

**TABLE R-11
RAFTERS WITH L/240 DEFLECTION LIMITATION**

DESIGN CRITERIA:
 Strength - Live Load of 40 psf plus
 Dead Load of 20 psf determines the required bending design value.
 Deflection - For 40 psf live load.
 Limited to span in inches divided by 240.

Rafter Size (in)	Spacing (in)	Bending Design Value, F_b , (psi)																								
		300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700
2x6	12.0	5-0	5-10	6-6	7-1	7-8	8-2	8-8	9-2	9-7	10-0	10-5	10-10	11-3	11-7	11-11	12-4	12-8	13-0	13-3	13-7	13-11	14-2			
	16.0	4-4	5-0	5-7	6-2	6-8	7-1	7-6	7-11	8-4	8-8	9-1	9-5	9-9	10-0	10-4	10-8	10-11	11-3	11-6	11-9	12-0	12-4	12-7	12-10	13-1
	19.2	4-0	4-7	5-1	5-7	6-1	6-6	6-10	7-3	7-7	7-11	8-3	8-7	8-11	9-2	9-5	9-9	10-0	10-3	10-6	10-9	11-0	11-3	11-5	11-8	11-11
	24.0	3-7	4-1	4-7	5-0	5-5	5-10	6-2	6-6	6-10	7-1	7-5	7-8	7-11	8-2	8-5	8-8	8-11	9-2	9-5	9-7	9-10	10-0	10-3	10-5	10-8
2x8	12.0	6-7	7-8	8-7	9-4	10-1	10-10	11-6	12-1	12-8	13-3	13-9	14-4	14-10	15-3	15-9	16-3	16-8	17-1	17-6	17-11	18-4	18-9			
	16.0	5-9	6-7	7-5	8-1	8-9	9-4	9-11	10-6	11-0	11-6	11-11	12-5	12-10	13-3	13-8	14-0	14-5	14-10	15-2	15-6	15-10	16-3	16-7	16-10	17-2
	19.2	5-3	6-0	6-9	7-5	8-0	8-7	9-1	9-7	10-0	10-6	10-11	11-4	11-8	12-1	12-5	12-10	13-2	13-6	13-10	14-2	14-6	14-10	15-1	15-5	15-8
	24.0	4-8	5-5	6-0	6-7	7-2	7-8	8-1	8-7	9-0	9-4	9-9	10-1	10-6	10-10	11-2	11-6	11-9	12-1	12-5	12-8	12-11	13-3	13-6	13-9	14-0
2x10	12.0	8-5	9-9	10-11	11-11	12-11	13-9	14-8	15-5	16-2	16-11	17-7	18-3	18-11	19-6	20-1	20-8	21-3	21-10	22-4	22-10	23-5	23-11			
	16.0	7-4	8-5	9-5	10-4	11-2	11-11	12-8	13-4	14-0	14-8	15-3	15-10	16-4	16-11	17-5	17-11	18-5	18-11	19-4	19-10	20-3	20-8	21-1	21-6	21-11
	19.2	6-8	7-8	8-7	9-5	10-2	10-11	11-7	12-2	12-9	13-4	13-11	14-5	14-11	15-5	15-11	16-4	16-10	17-3	17-8	18-1	18-6	18-11	19-3	19-8	20-0
	24.0	6-0	6-11	7-8	8-5	9-1	9-9	10-4	10-11	11-5	11-11	12-5	12-11	13-4	13-9	14-3	14-8	15-0	15-5	15-10	16-2	16-6	16-11	17-3	17-7	17-11
2x12	12.0	10-3	11-10	13-3	14-6	15-8	16-9	17-9	18-9	19-8	20-6	21-5	22-2	23-0	23-9	24-5	25-2	25-10								
	16.0	8-11	10-3	11-6	12-7	13-7	14-6	15-5	16-3	17-0	17-9	18-6	19-3	19-11	20-6	21-2	21-9	22-5	23-0	23-6	24-1	24-8	25-2	25-8		
	19.2	8-1	9-4	10-6	11-6	12-5	13-3	14-1	14-10	15-7	16-3	16-11	17-6	18-2	18-9	19-4	19-11	20-5	21-0	21-6	22-0	22-6	23-0	23-5	23-11	24-4
	24.0	7-3	8-5	9-4	10-3	11-1	11-10	12-7	13-3	13-11	14-6	15-1	15-8	16-3	16-9	17-3	17-9	18-3	18-9	19-3	19-8	20-1	20-6	21-0	21-5	21-9
E	12.0	0.11	0.17	0.24	0.31	0.39	0.48	0.57	0.67	0.77	0.88	0.99	1.10	1.22	1.35	1.48	1.61	1.75	1.89	2.03	2.18	2.33	2.48			
	16.0	0.09	0.15	0.20	0.27	0.34	0.41	0.49	0.58	0.67	0.76	0.86	0.96	1.06	1.17	1.28	1.39	1.51	1.63	1.76	1.88	2.01	2.15	2.28	2.42	2.56
	19.2	0.09	0.13	0.19	0.24	0.31	0.38	0.45	0.53	0.61	0.69	0.78	0.87	0.97	1.07	1.17	1.27	1.38	1.49	1.60	1.72	1.84	1.96	2.08	2.21	2.34
	24.0	0.08	0.12	0.17	0.22	0.28	0.34	0.40	0.47	0.54	0.62	0.70	0.78	0.87	0.95	1.04	1.14	1.23	1.33	1.43	1.54	1.64	1.75	1.86	1.98	2.09

Note: The required modulus of elasticity, E, in 1,000,000 pounds per square inch is shown at the bottom of each table, is limited to 2.5 million psi and less, and is applicable to all lumber sizes shown. Spans are shown in feet-inches and are limited to 26' and less. Check sources of supply for availability of lumber in lengths greater than 20'.

**TABLE R-14
RAFTERS WITH L/180 DEFLECTION LIMITATION**

DESIGN CRITERIA:

Strength - Live Load of 30 psf plus
 Dead Load of 10 psf determines the required bending design value.
 Deflection - For 30 psf live load.
 Limited to span in inches divided by 180.

