



AMERICAN INSTITUTE OF TIMBER CONSTRUCTION

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AITC 112-93

STANDARD FOR TONGUE-AND-GROOVE HEAVY TIMBER ROOF DECKING

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1. INTRODUCTION

- 1.1 This Standard applies to sawn tongue-and-groove decking only and does not apply to laminated, panelized or other special decking systems. This standard covers species, sizes, patterns, lengths, moisture content, application, specifications, weights, applicable unit stresses, allowable loads and slope conversion values for heavy timber roof decking in nominal 2, 3, and 4 inch thickness, using single or double tongues and grooves.
- 1.2 Heavy timber roof decking is a specialty lumber product, constituting an important part of modern timber construction, which can be used for many applications to provide an all-wood appearance. Nominal three and four inch thick roof decking is especially well adapted for use with glued laminated arches and girders and is easily and quickly erected. To be suitable for purposes intended, heavy timber roof decking must be well manufactured to a low moisture content as described herein.
- 1.3 The lumber used in heavy timber roof decking shall be graded in accordance with the grading rules under which the species is customarily graded. The standard grading and dressing rules referenced in this Standard are:
 - (a) "Standard Grading Rules for Northeastern Lumber," 1991, Northeastern Lumber Manufacturers Association, 272 Tuttle Rd., PO Box 87A, Cumberland Center, ME 04021 (NELMA)
 - (b) "Standard Specifications for Grades of California Redwood Lumber," April 1992, Edition, Redwood Inspection Service, 405 Enfrete Dr., Suite 200, Novato, CA 94949 (RIS)

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- (c) "Standard Grading Rules For Southern Pine Lumber," 1991, Southern Pine Inspection Bureau, 4709 Scenic Highway, Pensacola, FL 32504 (SPIB)
- (d) "Standard Grading Rules for West Coast Lumber, No. 17," Effective September 1, 1991, West Coast Lumber Inspection Bureau, P.O. Box 23145, Portland, OR 97223 (WCLIB)
- (e) "Standard Grading Rules for Western Lumber," Effective September 1, 1991, Western Wood Products Association, 522 SW Fifth, Yeon Building, Portland, OR 97204 (WWPA)
- (f) "NLGA Standard Grading Rules for Canadian Lumber," Effective September 1, 1991, National Lumber Grades Authority, 260-1055 W. Hastings St., Vancouver B.C. V6E 2E9, Canada (a Canadian Agency) (NLGA)

Copies of these grading rules may be obtained from the respective grading rule agencies.

- 1.4 Moisture content requirements of the regional lumber grading rules may differ from this Standard. Unless their Standard is followed in all requirements, the product will not conform with this Standard.

2. SPECIES

- 2.1 The species usually available and currently used in this product, as well as the regional inspection agencies under which decking lumber is ordinarily graded, are given in Table 1.

3. SIZES AND PATTERNS

- 3.1 TWO INCH DECKING. The standard size is 2 x 6 inch and 2 x 8 inch, nominal, dressed at the moisture content specified herein to the actual size and V-grooved pattern shown in Figure 1. Other thicknesses and widths are also available. See regional grading rules listed in paragraph 1.3 for dimensions for individual species.
- 3.2 THREE AND FOUR INCH DECKING. Standard sizes are 3 x 6 inch and 4 x 6 inch, nominal, at the moisture content specified herein. Figures 2 and 3 provide typical dimensions for 3 x 6 inch and 4 x 6 inch nominal decking, respectively, illustrating a V-joint pattern. Other thicknesses and widths may be available.
- 3.3 Other patterns are available, including grooved, striated and eased joint. The regional grading rules agencies indicated in paragraph 1.3 should be contacted for further details concerning specific patterns and sizes.

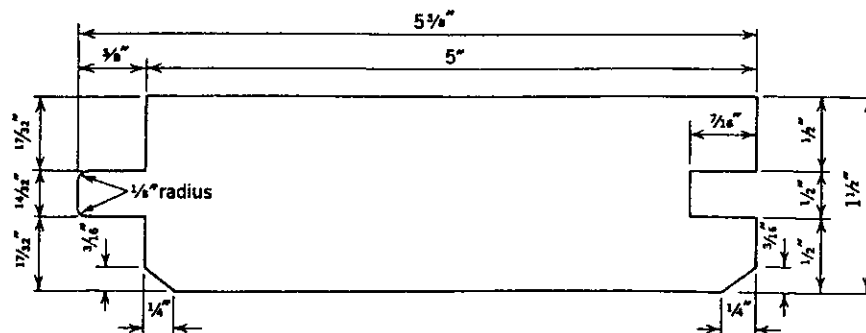


Figure 1. 2 x Nominal V-Joint Pattern. (See regional grading rules listed in paragraph 1.3 for dimensions for individual species.)

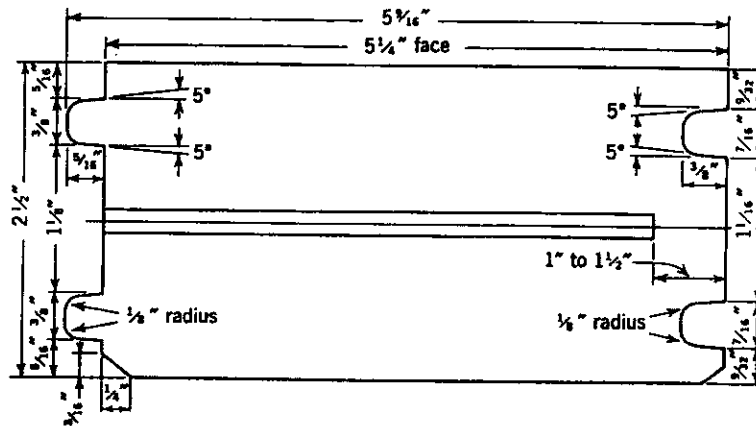


Figure 2. 3 x 6 inch, Nominal V-Joint Pattern. Note: Profile dimensions apply to all patterns. (See regional grading rules in paragraph 1.3 for dimensions for individual species.)

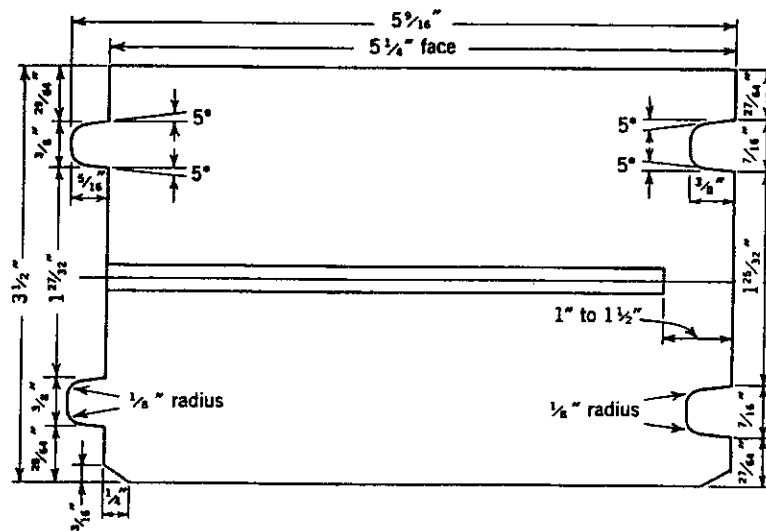


Figure 3. 4 x 6 inch Nominal V-Joint Pattern. Note: Profile dimensions apply to all patterns. (See regional grading rules in paragraph 1.3 for dimensions for individual species.)

