

# 2021 Virginia Construction Code

## CHAPTER 23 WOOD

### SECTION 2304 GENERAL CONSTRUCTION REQUIREMENTS

#### 2304.1 General.

The provisions of this section apply to design methods specified in [Section 2302.1](#).

#### 2304.2 Size of structural members.

Computations to determine the required sizes of members shall be based on the net dimensions (actual sizes) and not nominal sizes.

#### 2304.3 Wall framing.

The framing of exterior and interior walls shall be in accordance with the provisions specified in [Section 2308](#) unless a specific design is furnished.

##### 2304.3.1 Bottom plates.

Studs shall have full bearing on a 2-inch-thick (actual  $1\frac{1}{2}$ -inch, 38 mm) or larger plate or sill having a width not less than equal to the width of the studs.

##### 2304.3.2 Framing over openings.

Headers, double joists, trusses or other *approved* assemblies that are of adequate size to transfer *loads* to the vertical members shall be provided over window and door openings in *load-bearing walls* and partitions.

##### 2304.3.3 Shrinkage.

Wood walls and bearing partitions shall not support more than two floors and a roof unless an analysis satisfactory to the *building official* shows that shrinkage of the wood framing will not have adverse effects on the structure or any plumbing, electrical or mechanical systems or other equipment installed therein due to excessive shrinkage or differential movements caused by shrinkage. The analysis shall show that the roof drainage system and the foregoing systems or equipment will not be adversely affected or, as an alternate, such systems shall be designed to accommodate the differential shrinkage or movements.

#### 2304.4 Floor and roof framing.

The framing of wood-joisted floors and wood-framed roofs shall be in accordance with the provisions specified in [Section 2308](#) unless a specific design is furnished.

#### 2304.5 Framing around flues and chimneys.

Combustible framing shall be not less than 2 inches (51 mm), but shall be not less than the distance specified in [Sections 2111](#) and [2113](#) and the *International Mechanical Code*, from flues, chimneys and fireplaces, and 6 inches (152 mm) away from flue openings.

#### 2304.6 Exterior wall sheathing.

Wall sheathing on the outside of *exterior walls*, including *gables*, and the connection of the sheathing to framing shall be designed in accordance with the general provisions of this code and shall be capable of resisting wind pressures in accordance with [Section 1609](#).

##### 2304.6.1 Wood structural panel sheathing.

Where *wood structural panel* sheathing is used as the exposed finish on the outside of *exterior walls*, it shall have an exterior exposure durability classification. Where *wood structural panel* sheathing is used elsewhere, but not as the exposed finish, it shall be of a type manufactured with exterior glue (Exposure 1 or Exterior). *Wood structural panel* sheathing, connections and framing spacing shall be in accordance with [Table 2304.6.1](#) for the applicable wind speed and exposure category where used in enclosed buildings with a mean roof height not greater than 30 feet (9144 mm) and a topographic factor ( $K_z$ ) of 1.0.

TABLE 2304.6.1

MAXIMUM ALLOWABLE STRESS DESIGN WIND SPEED,  $V_{asd}$  PERMITTED FOR WOOD STRUCTURAL PANEL WALL SHEATHING USED TO RESIST WIND PRESSURES<sup>a, b, c</sup>

MINIMUM NAIL		MINIMUM WOOD STRUCTURAL PANEL SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inches)	MAXIMUM WALL STUD SPACING (inches)	PANEL NAIL SPACING		MAXIMUM ALLOWABLE STRESS DESIGN WIND SPEED, $V_{asd}$ <sup>d</sup> (MPH)		
Size	Penetration (inches)				Edges (inches o.c.)	Field (inches o.c.)	Wind exposure category		
							B	C	D
6d common (2.0" × 0.113")	1.5	24/0	$\frac{3}{8}$	16	6	12	110	90	85
		24/16	$\frac{7}{16}$	16	6	12	110	100	90
						6	150	125	110

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8d common (2.5" x 0.131")	1.75	24/16	7/16	16	6	12	130	110	105
				24	6	6	150	125	110
						12	110	90	85
						6	110	90	85

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- Panel strength axis shall be parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.
- The table is based on wind pressures acting toward and away from building surfaces in accordance with Section 30.7 of [ASCE 7](#). Lateral requirements shall be in accordance with [Section 2305](#) or [2308](#).
- Wood structural panels with span ratings of wall-16 or wall-24 shall be permitted as an alternative to panels with a 24/0 span rating. Plywood siding rated 16 on center or 24 on center shall be permitted as an alternative to panels with a 24/16 span rating. Wall-16 and plywood siding 16 on center shall be used with studs spaced not more than 16 inches on center.
- $V_{asd}$  shall be determined in accordance with [Section 1609.3.1](#).

#### 2304.7 Interior paneling.

Softwood wood structural panels used for interior paneling shall conform to the provisions of [Chapter 8](#) and shall be installed in accordance with [Table 2304.10.2](#). Panels shall comply with [DOC PS 1](#), [DOC PS 2](#) or [ANSI/APA PRP 210](#). Prefinished hardboard paneling shall meet the requirements of [ANSI A135.5](#). Hardwood plywood shall conform to [HPVA HP-1](#).

#### 2304.8 Floor and roof sheathing.

Structural floor sheathing and structural roof sheathing shall comply with [Sections 2304.8.1](#) and [2304.8.2](#), respectively.