Rafter Size (in)	Spacing (in)	Bending Design Value, F_b , (psi)																																
		200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000				
2x4	12.0	3-2	3-11	4-6	5-1	5-6	6-0	6-5	6-9	7-2	7-6	7-10	8-2	8-5	8-9	9-0	9-4	9-7	9-10	10-1	10-4	10-7	10-10	11-1										
	16.0	2-9	3-5	3-11	4-4	4-10	5-2	5-6	5-10	6-2	6-6	6-9	7-1	7-4	7-7	7-10	8-1	8-4	8-6	8-9	9-0	9-2	9-5	9-7	9-9	10-0								
	19.2	2-6	3-1	3-7	4-0	4-4	4-9	5-1	5-4	5-8	5-11	6-2	6-5	6-8	6-11	7-2	7-4	7-7	7-9	8-0	8-2	8-5	8-7	8-9	8-11	9-1	9-3	9-5						
	24.0	2-3	2-9	3-2	3-7	3-11	4-3	4-6	4-10	5-1	5-4	5-6	5-9	6-0	6-2	6-5	6-7	6-9	7-0	7-2	7-4	7-6	7-8	7-10	8-0	8-2	8-4	8-5	8-7	8-9				
2x6	12.0	5-0	6-2	7-1	7-11	8-8	9-5	10-0	10-8	11-3	11-9	12-4	12-10	13-3	13-9	14-2	14-8	15-1	15-6	15-11	16-3	16-8	17-0	17-5										
	16.0	4-4	5-4	6-2	6-10	7-6	8-2	8-8	9-3	9-9	10-2	10-8	11-1	11-6	11-11	12-4	12-8	13-1	13-5	13-9	14-1	14-5	14-9	15-1	15-4	15-8								
	19.2	4-0	4-10	5-7	6-3	6-10	7-5	7-11	8-5	8-11	9-4	9-9	10-1	10-6	10-10	11-3	11-7	11-11	12-3	12-7	12-10	13-2	13-6	13-9	14-0	14-4	14-7	14-10						
	24.0	3-7	4-4	5-0	5-7	6-2	6-8	7-1	7-6	7-11	8-4	8-8	9-1	9-5	9-9	10-0	10-4	10-8	10-11	11-3	11-6	11-9	12-0	12-4	12-7	12-10	13-1	13-3	13-6	13-9				
2x8	12.0	6-7	8-1	9-4	10-6	11-6	12-5	13-3	14-0	14-10	15-6	16-3	16-10	17-6	18-1	18-9	19-4	19-10	20-5	20-11	21-5	21-11	22-5	22-11										
	16.0	5-9	7-0	8-1	9-1	9-11	10-9	11-6	12-2	12-10	13-5	14-0	14-7	15-2	15-8	16-3	16-9	17-2	17-8	18-1	18-7	19-0	19-5	19-10	20-3	20-8								
	19.2	5-3	6-5	7-5	8-3	9-1	9-9	10-6	11-1	11-8	12-3	12-10	13-4	13-10	14-4	14-10	15-3	15-8	16-2	16-7	16-11	17-4	17-9	18-1	18-6	18-10	19-3	19-7						
	24.0	4-8	5-9	6-7	7-5	8-1	8-9	9-4	9-11	10-6	11-0	11-6	11-11	12-5	12-10	13-3	13-8	14-0	14-5	14-10	15-2	15-6	15-10	16-3	16-7	16-10	17-2	17-6	17-10	18-1				
2x10	12.0	8-5	10-4	11-11	13-4	14-8	15-10	16-11	17-11	18-11	19-10	20-8	21-6	22-4	23-1	23-11	24-7	25-4	26-0															
	16.0	7-4	8-11	10-4	11-7	12-8	13-8	14-8	15-6	16-4	17-2	17-11	18-8	19-4	20-0	20-8	21-4	21-11	22-6	23-1	23-8	24-3	24-10	25-4	25-10									
	19.2	6-8	8-2	9-5	10-7	11-7	12-6	13-4	14-2	14-11	15-8	16-4	17-0	17-8	18-3	18-11	19-6	20-0	20-7	21-1	21-8	22-2	22-8	23-1	23-7	24-1	24-6	25-0						
	24.0	6-0	7-4	8-5	9-5	10-4	11-2	11-11	12-8	13-4	14-0	14-8	15-3	15-10	16-4	16-11	17-5	17-11	18-5	18-11	19-4	19-10	20-3	20-8	21-1	21-6	21-11	22-4	22-9	23-1				
E	12.0	0.06	0.11	0.17	0.24	0.32	0.40	0.49	0.59	0.69	0.79	0.91	1.02	1.14	1.27	1.39	1.53	1.66	1.80	1.95	2.10	2.25	2.40	2.56										
	16.0	0.05	0.10	0.15	0.21	0.28	0.35	0.43	0.51	0.60	0.69	0.78	0.88	0.99	1.10	1.21	1.32	1.44	1.56	1.69	1.82	1.95	2.08	2.22	2.36	2.50								
	19.2	0.05	0.09	0.14	0.19	0.25	0.32	0.39	0.47	0.54	0.63	0.72	0.81	0.90	1.00	1.10	1.21	1.32	1.43	1.54	1.66	1.78	1.90	2.03	2.15	2.28	2.42	2.55						
	24.0	0.04	0.08	0.12	0.17	0.23	0.29	0.35	0.42	0.49	0.56	0.64	0.72	0.81	0.89	0.99	1.08	1.18	1.28	1.38	1.48	1.59	1.70	1.81	1.93	2.04	2.16	2.28	2.41	2.53				

Note: The required modulus of elasticity, E, in 1,000,000 pounds per square inch is shown at the bottom of each table, is limited to 2.6 million psi and less, and is applicable to all lumber sizes shown. Spans are shown in feet-inches and are limited to 26' and less. Check sources of supply for availability of lumber in lengths greater than 20'.

**TABLE R-15
RAFTERS WITH L/180 DEFLECTION LIMITATION**

DESIGN CRITERIA:

Strength - Live Load of 40 psf plus
 Dead Load of 10 psf determines the required bending design value.
 Deflection - For 40 psf live load.
 Limited to span in inches divided by 180.

Rafter Size (in)	Spacing (in)	Bending Design Value, F_b , (psi)																														
		200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000		
2x 4	12.0	2-10	3-6	4-0	4-6	4-11	5-4	5-9	6-1	6-5	6-8	7-0	7-3	7-7	7-10	8-1	8-4	8-7	8-10	9-0	9-3	9-6	9-8	9-11	10-1							
	16.0	2-6	3-0	3-6	3-11	4-3	4-8	4-11	5-3	5-6	5-10	6-1	6-4	6-7	6-9	7-0	7-3	7-5	7-8	7-10	8-0	8-2	8-5	8-7	8-9	8-11	9-1					
	19.2	2-3	2-9	3-2	3-7	3-11	4-3	4-6	4-10	5-1	5-4	5-6	5-9	6-0	6-2	6-5	6-7	6-9	7-0	7-2	7-4	7-6	7-8	7-10	8-0	8-2	8-4	8-5	8-7			
	24.0	2-0	2-6	2-10	3-2	3-6	3-9	4-0	4-3	4-6	4-9	4-11	5-2	5-4	5-6	5-9	5-11	6-1	6-3	6-5	6-7	6-8	6-10	7-0	7-2	7-3	7-5	7-7	7-8	7-10		
2x 6	12.0	4-6	5-6	6-4	7-1	7-9	8-5	9-0	9-6	10-0	10-6	11-0	11-5	11-11	12-4	12-8	13-1	13-6	13-10	14-2	14-7	14-11	15-3	15-7	15-11							
	16.0	3-11	4-9	5-6	6-2	6-9	7-3	7-9	8-3	8-8	9-1	9-6	9-11	10-3	10-8	11-0	11-4	11-8	12-0	12-4	12-7	12-11	13-2	13-6	13-9	14-0	14-3					
	19.2	3-7	4-4	5-0	5-7	6-2	6-8	7-1	7-6	7-11	8-4	8-8	9-1	9-5	9-9	10-0	10-4	10-8	10-11	11-3	11-6	11-9	12-0	12-4	12-7	12-10	13-1	13-3	13-6			
	24.0	3-2	3-11	4-6	5-0	5-6	5-11	6-4	6-9	7-1	7-5	7-9	8-1	8-5	8-8	9-0	9-3	9-6	9-9	10-0	10-3	10-6	10-9	11-0	11-3	11-5	11-8	11-11	12-1	12-4		
2x 8	12.0	5-11	7-3	8-4	9-4	10-3	11-1	11-10	12-7	13-3	13-11	14-6	15-1	15-8	16-3	16-9	17-3	17-9	18-3	18-9	19-2	19-8	20-1	20-6	20-11							
	16.0	5-2	6-3	7-3	8-1	8-11	9-7	10-3	10-10	11-6	12-0	12-7	13-1	13-7	14-0	14-6	14-11	15-5	15-10	16-3	16-7	17-0	17-5	17-9	18-1	18-6	18-10					
	19.2	4-8	5-9	6-7	7-5	8-1	8-9	9-4	9-11	10-6	11-0	11-6	11-11	12-5	12-10	13-3	13-8	14-0	14-5	14-10	15-2	15-6	15-10	16-3	16-7	16-10	17-2	17-6	17-10			
	24.0	4-2	5-2	5-11	6-7	7-3	7-10	8-4	8-11	9-4	9-10	10-3	10-8	11-1	11-6	11-10	12-2	12-7	12-11	13-3	13-7	13-11	14-2	14-6	14-10	15-1	15-5	15-8	15-11	16-3		
2x10	12.0	7-7	9-3	10-8	11-11	13-1	14-2	15-1	16-0	16-11	17-9	18-6	19-3	20-0	20-8	21-4	22-0	22-8	23-3	23-11	24-6	25-1	25-7									
	16.0	6-6	8-0	9-3	10-4	11-4	12-3	13-1	13-10	14-8	15-4	16-0	16-8	17-4	17-11	18-6	19-1	19-7	20-2	20-8	21-2	21-8	22-2	22-8	23-1	23-7	24-0					
	19.2	6-0	7-4	8-5	9-5	10-4	11-2	11-11	12-8	13-4	14-0	14-8	15-3	15-10	16-4	16-11	17-5	17-11	18-5	18-11	19-4	19-10	20-3	20-8	21-1	21-6	21-11	22-4	22-9			
	24.0	5-4	6-6	7-7	8-5	9-3	10-0	10-8	11-4	11-11	12-6	13-1	13-7	14-2	14-8	15-1	15-7	16-0	16-6	16-11	17-4	17-9	18-1	18-6	18-11	19-3	19-7	20-0	20-4	20-8		
E	12.0	0.06	0.11	0.17	0.23	0.31	0.38	0.47	0.56	0.66	0.76	0.86	0.97	1.09	1.21	1.33	1.46	1.59	1.72	1.86	2.00	2.14	2.29	2.44	2.60							
	16.0	0.05	0.09	0.14	0.20	0.26	0.33	0.41	0.49	0.57	0.66	0.75	0.84	0.94	1.05	1.15	1.26	1.37	1.49	1.61	1.73	1.86	1.99	2.12	2.25	2.39	2.53					
	19.2	0.05	0.09	0.13	0.18	0.24	0.30	0.37	0.44	0.52	0.60	0.68	0.77	0.86	0.95	1.05	1.15	1.25	1.36	1.47	1.58	1.70	1.81	1.93	2.05	2.18	2.31	2.43	2.57			
	24.0	0.04	0.08	0.12	0.16	0.22	0.27	0.33	0.40	0.46	0.54	0.61	0.69	0.77	0.85	0.94	1.03	1.12	1.22	1.31	1.41	1.52	1.62	1.73	1.84	1.95	2.06	2.18	2.30	2.41		