4. LENGTHS

- 4.1 Decking pieces may be of specified length or may be random length. All layup arrangements except controlled random layup require that the specifier indicate the required lengths.
- 4.2 If pieces are for controlled random layup, odd or even lengths are permitted, and the minimum lengths based on fbm percentages shall be as follows:
 - 4.2.1 Two Inch Decking
 - * Not less than 40% to be 14 ft and longer
 - * Not more than 10% to be less than 10 ft
 - * Not more than 1% to be 4 to 5 ft
 - * Minimum length is limited to 75% of the span length (i.e., for 8 ft support spacing, 6 ft)
 - 4.2.2 Three Inch Decking
 - * Not less than 40% to be 14 ft and longer with at least 20% equal to or greater in length than the maximum span.
 - * Not more than 10% to be less than 10 ft
 - * Not more than 1% to be 4 to 5 ft

TABLE 1
HEAVY TIMBER DECK SPECIES

Species	Grading Rules Under Which Graded	Paragraph Number of Grading Rules Under Which Graded ^a	
		Select Quality ^b	Commercial Quality ^c
Cedar, Northern White Cedars, Western Cedars, Western (North) Coast Species	NELMA WWPA, WCLIB NLGA (Canadian) NLGA (Canadian)	15.1 55.11, 127-b 127-b 127-b	15.2 55.12, 127-c 127-c 127-c
Douglas Fir-Larch Douglas Fir-Larch (North) Douglas Fir (South) Fir, Balsam	WWPA, WCLIB NLGA (Canadian) WWPA NELMA	55.11, 127-b 127-b 55.11 15.1	55.12, 127-c 127-c 55.12 15.2
Hem-Fir Hem-Fir (North) Hemlock, Eastern-Tamarack Hemlock, Eastern-Tamarack (North)	WWPA, WCLIB NLGA (Canadian) NELMA NLGA (Canadian)	55.11, 127-b 127-b 15.1 127-b	55.12, 127-c 127-c 15.2 127-c
Hemlock, Western Hemlock, Western (North) Northern Species	WCLIB NLGA (Canadian) NLGA (Canadian)	127-b 127-b 127-b	127-c 127-c 127-c
Pine, Eastern White Pine, Eastern White (North) Pine, Northern	NELMA NLGA (Canadian) NELMA	15.1 127-b 15.1	15.2 127-c 15.2
Pine, Ponderosa Pine, Red Pine, Southern ^{d,e} Pine, Western White	NLGA (Canadian) NLGA (Canadian) SPIB NLGA (Canadian)	127-b 127-b 412 127-b	127-c 127-c 413 127-c
Redwood, California SPF, South Spruce, Coast Sitka Spruce, Eastern Spruce-Pine-Fir Spruce, Sitka Western Woods	RIS NELMA, WWPA NLGA (Canadian) NELMA NLGA (Canadian) WCLIB WWPA	315 15.1, 55.11 127-b 15.1 127-b 127-b 55.11	316 15.2, 55.12 127-c 15.2 127-c 127-c 55.12

^a When species may be graded under WCLIB and WWPA rules, the first paragraph number is for WWPA and the second for WCLIB rules.

^b Select quality grades are as follows for the grading rules indicated:

WCLIB;	Select Dex	SPIB;	Select Decking
WWPA;	Selected Decking	RIS;	Select Decking
NELMA;	Selected Decking	NLGA;	Select Decking

^c Commercial quality grades are as follows for the grading rules indicated:

WCLIB;	Commercial Dex	SPIB;	Commercial Decking
WWPA;	Commercial Decking	RIS;	Commercial Decking
NELMA;	Commercial Decking	NLGA;	Commercial Decking

^d Southern Pine decking is also available in the following grades:
Dense Standard Decking, para. 411; Dense Select Decking, para. 412.1; and Dense Commercial Decking, para. 413.1

^e Southern Pine is limited to the botanical species of longleaf, slash, shortleaf and loblolly. Lumber cut from trees of this species is classified as "Southern Pine" in the SPIB Grading Rules.

4.2.3 Four Inch Decking

- * Not less than 25% to be 16 ft and longer with at least 20% equal to or greater in length than the maximum span
- * Not less than 50% to be 15 ft and longer
- * Not more than 10% to be 5 to 10 ft
- * Not more than 1% to be 4 to 5 ft

5. MOISTURE CONTENT

- 5.1 TWO INCH DECKING. The maximum moisture content shall be 15%.
- 5.2 THREE AND FOUR INCH DECKING. The maximum moisture content shall be 19%.
- 5.3 Moisture content shall be determined by such methods as will assure these limitations.

6. APPLICATION

- 6.1 Tongue-and-groove wood decking is to be installed with tongues up on sloped or pitched roofs, and outward in direction of laying on flat roofs. It is to be laid with pattern faces down and exposed on the underside.
- 6.2 Each piece shall be square-end trim. When random lengths are furnished, each piece must be square-end trimmed across the face so that at least 90% of the pieces will be within 3/64 inches of square. The vertical end cut may vary from square to the bevel cut shown in Figure 4.

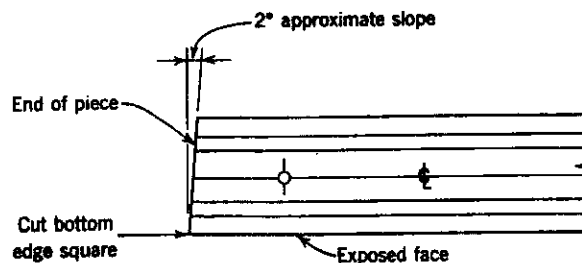


Figure 4. Beveled End Cut. (Beveled end cut is optional.)

6.3 NAILING SCHEDULES

- 6.3.1 Two Inch Decking. Each piece shall be toenailed through the tongue and face nailed with one nail per support, using 16d common nails.
- 6.3.2 Three and Four Inch Decking. Each piece should be toenailed at each support with one 40d nail and face nailed with one 60d nail. Courses shall be spiked to each other with 8 inch spikes at intervals not to exceed 30 inches through predrilled edge holes and with one spike at a distance not exceeding 10 inches from each piece. See figure 5 for drilling details.

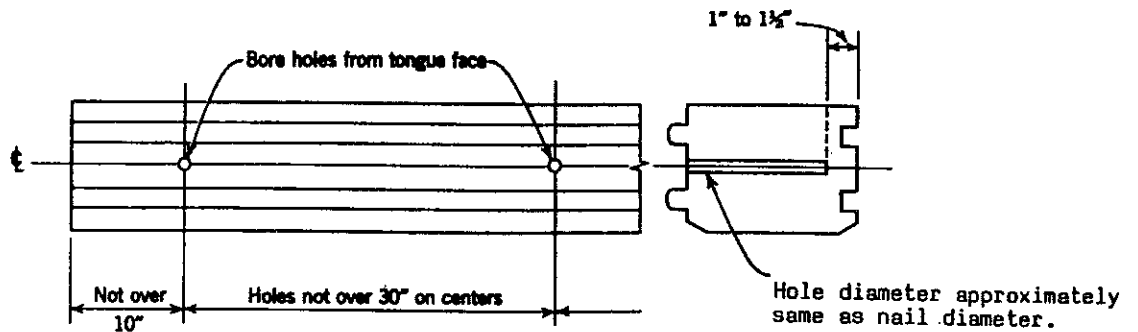


Figure 5. Boring Detail. Locate end holes not over 10 inches from end of piece.

