration of approximately ten years. When the cumulative duration of the full maximum load does not exceed the specified time period, all reference design values (except $F_{c\perp}$, E , and E_{min}) shall be multiplied by the appropriate load duration factor. Frequently used load duration factors are provided to the right.

Load Duration (Typical Design Loads)	C_D
Permanent (dead load)	0.9
Ten years (occupancy live load)	1.0
Two months (snow load)	1.15
Seven days (construction load)	1.25
Ten minutes (wind/earthquake load)	1.6
Impact ¹ (impact load)	2.0

(1) Load duration factors greater than 1.6 shall not apply to structural members pressure treated with waterborne preservatives, or fire-retardant chemicals. The impact load duration factor shall not apply to connections.

Table A-4 Flat Use Factor, C_{fu}

For lumber 2" to 4" thick

Applies to F_b values only

Reference bending design values, F_b , are based on edgewise use (load applied to narrow face). When dimension lumber is used flatwise (load applied to wide face), F_b shall also be multiplied by the flat use factors to the right.

Width (depth)	Flat Use Factors, C_{fu}	
	Thickness (breadth) 2" & 3"	4"
2" & 3"	1.0	–
4"	1.1	1.0
5"	1.1	1.05
6"	1.15	1.05
8"	1.15	1.05
10" & wider	1.2	1.1