Note: The required modulus of elasticity, E, in 1,000,000 pounds per square inch is shown at the bottom of each table, is limited to 2.6 million psi and less, and is applicable to all lumber sizes shown. Spans are shown in feet-inches and are limited to 26' and less. Check sources of supply for availability of lumber in lengths greater than 20'.

Span Tables for Joists and Rafters

**TABLE R-22
RAFTERS WITH L/180 DEFLECTION LIMITATION**

DESIGN CRITERIA:

Strength - Live Load of 30 psf plus

Dead Load of 20 psf determines the required bending design value.

Deflection - For 30 psf live load.

Limited to span in inches divided by 180.

Rafter Size (in)	Spacing (in)	Bending Design Value, F_b , (psi)																													
		200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	
2x4	12.0	2-10	3-6	4-0	4-6	4-11	5-4	5-9	6-1	6-5	6-8	7-0	7-3	7-7	7-10	8-1	8-4	8-7	8-10	9-0	9-3	9-6	9-8	9-11	10-1	10-4	10-6	10-8	10-11	11-1	
	16.0	2-6	3-0	3-6	3-11	4-3	4-8	4-11	5-3	5-6	5-10	6-1	6-4	6-7	6-9	7-0	7-3	7-5	7-8	7-10	8-0	8-2	8-5	8-7	8-9	8-11	9-1	9-3	9-5	9-7	
	19.2	2-3	2-9	3-2	3-7	3-11	4-3	4-6	4-10	5-1	5-4	5-6	5-9	6-0	6-2	6-5	6-7	6-9	7-0	7-2	7-4	7-6	7-8	7-10	8-0	8-2	8-4	8-5	8-7	8-9	
	24.0	2-0	2-6	2-10	3-2	3-6	3-9	4-0	4-3	4-6	4-9	4-11	5-2	5-4	5-6	5-9	5-11	6-1	6-3	6-5	6-7	6-8	6-10	7-0	7-2	7-3	7-5	7-7	7-8	7-10	
2x6	12.0	4-6	5-6	6-4	7-1	7-9	8-5	9-0	9-6	10-0	10-6	11-0	11-5	11-11	12-4	12-8	13-1	13-6	13-10	14-2	14-7	14-11	15-3	15-7	15-11	16-2	16-6	16-10	17-1	17-5	
	16.0	3-11	4-9	5-6	6-2	6-9	7-3	7-9	8-3	8-8	9-1	9-6	9-11	10-3	10-8	11-0	11-4	11-8	12-0	12-4	12-7	12-11	13-2	13-6	13-9	14-0	14-3	14-7	14-10	15-1	
	19.2	3-7	4-4	5-0	5-7	6-2	6-8	7-1	7-6	7-11	8-4	8-8	9-1	9-5	9-9	10-0	10-4	10-8	10-11	11-3	11-6	11-9	12-0	12-4	12-7	12-10	13-1	13-3	13-6	13-9	
	24.0	3-2	3-11	4-6	5-0	5-6	5-11	6-4	6-9	7-1	7-5	7-9	8-1	8-5	8-8	9-0	9-3	9-6	9-9	10-0	10-3	10-6	10-9	11-0	11-3	11-5	11-8	11-11	12-1	12-4	
2x8	12.0	5-11	7-3	8-4	9-4	10-3	11-1	11-10	12-7	13-3	13-11	14-6	15-1	15-8	16-3	16-9	17-3	17-9	18-3	18-9	19-2	19-8	20-1	20-6	20-11	21-4	21-9	22-2	22-6	22-11	
	16.0	5-2	6-3	7-3	8-1	8-11	9-7	10-3	10-10	11-6	12-0	12-7	13-1	13-7	14-0	14-6	14-11	15-5	15-10	16-3	16-7	17-0	17-5	17-9	18-1	18-6	18-10	19-2	19-6	19-10	
	19.2	4-8	5-9	6-7	7-5	8-1	8-9	9-4	9-11	10-6	11-0	11-6	11-11	12-5	12-10	13-3	13-8	14-0	14-5	14-10	15-2	15-6	15-10	16-3	16-7	16-10	17-2	17-6	17-10	18-1	
	24.0	4-2	5-2	5-11	6-7	7-3	7-10	8-4	8-11	9-4	9-10	10-3	10-8	11-1	11-6	11-10	12-2	12-7	12-11	13-3	13-7	13-11	14-2	14-6	14-10	15-1	15-5	15-8	15-11	16-3	
2x10	12.0	7-7	9-3	10-8	11-11	13-1	14-2	15-1	16-0	16-11	17-9	18-6	19-3	20-0	20-8	21-4	22-0	22-8	23-3	23-11	24-6	25-1	25-7								
	16.0	6-6	8-0	9-3	10-4	11-4	12-3	13-1	13-10	14-8	15-4	16-0	16-8	17-4	17-11	18-6	19-1	19-7	20-2	20-8	21-2	21-8	22-2	22-8	23-1	23-7	24-0	24-6	24-11	25-4	
	19.2	6-0	7-4	8-5	9-5	10-4	11-2	11-11	12-8	13-4	14-0	14-8	15-3	15-10	16-4	16-11	17-5	17-11	18-5	18-11	19-4	19-10	20-3	20-8	21-1	21-6	21-11	22-4	22-9	23-1	
	24.0	5-4	6-6	7-7	8-5	9-3	10-0	10-8	11-4	11-11	12-6	13-1	13-7	14-2	14-8	15-1	15-7	16-0	16-6	16-11	17-4	17-9	18-1	18-6	18-11	19-3	19-7	20-0	20-4	20-8	
E	12.0	0.04	0.08	0.12	0.17	0.23	0.29	0.35	0.42	0.49	0.57	0.65	0.73	0.82	0.91	1.00	1.09	1.19	1.29	1.39	1.50	1.61	1.72	1.83	1.95	2.07	2.19	2.31	2.43	2.56	
	16.0	0.04	0.07	0.11	0.15	0.20	0.25	0.31	0.36	0.43	0.49	0.56	0.63	0.71	0.78	0.86	0.95	1.03	1.12	1.21	1.30	1.39	1.49	1.59	1.69	1.79	1.89	2.00	2.11	2.22	
	19.2	0.03	0.06	0.10	0.14	0.18	0.23	0.28	0.33	0.39	0.45	0.51	0.58	0.65	0.72	0.79	0.86	0.94	1.02	1.10	1.19	1.27	1.36	1.45	1.54	1.63	1.73	1.83	1.92	2.03	
	24.0	0.03	0.06	0.09	0.12	0.16	0.20	0.25	0.30	0.35	0.40	0.46	0.52	0.58	0.64	0.71	0.77	0.84	0.91	0.99	1.06	1.14	1.22	1.30	1.38	1.46	1.55	1.63	1.72	1.81	

Note: The required modulus of elasticity, E, in 1,000,000 pounds per square inch is shown at the bottom of each table, is limited to 2.6 million psi and less, and is applicable to all lumber sizes shown. Spans are shown in feet-inches and are limited to 26' and less. Check sources of supply for availability of lumber in lengths greater than 20'.