6.4 Heavy timber decking may be installed in any of the following arrangements:

6.4.1 Simple Span. All pieces supported on two supports.

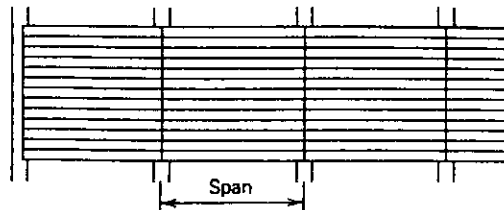


Figure 6. Simple Span Layout

6.4.2 Controlled Random Layout. This arrangement is applicable to 4 or more supports (3 or more spans). (With less than 4 supports, a special pattern requiring specified lengths must be used.) Joints in the same general line (within 6 inches of being in line each way) shall be separated by at least two intervening courses. In the end bays each piece must rest on at least one support and must continue over the first inner support for at least 2 ft. For 3 and 4 inch decking in the interior bays, occasional pieces not resting over a support may occur provided the ends of the adjacent pieces in the same course are continued for at least 2 ft over the next support. This condition shall not occur more than once in every 6 courses in each interior bay.

6.4.2.1 Two Inch Decking. There shall be a minimum distance of 2 ft between end joints in adjacent courses. To provide lateral restraint for the supporting member, the pieces in at least the first and second courses must bear on at least two supports with end joints in these two courses occurring in alternate supports. A maximum of seven intervening courses is allowed before this pattern is repeated. If some other provision, such as plywood overlayment, is made to provide continuity, this pattern is not necessary.

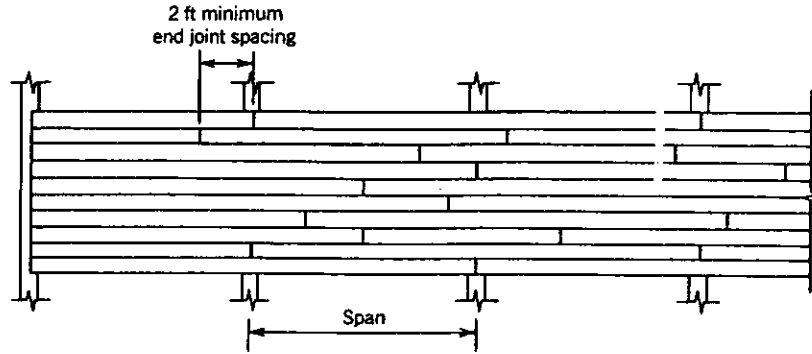


Figure 7. Controlled Random Layup. (Two inch decking)

6.4.2.2 Three and Four Inch Decking. There shall be a minimum distance of 4 ft between end joints in adjacent courses.

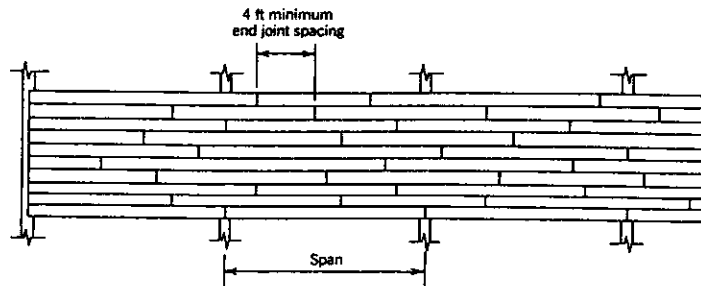


Figure 8. Controlled Random Layup. (Three & Four inch decking)

6.4.3 Cantilever Spans With Controlled Random Layup. When the overhang does not exceed 1-1/2 ft, 2 ft and 3 ft for nominal 2 inch, 3 inch, and 4 inch thick decking, no special considerations for layup are necessary. The maximum cantilever length for controlled random layup is limited to 0.3 times the length of the first adjacent interior span. For cantilever overhangs exceeding the normal overhang, but not exceeding the maximum, a structural fascia should be fastened to each decking piece to maintain a continuously straight roof line. Also, there shall be no end joints in the cantilevered portion or within 1/2 the span ($L/2$) of the outer support.

6.4.4 Cantilevered Pieces Intermixed. This arrangement is applicable to 4 or more supports (3 or more spans). Pieces in the starter course and every third course are simple span. Pieces in other courses are cantilevered over the supports with end joints at alternate quarter or third points of the spans, and each piece rests on at least one support. A tie between supports is provided by the simple span courses of the arrangement.

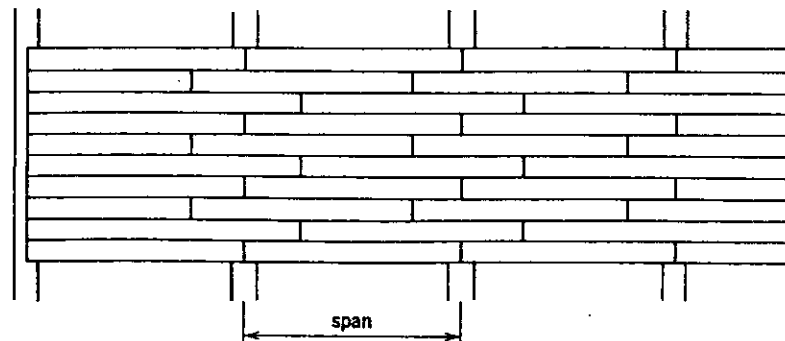


Figure 9. Cantilevered Pieces Intermixed Layup.

- 6.4.5 **Combination Simple and Two-Span Continuous.** Alternate pieces in end spans are simple span; adjacent pieces are two-span continuous. End joints are staggered in adjacent courses and occur over support.

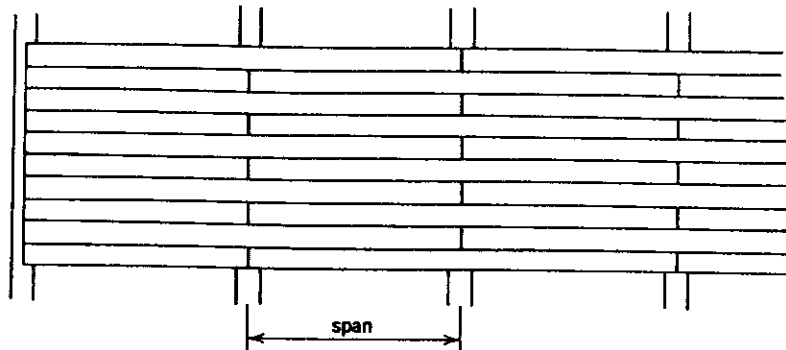


Figure 10. Combination Simple and Two-Span Continuous Layout.

- 6.4.6 **Two-Span Continuous.** All pieces are supported on three supports. All end joints occur in line on every other support.

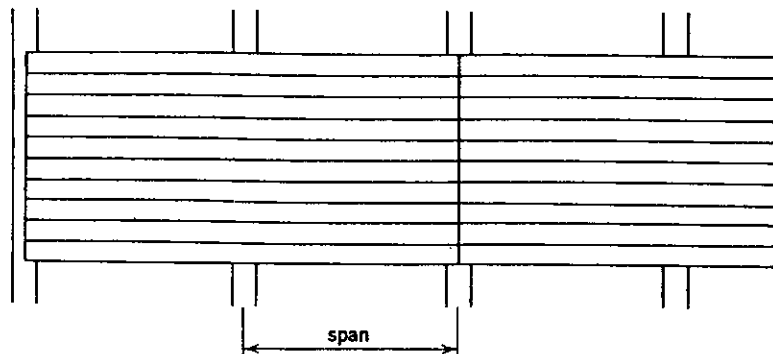


Figure 11. Two-span Continuous Layout.