**TABLE R-23
RAFTERS WITH L/180 DEFLECTION LIMITATION**

DESIGN CRITERIA:

Strength - Live Load of 40 psf plus

Dead Load of 20 psf determines the required bending design value.

Deflection - For 40 psf live load.

Limited to span in inches divided by 180.

Rafter Size (in)	Spacing (in)	Bending Design Value, F_b , (psi)																												
		200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000
2x4	12.0	2-7	3-2	3-8	4-1	4-6	4-11	5-3	5-6	5-10	6-1	6-5	6-8	6-11	7-2	7-5	7-7	7-10	8-0	8-3	8-5	8-8	8-10	9-0	9-3	9-5	9-7	9-9	9-11	10-1
	16.0	2-3	2-9	3-2	3-7	3-11	4-3	4-6	4-10	5-1	5-4	5-6	5-9	6-0	6-2	6-5	6-7	6-9	7-0	7-2	7-4	7-6	7-8	7-10	8-0	8-2	8-4	8-5	8-7	8-9
	19.2	2-1	2-6	2-11	3-3	3-7	3-10	4-1	4-4	4-7	4-10	5-1	5-3	5-5	5-8	5-10	6-0	6-2	6-4	6-6	6-8	6-10	7-0	7-2	7-3	7-5	7-7	7-9	7-10	8-0
	24.0	1-10	2-3	2-7	2-11	3-2	3-5	3-8	3-11	4-1	4-4	4-6	4-8	4-11	5-1	5-3	5-5	5-6	5-8	5-10	6-0	6-1	6-3	6-5	6-6	6-8	6-9	6-11	7-0	7-2
2x6	12.0	4-1	5-0	5-10	6-6	7-1	7-8	8-2	8-8	9-2	9-7	10-0	10-5	10-10	11-3	11-7	11-11	12-4	12-8	13-0	13-3	13-7	13-11	14-2	14-6	14-9	15-1	15-4	15-7	15-11
	16.0	3-7	4-4	5-0	5-7	6-2	6-8	7-1	7-6	7-11	8-4	8-8	9-1	9-5	9-9	10-0	10-4	10-8	10-11	11-3	11-6	11-9	12-0	12-4	12-7	12-10	13-1	13-3	13-6	13-9
	19.2	3-3	4-0	4-7	5-1	5-7	6-1	6-6	6-10	7-3	7-7	7-11	8-3	8-7	8-11	9-2	9-5	9-9	10-0	10-3	10-6	10-9	11-0	11-3	11-5	11-8	11-11	12-2	12-4	12-7
	24.0	2-11	3-7	4-1	4-7	5-0	5-5	5-10	6-2	6-6	6-10	7-1	7-5	7-8	7-11	8-2	8-5	8-8	8-11	9-2	9-5	9-7	9-10	10-0	10-3	10-5	10-8	10-10	11-0	11-3
2x8	12.0	5-5	6-7	7-8	8-7	9-4	10-1	10-10	11-6	12-1	12-8	13-3	13-9	14-4	14-10	15-3	15-9	16-3	16-8	17-1	17-6	17-11	18-4	18-9	19-1	19-6	19-10	20-3	20-7	20-11
	16.0	4-8	5-9	6-7	7-5	8-1	8-9	9-4	9-11	10-6	11-0	11-6	11-11	12-5	12-10	13-3	13-8	14-0	14-5	14-10	15-2	15-6	15-10	16-3	16-7	16-10	17-2	17-6	17-10	18-1
	19.2	4-3	5-3	6-0	6-9	7-5	8-0	8-7	9-1	9-7	10-0	10-6	10-11	11-4	11-8	12-1	12-5	12-10	13-2	13-6	13-10	14-2	14-6	14-10	15-1	15-5	15-8	16-0	16-3	16-7
	24.0	3-10	4-8	5-5	6-0	6-7	7-2	7-8	8-1	8-7	9-0	9-4	9-9	10-1	10-6	10-10	11-2	11-6	11-9	12-1	12-5	12-8	12-11	13-3	13-6	13-9	14-0	14-4	14-7	14-10
2x10	12.0	6-11	8-5	9-9	10-11	11-11	12-11	13-9	14-8	15-5	16-2	16-11	17-7	18-3	18-11	19-6	20-1	20-8	21-3	21-10	22-4	22-10	23-5	23-11	24-5	24-10	25-4	25-10		
	16.0	6-0	7-4	8-5	9-5	10-4	11-2	11-11	12-8	13-4	14-0	14-8	15-3	15-10	16-4	16-11	17-5	17-11	18-5	18-11	19-4	19-10	20-3	20-8	21-1	21-6	21-11	22-4	22-9	23-1
	19.2	5-5	6-8	7-8	8-7	9-5	10-2	10-11	11-7	12-2	12-9	13-4	13-11	14-5	14-11	15-5	15-11	16-4	16-10	17-3	17-8	18-1	18-6	18-11	19-3	19-8	20-0	20-5	20-9	21-1
	24.0	4-11	6-0	6-11	7-8	8-5	9-1	9-9	10-4	10-11	11-5	11-11	12-5	12-11	13-4	13-9	14-3	14-8	15-0	15-5	15-10	16-2	16-6	16-11	17-3	17-7	17-11	18-3	18-7	18-11
E	12.0	0.04	0.08	0.13	0.18	0.23	0.29	0.36	0.43	0.50	0.58	0.66	0.74	0.83	0.92	1.01	1.11	1.21	1.31	1.41	1.52	1.63	1.74	1.86	1.98	2.10	2.22	2.34	2.47	2.60
	16.0	0.04	0.07	0.11	0.15	0.20	0.25	0.31	0.37	0.43	0.50	0.57	0.64	0.72	0.80	0.88	0.96	1.05	1.13	1.22	1.32	1.41	1.51	1.61	1.71	1.82	1.92	2.03	2.14	2.25
	19.2	0.04	0.06	0.10	0.14	0.18	0.23	0.28	0.34	0.40	0.46	0.52	0.59	0.65	0.73	0.80	0.88	0.95	1.04	1.12	1.20	1.29	1.38	1.47	1.56	1.66	1.75	1.85	1.95	2.05
	24.0	0.03	0.06	0.09	0.13	0.16	0.21	0.25	0.30	0.35	0.41	0.46	0.52	0.59	0.65	0.72	0.78	0.85	0.93	1.00	1.08	1.15	1.23	1.31	1.40	1.48	1.57	1.66	1.75	1.84

Note: The required modulus of elasticity, E, in 1,000,000 pounds per square inch is shown at the bottom of each table, is limited to 2.6 million psi and less, and is applicable to all lumber sizes shown. Spans are shown in feet-inches and are limited to 26' and less. Check sources of supply for availability of lumber in lengths greater than 20'.