7. SPECIFICATIONS

- 7.1 The specifications for tongue-and-groove decking for the various species as well as inspection and shipping provisions shall be as specified in the standard grading rules under which the species is graded and shall be subject to such other provisions of the standard grading rules as may be applicable. (See paragraph 1.3).
- 7.2 **SELECT QUALITY.** Decking of this quality is recommended for construction for which good strength and fine appearance are desired. Knots and other natural characteristics of specified limitations are permitted.
- 7.3 **COMMERCIAL QUALITY.** Decking of this quality is recommended and customarily used for the same purposes served by the higher quality when appearance requirements are less critical.

8. WEIGHTS OF INSTALLED DECKING (See Table 2, page 10)

9. ALLOWABLE LOADS

- 9.1 Allowable loads for heavy timber decking may be determined by entering Tables 4 through 8 with the appropriate bending stress and modulus of elasticity values, and using the lower of the tabulated load values from the tables for the nominal thickness and span under consideration. Bending stress and modulus of elasticity values for wood decking species, as recommended by the regional lumber rules-writing agency by which the species is graded, are given in Table 3.
- 9.2 Allowable loads given in Tables 4 through 8 are for the simple span and controlled random layup arrangements illustrated under paragraph 6.3.1 and 6.3.2.

9.3 CONTROLLED RANDOM LAYUP LOAD VALUES

- 9.3.1 Two Inch Decking. The allowable loads for controlled random layup, limited by bending, for 2 inch nominal thickness decking as given in Table 4, are based on the standard engineering formula for a three-equal-span, continuous, uniformly-loaded member; however, only 2/3 of the moment of inertia for the cross section was used in calculating the loads. Loads limited by deflection as given in Table 5, are for the maximum deflections in the end spans.
- 9.3.2 Three and Four Inch Decking. The allowable loads for controlled random layup of 3 and 4 inch nominal thickness decking as given in Tables 6 through 8, are based on the standard engineering formula for a three-equal-span, continuous, uniformly-loaded member; however, only 80% of the moment of inertia for the cross section was used in calculating the loads. Loads limited by deflection, as given in Tables 7 and 8, are for the maximum deflections in the end spans.
- 9.3.3 The percentage adjustments in moment of inertia discussed in 9.3.1 and 9.3.2 take into account the differences between continuous decking without joints and the controlled random layup of decking as specified herein. The factors of 2/3 for 2 inch and 80% for 3 and 4 inch decking were selected after careful evaluation of tests and previous experience.
- 9.3.4 When controlled random layup as specified herein is used for unequal spans, non-uniform loading, cantilever action, or conditions other than covered herein by the tabulated values, the same adjustment factors should be applied to the moment of inertia used in standard engineering formulas representing the actual conditions of load and span.
- 9.4 The allowable load given in Tables 4 and 5 are based on a maximum moisture content of 15% for 2 inch decking. The allowable loads given in Tables 6 through 8 are based on a maximum moisture content of 19% for 3 and 4 inch decking. If the maximum moisture content is limited to 15% for 3 and 4 inches decking, the allowable bending stress valued given in Table 7 may be multiplied by 1.08 and the modulus elasticity values in Tables 7 and 8 may be multiplied by 1.05.

TABLE 2
WEIGHTS OF INSTALLED HEAVY TIMBER DECKING
IN POUNDS PER SQUARE FOOT OF ROOF SURFACE^a

Species	THICKNESS			
	1-1/2 in. net ^b (2 in. nom.)	2-1/2 in. net ^c (3 in. nom.)	3-1/2 in. net (4 in. nom.)	Agency ^d
Cedar, Northern White	2.7	4.5	6.3	1
Cedars, Western ^d	3.0	4.9	6.9	3,4
Cedars, Western (North) ^e	2.9	4.8	6.7	2
Coast Species ^e	3.9	6.4	9.0	2
Douglas Fir-Larch ^d	4.3	7.2	10.1	3,4
Douglas Fir-Larch (North) ^e	4.4	7.3	10.3	2
Douglas Fir (South)	4.1	6.9	9.6	3
Fir, Balsam	3.2	5.4	7.5	1
Hem-Fir ^e	3.7	6.1	8.6	3,4
Hem-Fir (North) ^e	3.8	6.3	8.8	2
Hemlock, Eastern-Tamarack ^e	3.8	6.3	8.8	1
Hemlock, Eastern-Tamarack (North) ^{d,e}	4.0	6.7	9.4	2
Hemlock, Western	4.0	6.7	9.4	4
Northern Species ^f	2.9-5.3	4.8-8.8	6.7-12.4	2
Pine, Eastern White	3.3	5.5	7.7	1
Pine, Eastern White (North)	3.4	5.7	8.0	2
Pine, Northern ^f	3.8-4.5	6.3-7.5	8.8-10.5	1
Pine, Ponderosa	4.1	6.9	9.6	2
Pine, Red	3.7	6.1	8.6	2
Pine, Southern ^e	4.6	7.6	10.7	5
Pine, Western White	3.4	5.7	8.0	2
Redwood, California	3.7	6.1	8.6	6
SPF, South	3.7	6.1	8.6	1,3
Spruce, Coast Sitka	3.3	5.5	7.7	2
Spruce, Eastern	3.6	6.0	8.4	1
Spruce-Pine-Fir ^f	3.0-4.0	5.1-6.7	7.1-9.4	2
Spruce, Sitka	3.6	6.0	8.4	4
Western Woods ^f	2.9-4.6	4.8-7.6	6.7-10.7	3

^a All weights given in Table 2 are based on volume at 14% moisture content rounded to the nearest 0.1 lb. These weights may be reduced by 2% where 15 % maximum moisture content is specified (which is an average of 12% M.C.).

^b For a net thickness of 1-7/16 in., multiply tabulated weights by a factor of 0.958.

^c For a net thickness of 2-5/8 in., multiply tabulated weights by a factor of 1.05.

^d Species listed are as graded by the following grading rules agencies: NELMA (1), NLGA (Canadian) (2), WWPA (3), WCLIB (4), SPIB (5), and RIS (6).

^e Weights given for this species grouping are based on the weighted average of the standing timber volume. Lumber from some areas or species within the group may vary slightly from the average.

^f Weights given for this species grouping are the range of weights for species that could be included.

- 9.5 Allowable load values given in Tables 4 and 6 are based on normal duration of loading. If decking is used for purposes where other durations of load control, increase the tabulated values by multiplying by the appropriate duration of load factor C_D as follows:

0.9	for permanent load;
1.15	for 2 months duration, as for snow;
1.25	for 7 days duration;
1.6	for wind or earthquake; or
2.0	for impact

These increases are not cumulative.