ILHR 20-25 Appendix

Table W-1 Design Values for Joists and Rafters - Visually Graded Lumber

Species or Species Combination	Species That May Be Included in Combination
Aspen	Big Tooth Aspen, Quaking Aspen
Beech-Birch-Hickory	American Beech, Bitternut Hickory, Mockernut Hickory, Nutmeg Hickory, Pecan Hickory, Pignut Hickory, Shagbark Hickory, Shellbark Hickory, Sweet Birch, Water Hickory, Yellow Birch
Cottonwood	
Douglas Fir-Larch	Douglas Fir, Western Larch
Douglas Fir-Larch (North)	Douglas Fir, Western Larch
Douglas Fir-South	
Eastern Hemlock-Tamarack	Eastern Hemlock, Tamarack
Eastern Softwoods	Balsam Fir, Black Spruce, Eastern Hemlock, Eastern White Pine, Jack Pine, Norway (Red) Pine, Pitch Pine, Red Spruce, Tamarack, White Spruce
Eastern White Pine	
Hem-Fir	California Red Fir, Grand Fir, Noble Fir, Pacific Silver Fir, Western Hemlock, White Fir
Hem-Fir (North)	Amabilis Fir, Western Hemlock
Mixed Maple	Black Maple, Red Maple, Silver Maple, Sugar Maple
Mixed Oak	All Oak Species graded under NELMA rules
Mixed Southern Pine	Any species in the Southern Pine species combination, plus either or both of the following: Virginia Pine, Pond Pine
Northern Red Oak	Black Oak, Northern Red Oak, Pin Oak, Scarlet Oak
Northern Species	All softwood species graded under NLGA rules
Northern White Cedar	
Red Maple	
Red Oak	Black Oak, Cherrybark Oak, Laurel Oak, Northern Red Oak, Pin Oak, Scarlet Oak, Southern Red Oak, Water Oak, Willow Oak
Redwood	
Southern Pine	Loblolly Pine, Longleaf Pine, Shortleaf Pine, Slash Pine
Spruce-Pine-Fir	Alpine Fir, Balsam Fir, Black Spruce, Engelmann Spruce, Jack Pine, Lodgepole Pine, Red Spruce, White Spruce
Spruce-Pine-Fir (South)	Balsam Fir, Black Spruce, Engelmann Spruce, Jack Pine, Lodgepole Pine, Norway (Red) Pine, Red Spruce, Sitka Spruce, White Spruce
Western Cedars	Alaska Cedar, Incense Cedar, Port Orford Cedar, Western Red Cedar
Western Woods	Any species in the Douglas Fir-Larch, Douglas Fir-South, Hem-Fir, and Spruce-Pine-Fir (South) species combinations, plus any or all of the following: Alpine Fir, Idaho White Pine, Mountain Hemlock, Ponderosa Pine, Sugar Pine
White Oak	Bur Oak, Chestnut Oak, Live Oak, Overcup Oak, Post Oak, Swamp Chestnut Oak, Swamp White Oak, White Oak
Yellow Poplar	

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values shall be reduced 13%.

Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
COTTONWOOD						
Select Structural	2x4	1510	1735	1885	1,200,000	NSLB
No.1		1080	1240	1350	1,200,000	
No.2		1080	1240	1350	1,100,000	
No.3		605	695	755	1,000,000	
Stud		600	690	750	1,000,000	
Construction		805	925	1005	1,000,000	
Standard		460	530	575	900,000	
Utility		200	230	250	900,000	
Select Structural	2x6	1310	1505	1635	1,200,000	
No.1		935	1075	1170	1,200,000	
No.2		935	1075	1170	1,100,000	
No.3		525	600	655	1,000,000	
Stud	545	630	685	1,000,000		
Select Structural	2x8	1210	1390	1510	1,200,000	
No.1		865	990	1080	1,200,000	
No.2		865	990	1080	1,100,000	
No.3		485	555	605	1,000,000	
Select Structural	2x10	1105	1275	1385	1,200,000	
No.1		790	910	990	1,200,000	
No.2		790	910	990	1,100,000	
No.3		445	510	555	1,000,000	
Select Structural	2x12	1005	1155	1260	1,200,000	
No.1		720	825	900	1,200,000	
No.2		720	825	900	1,100,000	
No.3		405	465	505	1,000,000	
DOUGLAS FIR-LARCH						
Select Structural	2x4	2500	2875	3125	1,900,000	WCLIB WWPA
No.1 & Btr		1985	2280	2480	1,800,000	
No.1		1725	1985	2155	1,700,000	
No.2		1510	1735	1885	1,600,000	
No.3		865	990	1080	1,400,000	
Stud		855	980	1065	1,400,000	
Construction		1150	1325	1440	1,500,000	
Standard		635	725	790	1,400,000	
Utility		315	365	395	1,300,000	
Select Structural		2x6	2170	2495	2710	
No.1 & Btr	1720		1975	2150	1,800,000	
No.1	1495		1720	1870	1,700,000	
No.2	1310		1505	1635	1,600,000	
No.3	750		860	935	1,400,000	
Stud	775		895	970	1,400,000	
Select Structural	2x8	2000	2300	2500	1,900,000	
No.1 & Btr		1585	1825	1985	1,800,000	
No.1		1380	1585	1725	1,700,000	
No.2		1210	1390	1510	1,600,000	
No.3	690	795	865	1,400,000		
Select Structural	2x10	1835	2110	2295	1,900,000	
No.1 & Btr		1455	1675	1820	1,800,000	
No.1		1265	1455	1580	1,700,000	
No.2		1105	1275	1385	1,600,000	
No.3	635	725	790	1,400,000		
Select Structural	2x12	1670	1920	2085	1,900,000	
No.1 & Btr		1325	1520	1655	1,800,000	
No.1		1150	1325	1440	1,700,000	
No.2		1005	1155	1260	1,600,000	
No.3	575	660	720	1,400,000		

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values shall be reduced 13%.
 Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
DOUGLAS FIR-LARCH (NORTH)						
Select Structural	2x4	2245	2580	2805	1,900,000	NLGA
No.1/No.2		1425	1635	1780	1,600,000	
No.3		820	940	1025	1,400,000	
Stud		820	945	1030	1,400,000	
Construction		1095	1255	1365	1,500,000	
Standard		605	695	755	1,400,000	
Utility		290	330	360	1,300,000	
Select Structural	2x6	1945	2235	2430	1,900,000	
No.1/No.2		1235	1420	1540	1,600,000	
No.3		710	815	890	1,400,000	
Stud		750	860	935	1,400,000	
Select Structural	2x8	1795	2065	2245	1,900,000	
No.1/No.2		1140	1310	1425	1,600,000	
No.3		655	755	820	1,400,000	
Select Structural	2x10	1645	1890	2055	1,900,000	
No.1/No.2		1045	1200	1305	1,600,000	
No.3		600	690	750	1,400,000	
Select Structural	2x12	1495	1720	1870	1,900,000	
No.1/No.2		950	1090	1185	1,600,000	
No.3		545	630	685	1,400,000	
DOUGLAS FIR-SOUTH						
Select Structural	2x4	2245	2580	2805	1,400,000	WWPA
No.1		1555	1785	1940	1,300,000	
No.2		1425	1635	1780	1,200,000	
No.3		820	940	1025	1,100,000	
Stud		820	945	1030	1,100,000	
Construction		1065	1225	1330	1,200,000	
Standard		605	695	755	1,100,000	
Utility	290	330	360	1,000,000		
Select Structural	2x6	1945	2235	2430	1,400,000	
No.1		1345	1545	1680	1,300,000	
No.2		1235	1420	1540	1,200,000	
No.3		710	815	890	1,100,000	
Stud	750	860	935	1,100,000		
Select Structural	2x8	1795	2065	2245	1,400,000	
No.1		1240	1430	1555	1,300,000	
No.2		1140	1310	1425	1,200,000	
No.3	655	755	820	1,100,000		
Select Structural	2x10	1645	1890	2055	1,400,000	
No.1		1140	1310	1425	1,300,000	
No.2		1045	1200	1305	1,200,000	
No.3	600	690	750	1,100,000		
Select Structural	2x12	1495	1720	1870	1,400,000	
No.1		1035	1190	1295	1,300,000	
No.2		950	1090	1185	1,200,000	
No.3	545	630	685	1,100,000		

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values shall be reduced 13%.

Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
EASTERN HEMLOCK-TAMARACK						
Select Structural	2x4	2155	2480	2695	1,200,000	NELMA NSLB
No.1		1335	1535	1670	1,100,000	
No.2		990	1140	1240	1,100,000	
No.3		605	695	755	900,000	
Stud		570	655	710	900,000	
Construction		775	895	970	1,000,000	
Standard		430	495	540	900,000	
Utility	200	230	250	800,000		
Select Structural	2x6	1870	2150	2335	1,200,000	
No.1		1160	1330	1450	1,100,000	
No.2		860	990	1075	1,100,000	
No.3		525	600	655	900,000	
Stud	520	595	645	900,000		
Select Structural	2x8	1725	1985	2155	1,200,000	
No.1		1070	1230	1335	1,100,000	
No.2		795	915	990	1,100,000	
No.3	485	555	605	900,000		
Select Structural	2x10	1580	1820	1975	1,200,000	
No.1		980	1125	1225	1,100,000	
No.2		725	835	910	1,100,000	
No.3	445	510	555	900,000		
Select Structural	2x12	1440	1655	1795	1,200,000	
No.1		890	1025	1115	1,100,000	
No.2		660	760	825	1,100,000	
No.3	405	465	505	900,000		
EASTERN SOFTWOODS						
Select Structural	2x4	2155	2480	2695	1,200,000	NELMA NSLB
No.1		1335	1535	1670	1,100,000	
No.2		990	1140	1240	1,100,000	
No.3		605	695	755	900,000	
Stud		570	655	710	900,000	
Construction		775	895	970	1,000,000	
Standard		430	495	540	900,000	
Utility	200	230	250	800,000		
Select Structural	2x6	1870	2150	2335	1,200,000	
No.1		1160	1330	1450	1,100,000	
No.2		860	990	1075	1,100,000	
No.3		525	600	655	900,000	
Stud	520	595	645	900,000		
Select Structural	2x8	1725	1985	2155	1,200,000	
No.1		1070	1230	1335	1,100,000	
No.2		795	915	990	1,100,000	
No.3	485	555	605	900,000		
Select Structural	2x10	1580	1820	1975	1,200,000	
No.1		980	1125	1225	1,100,000	
No.2		725	835	910	1,100,000	
No.3	445	510	555	900,000		
Select Structural	2x12	1440	1655	1795	1,200,000	
No.1		890	1025	1115	1,100,000	
No.2		660	760	825	1,100,000	
No.3	405	465	505	900,000		

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values shall be reduced 13%.
 Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
EASTERN WHITE PINE						
Select Structural	2x4	2155	2480	2695	1,200,000	NELMA NSLB
No.1		1335	1535	1670	1,100,000	
No.2		990	1140	1240	1,100,000	
No.3		605	695	755	900,000	
Stud		570	655	710	900,000	
Construction		775	895	970	1,000,000	
Standard		430	495	540	900,000	
Utility		200	230	250	800,000	
Select Structural	2x6	1870	2150	2335	1,200,000	
No.1		1160	1330	1450	1,100,000	
No.2		860	990	1075	1,100,000	
No.3		525	600	655	900,000	
Stud	520	595	645	900,000		
Select Structural	2x8	1725	1985	2155	1,200,000	
No.1		1070	1230	1335	1,100,000	
No.2		795	915	990	1,100,000	
No.3		485	555	605	900,000	
Select Structural	2x10	1580	1820	1975	1,200,000	
No.1		980	1125	1225	1,100,000	
No.2		725	835	910	1,100,000	
No.3		445	510	555	900,000	
Select Structural	2x12	1440	1655	1795	1,200,000	
No.1		890	1025	1115	1,100,000	
No.2		660	760	825	1,100,000	
No.3		405	465	505	900,000	
HEM-FIR						
Select Structural	2x4	2415	2775	3020	1,600,000	WCLIB WWPA
No.1 & Btr		1810	2085	2265	1,500,000	
No.1		1640	1885	2050	1,500,000	
No.2		1465	1685	1835	1,300,000	
No.3		865	990	1080	1,200,000	
Stud		855	980	1065	1,200,000	
Construction		1120	1290	1400	1,300,000	
Standard		635	725	790	1,200,000	
Utility	290	330	360	1,100,000		
Select Structural	2x6	2095	2405	2615	1,600,000	
No.1 & Btr		1570	1805	1960	1,500,000	
No.1		1420	1635	1775	1,500,000	
No.2		1270	1460	1590	1,300,000	
No.3		750	860	935	1,200,000	
Stud	775	895	970	1,200,000		
Select Structural	2x8	1930	2220	2415	1,600,000	
No.1 & Btr		1450	1665	1810	1,500,000	
No.1		1310	1510	1640	1,500,000	
No.2		1175	1350	1465	1,300,000	
No.3	690	795	865	1,200,000		
Select Structural	2x10	1770	2035	2215	1,600,000	
No.1 & Btr		1330	1525	1660	1,500,000	
No.1		1200	1380	1500	1,500,000	
No.2		1075	1235	1345	1,300,000	
No.3	635	725	790	1,200,000		
Select Structural	2x12	1610	1850	2015	1,600,000	
No.1 & Btr		1210	1390	1510	1,500,000	
No.1		1095	1255	1365	1,500,000	
No.2		980	1125	1220	1,300,000	
No.3	575	660	720	1,200,000		

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values shall be reduced 13%.

Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
HEM-FIR (NORTH)						
Select Structural	2x4	2245	2580	2805	1,700,000	NLGA
No.1/No.2		1725	1985	2155	1,600,000	
No.3		990	1140	1240	1,400,000	
Stud		980	1125	1225	1,400,000	
Construction		1325	1520	1655	1,500,000	
Standard		720	825	900	1,400,000	
Utility		345	395	430	1,300,000	
Select Structural	2x6	1945	2235	2430	1,700,000	
No.1/No.2		1495	1720	1870	1,600,000	
No.3		860	990	1075	1,400,000	
Stud		890	1025	1115	1,400,000	
Select Structural	2x8	1795	2065	2245	1,700,000	
No.1/No.2		1380	1585	1725	1,600,000	
No.3		795	915	990	1,400,000	
Select Structural	2x10	1645	1890	2055	1,700,000	
No.1/No.2		1265	1455	1580	1,600,000	
No.3		725	835	910	1,400,000	
Select Structural	2x12	1495	1720	1870	1,700,000	
No.1/No.2		1150	1325	1440	1,600,000	
No.3		660	760	825	1,400,000	
MIXED MAPLE						
Select Structural	2x4	1725	1985	2155	1,300,000	NELMA
No.1		1250	1440	1565	1,200,000	
No.2		1210	1390	1510	1,100,000	
No.3		690	795	865	1,000,000	
Stud		695	800	870	1,000,000	
Construction		920	1060	1150	1,100,000	
Standard		520	595	645	1,000,000	
Utility	260	300	325	900,000		
Select Structural	2x6	1495	1720	1870	1,300,000	
No.1		1085	1245	1355	1,200,000	
No.2		1045	1205	1310	1,100,000	
No.3		600	690	750	1,000,000	
Stud		635	725	790	1,000,000	
Select Structural	2x8	1380	1585	1725	1,300,000	
No.1		1000	1150	1250	1,200,000	
No.2		965	1110	1210	1,100,000	
No.3		550	635	690	1,000,000	
Select Structural	2x10	1265	1455	1580	1,300,000	
No.1		915	1055	1145	1,200,000	
No.2		885	1020	1105	1,100,000	
No.3		505	580	635	1,000,000	
Select Structural	2x12	1150	1325	1440	1,300,000	
No.1		835	960	1040	1,200,000	
No.2		805	925	1005	1,100,000	
No.3		460	530	575	1,000,000	

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values shall be reduced 13%.
 Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
MIXED OAK						
Select Structural	2x4	1985	2280	2480	1,100,000	NELMA
No.1		1425	1635	1780	1,000,000	
No.2		1380	1585	1725	900,000	
No.3		820	940	1025	800,000	
Stud		790	910	990	800,000	
Construction Standard		1065	1225	1330	900,000	
Utility		605	695	755	800,000	
		290	330	360	800,000	
Select Structural	2x6	1720	1975	2150	1,100,000	
No.1		1235	1420	1540	1,000,000	
No.2		1195	1375	1495	900,000	
No.3		710	815	890	800,000	
Stud	720	825	900	800,000		
Select Structural	2x8	1585	1825	1985	1,100,000	
No.1		1140	1310	1425	1,000,000	
No.2		1105	1270	1380	900,000	
No.3	655	755	820	800,000		
Select Structural	2x10	1455	1675	1820	1,100,000	
No.1		1045	1200	1305	1,000,000	
No.2		1010	1165	1265	900,000	
No.3	600	690	750	800,000		
Select Structural	2x12	1325	1520	1655	1,100,000	
No.1		950	1090	1185	1,000,000	
No.2		920	1060	1150	900,000	
No.3	545	630	685	800,000		
MIXED SOUTHERN PINE						
Select Structural	2x4	2360	2710	2950	1,600,000	SPIB
No.1		1670	1920	2080	1,500,000	
No.2		1500	1720	1870	1,400,000	
No.3		865	990	1080	1,200,000	
Stud		890	1020	1110	1,200,000	
Construction Standard		1150	1320	1440	1,300,000	
Utility		635	725	790	1,200,000	
		315	365	395	1,100,000	
Select Structural	2x6	2130	2450	2660	1,600,000	
No.1		1490	1720	1870	1,500,000	
No.2		1320	1520	1650	1,400,000	
No.3		775	895	970	1,200,000	
Stud	775	895	970	1,200,000		
Select Structural	2x8	2010	2310	2520	1,600,000	
No.1		1380	1590	1720	1,500,000	
No.2		1210	1390	1510	1,400,000	
No.3	720	825	900	1,200,000		
Select Structural	2x10	1730	1980	2160	1,600,000	
No.1		1210	1390	1510	1,500,000	
No.2		1060	1220	1330	1,400,000	
No.3	605	695	755	1,200,000		
Select Structural	2x12	1610	1850	2010	1,600,000	
No.1		1120	1290	1400	1,500,000	
No.2		1010	1160	1260	1,400,000	
No.3	575	660	720	1,200,000		

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

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Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
NORTHERN RED OAK						
Select Structural	2x4	2415	2775	3020	1,400,000	NELMA
No.1		1725	1985	2155	1,400,000	
No.2		1680	1935	2100	1,300,000	
No.3		950	1090	1185	1,200,000	
Stud		950	1090	1185	1,200,000	
Construction		1265	1455	1580	1,200,000	
Standard		720	825	900	1,100,000	
Utility		345	395	430	1,000,000	
Select Structural	2x6	2095	2405	2615	1,400,000	
No.1		1495	1720	1870	1,400,000	
No.2		1460	1675	1820	1,300,000	
No.3		820	945	1030	1,200,000	
Stud	865	990	1080	1,200,000		
Select Structural	2x8	1930	2220	2415	1,400,000	
No.1		1380	1585	1725	1,400,000	
No.2		1345	1545	1680	1,300,000	
No.3	760	875	950	1,200,000		
Select Structural	2x10	1770	2035	2215	1,400,000	
No.1		1265	1455	1580	1,400,000	
No.2		1235	1420	1540	1,300,000	
No.3	695	800	870	1,200,000		
Select Structural	2x12	1610	1850	2015	1,400,000	
No.1		1150	1325	1440	1,400,000	
No.2		1120	1290	1400	1,300,000	
No.3	635	725	790	1,200,000		
NORTHERN SPECIES						
Select Structural	2x4	1640	1885	2050	1,100,000	NLGA
No.1/No.2		990	1140	1240	1,100,000	
No.3		605	695	755	1,000,000	
Stud		570	655	710	1,000,000	
Construction		775	895	970	1,000,000	
Standard		430	495	540	900,000	
Utility		200	230	250	900,000	
Select Structural	2x6	1420	1635	1775	1,100,000	
No.1/No.2		860	990	1075	1,100,000	
No.3		525	600	655	1,000,000	
Stud		520	595	645	1,000,000	
Select Structural	2x8	1310	1510	1640	1,100,000	
No.1/No.2		795	915	990	1,100,000	
No.3		485	555	605	1,000,000	
Select Structural	2x10	1200	1380	1500	1,100,000	
No.1/No.2		725	835	910	1,100,000	
No.3		445	510	555	1,000,000	
Select Structural	2x12	1095	1255	1365	1,100,000	
No.1/No.2		660	760	825	1,100,000	
No.3		405	465	505	1,000,000	

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

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 Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
NORTHERN WHITE CEDAR						
Select Structural	2x4	1335	1535	1670	800,000	NELMA
No.1		990	1140	1240	700,000	
No.2		950	1090	1185	700,000	
No.3		560	645	700	600,000	
Stud		540	620	670	600,000	
Construction		720	825	900	700,000	
Standard		405	465	505	600,000	
Utility		200	230	250	600,000	
Select Structural	2x6	1160	1330	1450	800,000	
No.1		860	990	1075	700,000	
No.2		820	945	1030	700,000	
No.3		485	560	605	600,000	
Stud	490	560	610	600,000		
Select Structural	2x8	1070	1230	1335	800,000	
No.1		795	915	990	700,000	
No.2		760	875	950	700,000	
No.3		450	515	560	600,000	
Select Structural	2x10	980	1125	1225	800,000	
No.1		725	835	910	700,000	
No.2		695	800	870	700,000	
No.3		410	475	515	600,000	
Select Structural	2x12	890	1025	1115	800,000	
No.1		660	760	825	700,000	
No.2		635	725	790	700,000	
No.3		375	430	465	600,000	
RED MAPLE						
Select Structural	2x4	2245	2580	2805	1,700,000	NELMA
No.1		1595	1835	1995	1,600,000	
No.2		1555	1785	1940	1,500,000	
No.3		905	1040	1130	1,300,000	
Stud		885	1020	1105	1,300,000	
Construction		1210	1390	1510	1,400,000	
Standard		660	760	825	1,300,000	
Utility		315	365	395	1,200,000	
Select Structural	2x6	1945	2235	2430	1,700,000	
No.1		1385	1590	1730	1,600,000	
No.2		1345	1545	1680	1,500,000	
No.3		785	905	980	1,300,000	
Stud	805	925	1005	1,300,000		
Select Structural	2x8	1795	2065	2245	1,700,000	
No.1		1275	1470	1595	1,600,000	
No.2		1240	1430	1555	1,500,000	
No.3		725	835	905	1,300,000	
Select Structural	2x10	1645	1890	2055	1,700,000	
No.1		1170	1345	1465	1,600,000	
No.2		1140	1310	1425	1,500,000	
No.3		665	765	830	1,300,000	
Select Structural	2x12	1495	1720	1870	1,700,000	
No.1		1065	1225	1330	1,600,000	
No.2		1035	1190	1295	1,500,000	
No.3		605	695	755	1,300,000	

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

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Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
RED OAK						
Select Structural	2x4	1985	2280	2480	1,400,000	NELMA
No.1		1425	1635	1780	1,300,000	
No.2		1380	1585	1725	1,200,000	
No.3		820	940	1025	1,100,000	
Stud		790	910	990	1,100,000	
Construction		1065	1225	1330	1,200,000	
Standard		605	695	755	1,100,000	
Utility		290	330	360	1,000,000	
Select Structural	2x6	1720	1975	2150	1,400,000	
No.1		1235	1420	1540	1,300,000	
No.2		1195	1375	1495	1,200,000	
No.3		710	815	890	1,100,000	
Stud	720	825	900	1,100,000		
Select Structural	2x8	1585	1825	1985	1,400,000	
No.1		1140	1310	1425	1,300,000	
No.2		1105	1270	1380	1,200,000	
No.3		655	755	820	1,100,000	
Select Structural	2x10	1455	1675	1820	1,400,000	
No.1		1045	1200	1305	1,300,000	
No.2		1010	1165	1265	1,200,000	
No.3		600	690	750	1,100,000	
Select Structural	2x12	1325	1520	1655	1,400,000	
No.1		950	1090	1185	1,300,000	
No.2		920	1060	1150	1,200,000	
No.3		545	630	685	1,100,000	