- 9.6 The allowable load tables are for total uniformly distributed vertical loads, including dead and live, in pounds per square foot on a horizontal roof surface. When roofs have only a moderate slope (3 in 12 or less), dead and live load may be added together without adjustment for slope of roof.
- 9.7 For steeper sloping roofs, it is customary to adjust the load so as to express them in terms of square feet of roof surface. (See Figures 12 and 13.) For example, 10 lb dead load (6.7 lb for deck and 3.3 lb for roofing) is the vertical load of one square foot of sloping roof surface. Snow load is usually expressed in pounds per square foot of the horizontal projection of the sloping roof surface. Therefore, the vertical snow load must be converted to the vertical psf load of sloping roof surface. For example, a 60 psf snow load on the horizontal projection is equivalent to a vertical load of 46 psf on a 10 in 12 sloping roof surface. This combined with 10 psf dead load results in a total vertical load of 56 psf on the 10 in 12 sloping roof surface. The 56 psf total vertical load may then be converted to two components, one perpendicular or normal to the roof surface, and one parallel to the roof surface. In the example, the vertical load of 56 psf is equivalent to a component perpendicular to the roof of 43 psf and a component parallel to the roof of 37 psf.
- 9.8 Where decking is installed with the longitudinal axis parallel to the slope, the component perpendicular to the roof surface will produce bending and deflection; the parallel component will produce compression. The design value for compression parallel to grain may be taken as that of No. 2 structural joists and planks grade for the species. The decking must be designed for bending and axial stresses as well as deflection.
- 9.9 Where decking is installed with the longitudinal axis perpendicular to the slope, the load component perpendicular to the roof surface produces bending and deflection; the parallel load component, as may be induced by wind forces, is transferred by diaphragm action.

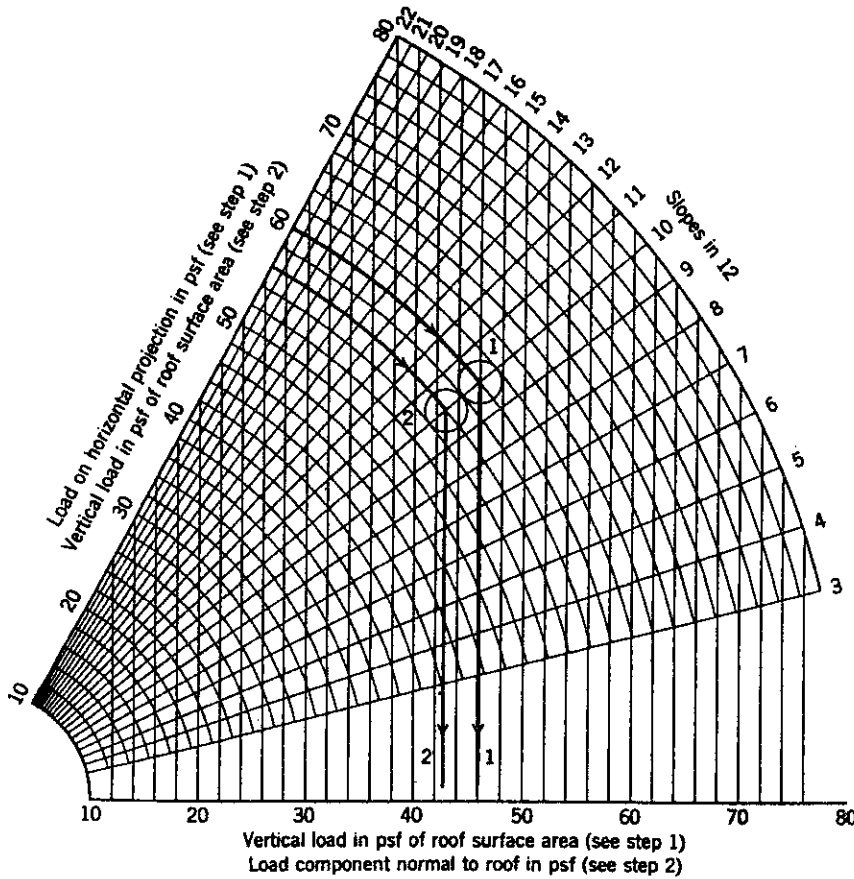


Figure 12. LOAD CONVERSION
 Example: 60 psf live load and 10 psf dead load on 10 in 12 slope. Step 1: 60 psf live load on horizontal projection equals 46 psf on roof surface areas. Vertical load on 10 in 12 roof slope. Step 2: 10 psf on roof surface area for dead load plus 46 psf on roof surface area live load, equals 56 psf on roof surface area combined load acting vertically; 56 psf on roof surface area vertical total load equals 43 psf normal to roof slope which causes bending and deflection.

Figure 13. SPAN CONVERSION
 Example: 25 ft horizontal span equals 28 ft slope span when slope is 6 in 12. Use 28 ft in determining board footage.