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

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Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency	
		Normal Duration	Snow Loading	7-Day Loading			
REDWOOD							
Clear Structural	2x4	3020	3470	3775	1,400,000	RIS	
Select Structural		2330	2680	2910	1,400,000		
Select Structural, open grain		1900	2180	2370	1,100,000		
No.1		1680	1935	2100	1,300,000		
No.1, open grain		1335	1535	1670	1,100,000		
No.2		1595	1835	1995	1,200,000		
No.2, open grain		1250	1440	1565	1,000,000		
No.3		905	1040	1130	1,100,000		
No.3, open grain		735	845	915	900,000		
Stud		725	835	910	900,000		
Construction Standard		950	1090	1185	900,000		
Utility		520	595	645	900,000		
			260	300	325		800,000
Clear Structural		2x6	2615	3010	3270		1,400,000
Select Structural	2020		2320	2525	1,400,000		
Select Structural, open grain	1645		1890	2055	1,100,000		
No.1	1460		1675	1820	1,300,000		
No.1, open grain	1160		1330	1450	1,100,000		
No.2	1385		1590	1730	1,200,000		
No.2, open grain	1085		1245	1355	1,000,000		
No.3	785		905	980	1,100,000		
No.3, open grain	635		730	795	900,000		
Stud	660		760	825	900,000		
Clear Structural	2x8	2415	2775	3020	1,400,000		
Select Structural		1865	2140	2330	1,400,000		
Select Structural, open grain		1520	1745	1900	1,100,000		
No.1		1345	1545	1680	1,300,000		
No.1, open grain		1070	1230	1335	1,100,000		
No.2		1275	1470	1595	1,200,000		
No.2, open grain		1000	1150	1250	1,000,000		
No.3		725	835	905	1,100,000		
No.3, open grain	585	675	735	900,000			
Clear Structural	2x10	2215	2545	2765	1,400,000		
Select Structural		1710	1965	2135	1,400,000		
Select Structural, open grain		1390	1600	1740	1,100,000		
No.1		1235	1420	1540	1,300,000		
No.1, open grain		980	1125	1225	1,100,000		
No.2		1170	1345	1465	1,200,000		
No.2, open grain		915	1055	1145	1,000,000		
No.3		665	765	830	1,100,000		
No.3, open grain	540	620	670	900,000			
Clear Structural	2x12	2015	2315	2515	1,400,000		
Select Structural		1555	1785	1940	1,400,000		
Select Structural, open grain		1265	1455	1580	1,100,000		
No.1		1120	1290	1400	1,300,000		
No.1, open grain		890	1025	1115	1,100,000		
No.2		1065	1225	1330	1,200,000		
No.2, open grain		835	960	1040	1,000,000		
No.3		605	695	755	1,100,000		
No.3, open grain	490	560	610	900,000			

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values shall be reduced 13%.

Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
SOUTHERN PINE						
Dense Select Structural	2x4	3510	4030	4380	1,900,000	
Select Structural		3280	3770	4100	1,800,000	
Non-Dense Select Structural		3050	3500	3810	1,700,000	
No.1 Dense		2300	2650	2880	1,800,000	
No.1		2130	2450	2660	1,700,000	
No.1 Non-Dense		1950	2250	2440	1,600,000	
No.2 Dense		1960	2250	2440	1,700,000	
No.2		1720	1980	2160	1,600,000	
No.2 Non-Dense		1550	1790	1940	1,400,000	
No.3		980	1120	1220	1,400,000	
Stud		1010	1160	1260	1,400,000	
Construction Standard		1270	1450	1580	1,500,000	
Utility		720	825	900	1,300,000	
			345	395	430	
Dense Select Structural	2x6	3100	3570	3880	1,900,000	
Select Structural		2930	3370	3670	1,800,000	
Non-Dense Select Structural		2700	3110	3380	1,700,000	
No.1 Dense		2010	2310	2520	1,800,000	
No.1		1900	2180	2370	1,700,000	
No.1 Non-Dense		1720	1980	2160	1,600,000	
No.2 Dense		1670	1920	2080	1,700,000	
No.2		1440	1650	1800	1,600,000	
No.2 Non-Dense		1320	1520	1650	1,400,000	
No.3		865	990	1080	1,400,000	
Stud		890	1020	1110	1,400,000	
Dense Select Structural	2x8	2820	3240	3520	1,900,000	SPIB
Select Structural		2650	3040	3310	1,800,000	
Non-Dense Select Structural		2420	2780	3020	1,700,000	
No.1 Dense		1900	2180	2370	1,800,000	
No.1		1730	1980	2160	1,700,000	
No.1 Non-Dense		1550	1790	1940	1,600,000	
No.2 Dense		1610	1850	2010	1,700,000	
No.2		1380	1590	1720	1,600,000	
No.2 Non-Dense		1260	1450	1580	1,400,000	
No.3		805	925	1010	1,400,000	
Dense Select Structural		2x10	2470	2840	3090	
Select Structural	2360		2710	2950	1,800,000	
Non-Dense Select Structural	2130		2450	2660	1,700,000	
No.1 Dense	1670		1920	2080	1,800,000	
No.1	1500		1720	1870	1,700,000	
No.1 Non-Dense	1380		1590	1730	1,600,000	
No.2 Dense	1380		1590	1730	1,700,000	
No.2	1210		1390	1510	1,600,000	
No.2 Non-Dense	1090		1260	1370	1,400,000	
No.3	690		795	865	1,400,000	
Dense Select Structural	2x12	2360	2710	2950	1,900,000	
Select Structural		2190	2510	2730	1,800,000	
Non-Dense Select Structural		2010	2310	2520	1,700,000	
No.1 Dense		1550	1790	1940	1,800,000	
No.1		1440	1650	1800	1,700,000	
No.1 Non-Dense		1320	1520	1650	1,600,000	
No.2 Dense		1320	1520	1650	1,700,000	
No.2		1120	1290	1400	1,600,000	
No.2 Non-Dense		1040	1190	1290	1,400,000	
No.3		660	760	825	1,400,000	

TABLE W-1 DESIGN VALUES FOR JOISTS AND RAFTERS - VISUALLY GRADED LUMBER

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values shall be reduced 13%.

Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"	Grading Rules Agency
		Normal Duration	Snow Loading	7-Day Loading		
SPRUCE-PINE-FIR						
Select Structural	2x4	2155	2480	2695	1,500,000	NLGA
No.1/No.2		1510	1735	1885	1,400,000	
No.3		865	990	1080	1,200,000	
Stud		855	980	1065	1,200,000	
Construction		1120	1290	1400	1,300,000	
Standard		635	725	790	1,200,000	
Utility		290	330	360	1,100,000	
Select Structural	2x6	1870	2150	2335	1,500,000	
No.1/No.2		1310	1505	1635	1,400,000	
No.3		750	860	935	1,200,000	
Stud		775	895	970	1,200,000	
Select Structural	2x8	1725	1985	2155	1,500,000	
No.1/No.2		1210	1390	1510	1,400,000	
No.3		690	795	865	1,200,000	
Select Structural	2x10	1580	1820	1975	1,500,000	
No.1/No.2		1105	1275	1385	1,400,000	
No.3		635	725	790	1,200,000	
Select Structural	2x12	1440	1655	1795	1,500,000	
No.1/No.2		1005	1155	1260	1,400,000	
No.3		575	660	720	1,200,000	
SPRUCE-PINE-FIR (SOUTH)						
Select Structural	2x4	2245	2580	2805	1,300,000	NELMA NSLB WCLIB WWPA
No.1		1465	1685	1835	1,200,000	
No.2		1295	1490	1615	1,100,000	
No.3		735	845	915	1,000,000	
Stud		725	835	910	1,000,000	
Construction		980	1125	1220	1,000,000	
Standard		545	630	685	900,000	
Utility	260	300	325	900,000		
Select Structural	2x6	1945	2235	2430	1,300,000	
No.1		1270	1460	1590	1,200,000	
No.2		1120	1290	1400	1,100,000	
No.3		635	730	795	1,000,000	
Stud		660	760	825	1,000,000	
Select Structural	2x8	1795	2065	2245	1,300,000	
No.1		1175	1350	1465	1,200,000	
No.2		1035	1190	1295	1,100,000	
No.3	585	675	735	1,000,000		
Select Structural	2x10	1645	1890	2055	1,300,000	
No.1		1075	1235	1345	1,200,000	
No.2		950	1090	1185	1,100,000	
No.3	540	620	670	1,000,000		
Select Structural	2x12	1495	1720	1870	1,300,000	
No.1		980	1125	1220	1,200,000	
No.2		865	990	1080	1,100,000	
No.3		490	560	610	1,000,000	