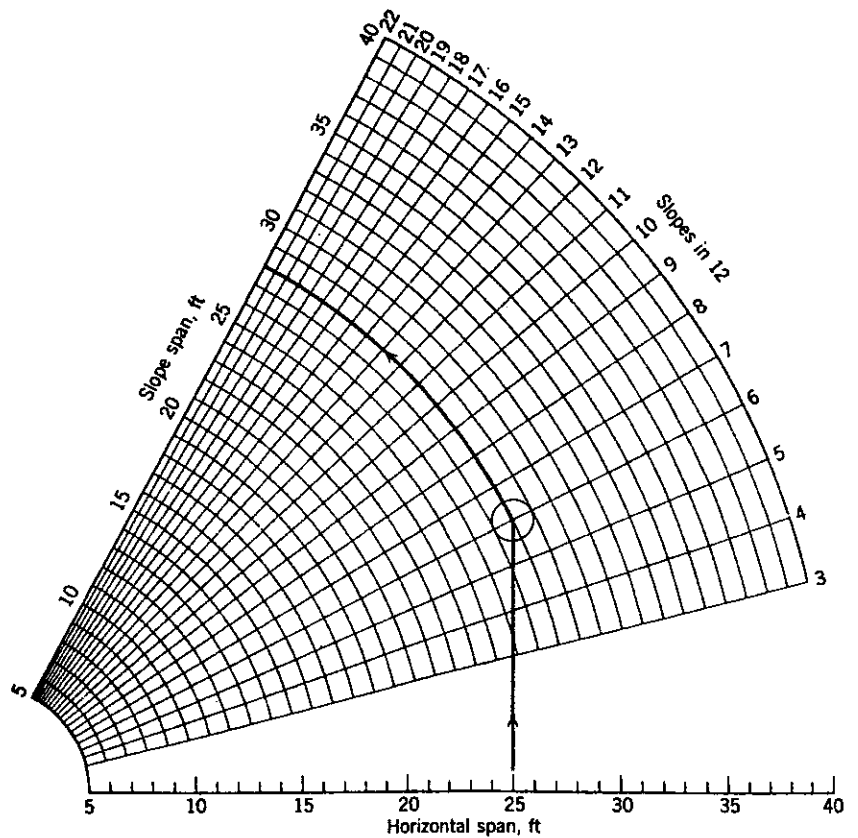


TABLE 3
BENDING STRESS AND MODULUS OF ELASTICITY
VALUES FOR HEAVY TIMBER DECKING SPECIES^a

Species	Select Quality		Commercial Quality		Agency ^d
	Bending Stress ^b psi	Modulus of Elasticity ^c psi	Bending Stress ^b psi	Modulus of Elasticity ^c psi	
Cedar, Northern White	1100	800,000	950	700,000	1
Cedars, Western	1450	1,100,000	1200	1,000,000	3,4
Cedars, Western (North)	1400	1,100,000	1200	1,000,000	2
Coast Species	1450	1,500,000	1200	1,400,000	2
Douglas Fir-Larch	2000	1,800,000	1650	1,700,000	3,4
Douglas Fir-Larch (North)	2000	1,800,000	1650	1,700,000	2
Douglas Fir (South)	1900	1,400,000	1600	1,300,000	3
Fir, Balsam	1650	1,500,000	1400	1,300,000	1
Hem-Fir	1600	1,500,000	1350	1,400,000	3,4
Hem-Fir (North)	1500	1,500,000	1300	1,400,000	2
Hemlock, Eastern-Tamarack	1700	1,300,000	1450	1,100,000	1
Hemlock, Eastern-Tamarack (North)	1700	1,300,000	1450	1,100,000	2
Hemlock, Western	1750	1,600,000	1450	1,400,000	4
Hemlock, Western (North)	1750	1,600,000	1450	1,400,000	2
Northern Species	1050	1,100,000	875	1,000,000	2
Pine, Eastern White	1300	1,200,000	1100	1,100,000	1
Pine, Eastern White (North)	1050	1,200,000	875	1,100,000	2
Pine, Northern	1550	1,400,000	1300	1,300,000	1
Pine, Ponderosa	1450	1,300,000	1250	1,100,000	2
Pine, Red	1350	1,300,000	1100	1,200,000	2
Pine, Southern	1650	1,600,000	1650	1,600,000	5
Pine, Western White	1300	1,400,000	1050	1,300,000	2
Redwood, California	1700	1,100,000	1350	1,000,000	6
SPF, South	1350	1,400,000	1100	1,200,000	1,3
Spruce, Coast Sitka	1450	1,700,000	1200	1,500,000	2
Spruce, Eastern	1300	1,500,000	1100	1,400,000	1
Spruce-Pine-Fir	1400	1,500,000	1150	1,300,000	2
Spruce, Sitka	1500	1,500,000	1250	1,300,000	4
Western Woods	1300	1,200,000	1100	1,100,000	3

^a The design values in bending (F_b), except for Redwood, are based on decking 4 in. thick. For other thicknesses, multiply by the size factor, C_F , as follows:

Thickness	C_F
2 in.	1.70
3 in.	1.04

Design values for visually graded decking are those recommended by the regional lumber rules writing agencies. These values are based on decking that is used where the moisture content in-service will not exceed 19%. When the moisture content in-service exceeds 19% for an extended period of time, the tabular design values shall be multiplied by the wet service factor, C_M , as follows:

C_M		
F_b	F_{cL}	E
0.85*	0.67	0.9

* When (F_b) (C_F) < 1150 psi, $C_M = 1.0$ for bending.

^b Repetitive member use values.

^c The tabulated values for modulus of elasticity are the average for the species grouping. For information concerning coefficient of variation of modulus of elasticity, see the appropriate grading rules for the species.

^d Stresses listed are as assigned by the following grading rules agencies: NELMA (1), NLGA (Canadian) (2), WWPA (3), WCLIB (4), SPIB (5), and RIS (6).

^e If specified as "close grain", California Redwood select decking is assigned a bending stress value of 1850 psi and a modulus of elasticity value of 1,400,000 psi when used at 19% M.C.

TABLE 4
TWO INCH NOMINAL THICKNESS^a
ALLOWABLE ROOF LOAD LIMITED BY BENDING

Bending Stress, psi	Allowable Uniformly Distributed Total Roof Load ^{b,c,d,e} , psf													
	Simple Span, ft							Controlled Random Layup Span, ft						
	6	7	8	9	10	11	12	6	7	8	9	10	11	12
875	73	54	41	32	26	22	18	61	45	34	27	22	18	15
950	79	58	44	35	28	24	20	66	48	37	29	24	20	16
1000	83	61	47	37	30	25	21	69	51	39	31	25	21	17
1050	88	64	49	39	32	26	22	73	54	41	32	26	22	18
1100	92	67	52	41	33	27	23	76	56	43	34	28	23	19
1150	96	70	54	42	34	28	24	80	59	45	35	29	24	20
1200	100	73	56	44	36	30	25	83	61	47	37	30	25	21
1250	104	76	58	46	38	31	26	87	64	49	39	31	26	22
1300	108	80	61	48	39	32	27	90	66	51	40	32	27	22
1350	112	83	63	50	40	33	28	94	69	53	42	34	28	23
1400	117	86	66	52	42	35	29	97	71	55	43	35	29	24
1450	121	89	68	54	44	36	30	101	74	57	45	36	30	25
1500	125	92	70	56	45	37	31	104	76	58	46	38	31	26
1550	129	95	73	57	46	38	32	108	79	60	48	39	32	27
1600	133	98	75	59	48	40	33	111	82	62	49	40	33	28
1650	138	101	77	61	50	41	34	114	84	64	51	41	34	29
1700	142	104	80	63	51	42	35	118	87	66	52	42	35	30
1750	146	107	82	65	52	43	36	122	89	68	54	44	36	30
1900	158	116	89	70	57	47	40	132	97	74	59	48	39	33
2000	167	122	94	74	60	50	42	139	102	78	62	50	41	35

- ^a Based on 1-1/2 in. net thickness. To determine allowable loads for 1-7/16 in. net thickness, multiply tabulated values by 0.918.
- ^b To determine allowable uniformly distributed total roof loads for other span conditions, use simple span load values for combination simple span and two-span continuous, and two-span continuous layouts; and use controlled random layup road values for cantilevered pieces intermixed layout.
- ^c Duration of load, $C_D = 1.0$ used in this table. For other durations of load, adjust by the appropriate factor.
- ^d No increase for size effect has been applied ($C_F = 1.00$). F_b values have been previously adjusted.
- ^e Dry conditions of use.

TABLE 5
TWO INCH NOMINAL THICKNESS^a
ALLOWABLE ROOF LOAD LIMITED BY DEFLECTION

Modulus of Elasticity psi	Deflection Limit ^b	Allowable Uniformly Distributed Total Roof Load ^{c,d} , psf											
		Simple Span, ft					Controlled Random Layup Span, ft						
		6	7	8	9	10	6	7	8	9	10	11	12
700,000	<i>l</i> /180	32	20	14	10	7	42	27	18	12	9	7	5
	<i>l</i> /240	24	15	10	7	5	32	20	13	9	7	5	4
800,000	<i>l</i> /180	37	23	16	11	8	48	30	20	14	10	8	6
	<i>l</i> /240	28	17	12	8	8	36	23	15	11	8	6	4
900,000	<i>l</i> /180	42	26	18	12	9	54	34	23	16	12	9	7
	<i>l</i> /240	31	20	13	9	7	41	26	17	12	9	7	5
1,000,000	<i>l</i> /180	46	29	20	14	10	60	38	25	18	13	10	8
	<i>l</i> /240	35	22	15	12	8	45	28	19	13	10	7	6
1,100,000	<i>l</i> /180	51	32	21	15	11	66	42	28	20	14	11	8
	<i>l</i> /240	38	24	16	11	8	50	31	21	15	11	8	6
1,200,000	<i>l</i> /180	56	35	23	16	12	72	46	30	21	16	12	9
	<i>l</i> /240	42	26	18	12	9	54	34	23	16	12	9	7
1,300,000	<i>l</i> /180	60	38	25	18	13	78	49	33	23	17	13	10
	<i>l</i> /240	45	28	19	13	10	59	37	25	17	13	10	7
1,400,000	<i>l</i> /180	65	41	27	19	14	84	53	36	25	18	14	10
	<i>l</i> /240	49	31	20	14	10	63	40	27	19	13	10	8
1,500,000	<i>l</i> /180	69	44	29	20	15	90	57	38	27	20	15	11
	<i>l</i> /240	52	33	22	15	11	68	43	29	20	15	11	8
1,600,000	<i>l</i> /180	74	47	31	22	16	96	61	41	28	21	16	12
	<i>l</i> /240	56	35	23	16	12	72	46	30	21	16	12	9
1,700,000	<i>l</i> /180	79	50	33	23	17	102	64	43	30	22	17	13
	<i>l</i> /240	59	37	25	17	13	77	48	32	23	17	12	10
1,800,000	<i>l</i> /180	83	52	35	25	18	108	68	46	32	23	18	14
	<i>l</i> /240	62	39	26	18	14	81	51	34	24	18	13	10

^a Based on 1-1/2 in. net thickness. To determine allowable loads for 1-7/16 in. net thickness, multiply tabulated value by 0.880.

^b For a deflection limit *l*/360, use 1/2 the tabulated value for a deflection limit of *l*/180.

^c To determine allowable uniformly distributed total roof loads for other span conditions, multiply controlled random layup load values by the following factors:

Cantilevered pieces intermixed;	1.05
Combination simple span and two-span continuous;	1.31
Two-span continuous;	1.85

^d Dry conditions of use.

TABLE 6
THREE AND FOUR INCH NOMINAL THICKNESS
ALLOWABLE ROOF LOAD LIMITED BY BENDING
SIMPLE SPAN AND CONTROLLED RANDOM LAYUPS (3 or more spans)

Bending Stress psi	Allowable Uniformly Distributed Total Roof Load ^{a, c, e, f, g} , psf																									
	3 inch Nominal Thickness ^b										4 inch Nominal Thickness ^d															
	Span, ft										Span, ft															
	8	9	10	11	12	13	14	15	16	17	18	19	20	8	9	10	11	12	13	14	15	16	17	18	19	20
875	114	90	73	60	51	43	37	32	28	25	22	20	18	223	176	143	118	99	84	73	64	56	49	44	40	36
950	124	98	79	65	55	47	40	35	31	27	24	22	20	242	192	155	128	108	92	79	69	61	54	48	43	39
1000	130	103	83	69	58	49	42	37	32	29	26	23	21	255	202	163	135	113	97	83	72	64	56	50	45	41
1050	137	108	88	72	61	52	45	39	34	30	27	24	22	268	212	172	142	119	101	88	76	67	59	53	48	43
1100	143	113	92	76	64	54	47	41	36	32	28	25	23	281	222	180	148	125	106	92	80	70	62	55	50	45
1150	150	118	96	79	66	57	49	42	37	33	30	26	24	293	232	188	155	130	111	96	83	73	65	58	52	47
1200	156	123	100	83	69	59	51	44	39	35	31	28	25	306	242	196	162	136	116	100	87	76	68	60	54	49
1250	163	129	104	86	72	62	53	46	41	36	32	29	26	319	252	204	169	142	121	104	91	80	71	63	56	51
1300	169	134	108	90	75	64	55	48	42	37	33	30	27	332	262	212	175	147	126	108	94	83	73	66	59	53
1350	176	139	112	93	78	66	57	50	44	39	35	31	28	344	272	220	182	153	130	112	98	86	76	68	61	55
1400	182	144	117	96	81	69	60	52	46	40	36	32	29	357	282	229	189	159	135	117	102	89	79	70	63	57
1450	189	149	121	100	84	71	62	54	47	42	37	33	30	370	292	237	196	164	140	121	105	92	82	73	66	59
1500	195	154	125	103	87	74	64	56	49	43	38	35	31	383	302	245	202	170	145	125	109	96	85	76	68	61
1550	202	159	129	107	90	76	66	57	50	45	40	36	32	396	312	253	209	176	150	129	112	99	88	78	70	63
1600	208	165	133	110	92	79	68	59	52	46	41	37	33	408	323	261	216	181	155	133	116	102	90	81	72	65
1650	215	170	138	114	95	81	70	61	54	48	42	38	34	421	333	270	223	187	159	138	120	105	93	83	75	67
1700	221	175	142	117	98	84	72	63	55	49	44	39	35	434	343	278	229	193	164	142	123	108	96	86	77	69
1750	228	180	146	120	101	86	74	65	57	50	45	40	36	447	353	286	236	198	169	146	127	112	99	88	79	71
1900	247	195	158	131	110	94	81	70	62	55	49	44	40	485	383	310	256	216	184	158	138	121	107	96	86	78
2000	260	206	167	138	116	99	85	74	65	58	51	46	42	510	403	327	270	227	193	167	145	128	113	101	90	82

- ^a These load values may also be used for cantilevered pieces intermixed, combination simple span and two-span continuous, and two-span continuous layups.
- ^b 2-1/2 in. net thickness. To determine allowable loads for 2-5/8 in. net thickness, multiply tabulated loads by 1.10.
- ^c All spans to the right of the double line require special ordering of additional long lengths to assure that at least 20% of the decking is equal to the span length or longer.
- ^d 3-1/2 in. net thickness.
- ^e Duration of load, $C_D = 1.0$ used in this table. For other durations of load, adjust by the appropriate factor.
- ^f No increase for size effect has been applied ($C_F = 1.00$). F_b values have been previously adjusted.
- ^g Dry conditions of use.

TABLE 7
THREE AND FOUR INCH NOMINAL THICKNESS
ALLOWABLE ROOF LOAD LIMITED BY DEFLECTION
SIMPLE SPAN LAYUP

Modulus of Elasticity, psi	Deflec- tion Limit ^a	Allowable Uniformly Distributed Total Roof Load ^d , psf																					
		3 inch Thickness ^b , Span, ft										4 inch Thickness ^c , Span, ft											
		8	9	10	11	12	13	14	15	16		8	9	10	11	12	13	14	15	16	17	18	19
700,000	<i>ℓ</i> /180	63	44	32	24	19	15	12	10	8	174	122	89	67	51	40	32	26	22	18	15	13	11
	<i>ℓ</i> /240	47	33	24	18	14	11	9	7	6	130	91	67	50	38	30	24	20	16	14	11	10	8
800,000	<i>ℓ</i> /180	72	51	37	28	21	17	13	11	9	198	139	102	76	59	46	37	30	25	21	17	15	13
	<i>ℓ</i> /240	54	38	28	21	16	13	10	8	7	149	104	76	57	44	35	28	22	19	16	13	11	10
900,000	<i>ℓ</i> /180	81	57	42	31	24	19	15	12	10	223	157	114	86	66	52	42	34	28	23	20	17	14
	<i>ℓ</i> /240	61	43	31	23	18	14	11	9	8	167	118	86	64	50	39	31	25	21	17	15	13	11
1,000,000	<i>ℓ</i> /180	90	64	46	35	27	21	17	14	11	248	174	127	95	74	58	46	38	31	26	22	19	16
	<i>ℓ</i> /240	68	48	35	26	20	16	13	10	8	186	131	95	72	55	43	35	28	23	19	16	14	12
1,100,000	<i>ℓ</i> /180	99	70	51	38	29	23	19	15	12	273	192	140	105	81	64	51	41	34	28	24	20	17
	<i>ℓ</i> /240	75	52	38	29	22	17	14	11	9	205	144	105	79	61	48	38	31	26	21	18	15	13
1,200,000	<i>ℓ</i> /180	108	76	56	42	32	25	20	16	14	298	209	153	114	88	69	56	45	37	31	26	22	19
	<i>ℓ</i> /240	81	57	42	31	24	19	15	12	10	223	157	114	86	66	52	42	34	28	23	20	17	14
1,300,000	<i>ℓ</i> /180	117	83	60	45	35	27	22	18	15	322	227	165	124	96	75	60	49	40	34	28	24	21
	<i>ℓ</i> /240	88	62	45	34	26	21	16	13	11	142	170	124	93	72	56	45	37	30	25	21	18	15
1,400,000	<i>ℓ</i> /180	127	89	65	49	38	30	24	19	16	347	244	178	134	103	81	65	53	43	36	30	26	22
	<i>ℓ</i> /240	95	67	49	37	28	22	18	14	12	261	183	133	100	77	61	49	40	33	27	23	19	17
1,500,000	<i>ℓ</i> /180	136	95	69	52	40	32	25	21	17	372	261	191	143	110	87	69	56	47	39	33	28	24
	<i>ℓ</i> /240	102	71	52	39	30	24	19	15	13	279	196	143	107	83	65	52	42	35	29	25	21	18
1,600,000	<i>ℓ</i> /180	145	102	74	56	43	34	27	22	18	397	279	203	153	118	93	74	60	50	41	35	30	25
	<i>ℓ</i> /240	109	76	56	42	32	25	20	16	14	298	209	152	115	88	69	56	45	37	31	26	22	19
1,700,000	<i>ℓ</i> /180	154	108	79	59	46	36	29	23	19	422	296	216	162	125	98	79	64	53	44	37	31	27
	<i>ℓ</i> /240	115	81	59	44	34	27	22	17	14	316	222	162	122	94	74	59	48	40	33	28	24	20
1,800,000	<i>ℓ</i> /180	163	114	83	63	48	38	30	25	20	446	314	229	172	132	104	83	68	56	47	39	33	29
	<i>ℓ</i> /240	122	86	62	47	36	28	23	19	15	335	235	172	129	99	78	62	51	42	35	29	25	21

^a For a deflection limit of *ℓ*/360, use 1/2 the tabulated value for a deflection limit of *ℓ*/180.

^b 2-1/2 in. net thickness. To determine allowable loads for 2-5/8 in. net thickness, multiply tabulated loads by 1.147.

^c 3-1/2 in. net thickness.

^d Dry conditions of use.

TABLE 8
THREE AND FOUR INCH NOMINAL THICKNESS
ALLOWABLE ROOF LOAD LIMITED BY DEFLECTION
CONTROLLED RANDOM LAYUP (3 or more spans)

Modulus of Elasticity, psi	Deflection Limit ^b	Allowable Uniformly Distributed Total Roof Load ^{a, f} , psf																									
		3 inch Nominal Thickness ^c										4 inch Nominal Thickness ^e															
		Span, ft ^d										Span, ft ^d															
		8	9	10	11	12	13	14	15	16	17	18	19	20	8	9	10	11	12	13	14	15	16	17	18	19	20
700,000	<i>ℓ</i> /180	96	67	49	37	28	22	18	14	12	10	8	7	6	262	184	134	101	78	61	49	40	33	27	23	20	17
	<i>ℓ</i> /240	72	50	37	28	21	17	13	11	9	7	6	5	4	197	138	100	76	58	46	37	30	24	20	17	15	12
800,000	<i>ℓ</i> /180	109	77	56	42	32	25	20	16	14	11	10	8	7	300	210	154	115	89	70	56	45	37	31	26	22	19
	<i>ℓ</i> /240	82	58	42	32	24	19	15	12	10	8	7	6	5	225	158	115	86	67	52	42	34	28	23	20	17	14
900,000	<i>ℓ</i> /180	123	86	63	47	36	29	23	19	15	13	11	9	8	337	237	173	130	100	79	63	51	42	35	30	25	22
	<i>ℓ</i> /240	92	65	47	35	27	21	17	14	12	10	8	7	6	253	178	129	97	75	59	47	38	32	26	22	19	16
1,000,000	<i>ℓ</i> /180	136	96	70	52	40	32	25	21	17	14	12	10	9	374	263	192	144	111	87	70	57	47	39	33	28	24
	<i>ℓ</i> /240	102	72	52	39	30	24	19	16	13	11	9	8	7	281	197	144	108	83	65	52	43	35	29	25	21	18
1,100,000	<i>ℓ</i> /180	150	105	77	58	44	35	28	23	19	16	13	11	10	412	289	211	158	122	96	77	63	52	43	36	31	26
	<i>ℓ</i> /240	113	79	58	43	33	26	21	17	14	12	10	8	7	309	217	158	119	92	72	58	47	39	32	27	23	20
1,200,000	<i>ℓ</i> /180	164	115	84	63	49	38	31	25	20	17	14	12	10	449	316	230	173	133	105	84	68	56	47	39	34	29
	<i>ℓ</i> /240	123	86	63	47	36	29	23	19	15	13	11	9	8	337	237	173	130	100	79	63	51	42	35	30	25	22
1,300,000	<i>ℓ</i> /180	177	125	91	68	53	41	33	27	22	18	16	13	11	487	342	249	187	144	114	91	74	61	51	43	36	31
	<i>ℓ</i> /240	133	93	68	51	39	31	25	20	17	14	12	10	9	365	256	187	140	108	85	68	55	46	38	32	27	23
1,400,000	<i>ℓ</i> /180	191	134	98	73	57	45	36	29	24	20	17	14	12	524	368	269	202	155	122	98	80	66	55	46	39	34
	<i>ℓ</i> /240	143	101	73	55	42	33	27	22	18	15	13	11	9	393	276	201	151	117	92	73	60	49	41	35	29	25
1,500,000	<i>ℓ</i> /180	205	144	105	79	61	48	38	31	26	21	18	15	13	562	395	288	216	166	131	105	85	70	59	49	42	36
	<i>ℓ</i> /240	154	108	79	59	46	36	29	23	19	16	13	11	10	421	296	216	162	125	98	79	64	53	44	37	31	27
1,600,000	<i>ℓ</i> /180	218	153	112	84	65	51	41	33	27	23	19	16	14	599	421	307	230	178	140	112	91	75	62	53	45	38
	<i>ℓ</i> /240	164	115	84	63	49	38	31	25	20	17	14	12	10	449	316	230	173	133	105	84	68	56	47	39	34	29
1,700,000	<i>ℓ</i> /180	232	163	119	89	69	54	43	35	29	24	20	17	15	636	447	326	245	189	148	119	97	80	66	56	48	41
	<i>ℓ</i> /240	174	122	89	67	52	41	32	26	22	18	15	13	11	478	335	245	184	142	111	89	72	60	50	42	36	31
1,800,000	<i>ℓ</i> /180	246	173	126	94	73	57	46	37	31	26	22	18	16	674	474	345	259	200	157	126	102	84	70	59	50	43
	<i>ℓ</i> /240	184	129	94	71	55	43	34	28	23	19	16	14	12	506	355	259	195	150	118	94	77	63	53	44	38	32

- ^a To determine allowable uniformly distributed total roof for other span conditions, multiply controlled random layup load values by the following factors: cantilevered pieces intermixed, multiply by 0.90; combination simple span and two-span continuous, multiply by 1.13; two-span continuous, multiply by 1.59.
- ^b For a deflection limit of *ℓ*/360, use 1/2 the tabulated value for a deflection limit of *ℓ*/180.
- ^c 2-1/2 in. net thickness. To determine allowable loads for 2-5/8 in. net thickness, multiply tabulated loads by 1.16.
- ^d All spans to the right of the double line require special ordering of additional long lengths to assure that at least 20% of the decking equal to the span length or longer.
- ^e 3-1/2 in. net thickness.
- ^f Dry conditions of use.

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