**TABLE 2304.8(1)**  
**ALLOWABLE SPANS FOR LUMBER FLOOR AND ROOF SHEATHING**

SPAN (inches)	MINIMUM NET THICKNESS (inches) OF LUMBER PLACED			
	Perpendicular to supports		Diagonally to supports	
	Surfaced dry <sup>a</sup>	Surfaced unseasoned	Surfaced dry <sup>a</sup>	Surfaced unseasoned
<b>Floors</b>				
24	3/4	25/32	3/4	25/32
16	5/8	11/16	5/8	11/16
<b>Roofs</b>				
24	5/8	11/16	3/4	25/32

For SI: 1 inch = 25.4 mm.

- Maximum 19-percent moisture content.

**TABLE 2304.8(2)**  
**SHEATHING LUMBER, MINIMUM GRADE REQUIREMENTS: BOARD GRADE**

SOLID FLOOR OR ROOF SHEATHING	SPACED ROOF SHEATHING	GRADING RULES
Utility	Standard	NLGA, WCLIB, WWPA
4 common or utility	3 common or standard	NLGA, WCLIB, WWPA, NSLB or NELMA
No. 3	No. 2	SPIB
Merchantable	Construction common	RIS

**TABLE 2304.8(3)**  
**ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANEL SHEATHING AND SINGLE-FLOOR GRADES CONTINUOUS OVER TWO OR MORE SPANS WITH STRENGTH AXIS PERPENDICULAR TO SUPPORTS<sup>a</sup>**

SHEATHING GRADES		ROOF <sup>b</sup>				FLOOR <sup>c</sup>
Panel span rating roof/floor span	Panel thickness (inches)	Maximum span (inches)		Load <sup>d</sup> (psf)		Maximum span (inches)
		With edge support <sup>e</sup>	Without edge support	Total load	Live load	

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16/0	$\frac{3}{8}$	16	16	40	30	0
20/0	$\frac{3}{8}$	20	20	40	30	0
24/0	$\frac{3}{8}, \frac{7}{16}, \frac{1}{2}$	24	20 <sup>f</sup>	40	30	0
24/16	$\frac{7}{16}, \frac{1}{2}$	24	24	50	40	16
32/16	$\frac{15}{32}, \frac{1}{2}, \frac{5}{8}$	32	28	40	30	16 <sup>g</sup>
40/20	$\frac{19}{32}, \frac{5}{8}, \frac{3}{4}, \frac{7}{8}$	40	32	40	30	20 <sup>g,h</sup>
48/24	$\frac{23}{32}, \frac{3}{4}, \frac{7}{8}$	48	36	45	35	24
54/32	$\frac{7}{8}, 1$	54	40	45	35	32
60/32	$\frac{7}{8}, 1\frac{1}{8}$	60	48	45	35	32
<b>SINGLE FLOOR GRADES</b>		<b>ROOF<sup>b</sup></b>				<b>FLOOR<sup>c</sup></b>
Panel span rating	Panel thickness (inches)	Maximum span (inches)		Load <sup>e</sup> (psf)		Maximum span (inches)
		With edge support <sup>e</sup>	Without edge support	Total load	Live load	
16 o.c.	$\frac{1}{2}, \frac{19}{32}, \frac{5}{8}$	24	24	50	40	16 <sup>g</sup>
20 o.c.	$\frac{19}{32}, \frac{5}{8}, \frac{3}{4}$	32	32	40	30	20 <sup>g, h</sup>
24 o.c.	$\frac{23}{32}, \frac{3}{4}$	48	36	35	25	24
32 o.c.	$\frac{7}{8}, 1$	48	40	50	40	32
48 o.c.	$1\frac{3}{32}, 1\frac{1}{8}$	60	48	50	40	48

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

- Applies to panels 24 inches or wider.
- Uniform load deflection limitations  $\frac{1}{180}$  of span under live load plus dead load,  $\frac{1}{240}$  under live load only.
- Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking unless  $\frac{1}{4}$ -inch minimum thickness underlayment or  $1\frac{1}{2}$  inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is  $\frac{3}{4}$ -inch wood strip. Allowable uniform load based on deflection of  $\frac{1}{360}$  of span is 100 pounds per square foot except the span rating of 48 inches on center is based on a total load of 65 pounds per square foot.
- Allowable load at maximum span.
- Tongue-and-groove edges, panel edge clips (one midway between each support, except two equally spaced between supports 48 inches on center), lumber blocking or other. Only lumber blocking shall satisfy blocked diaphragm requirements.
- For  $\frac{1}{2}$ -inch panel, maximum span shall be 24 inches.
- Span is permitted to be 24 inches on center where  $\frac{3}{4}$ -inch wood strip flooring is installed at right angles to joist.
- Span is permitted to be 24 inches on center for floors where  $1\frac{1}{2}$  inches of cellular or lightweight concrete is applied over the panels.

**TABLE 2304.8(4)**

**ALLOWABLE SPAN FOR WOOD STRUCTURAL PANEL COMBINATION SUBFLOOR-UNDERLAYMENT (SINGLE FLOOR)<sup>a</sup>**  
**(Panels Continuous Over Two or More Spans and Strength Axis Perpendicular to Supports)**

IDENTIFICATION	MAXIMUM SPACING OF JOISTS (inches)				
	16	20	24	32	48
Species group <sup>b</sup>	Thickness (inches)				
1	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	—	—
2, 3	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	—	—
4	$\frac{3}{4}$	$\frac{7}{8}$	1	—	—
Single floor span rating <sup>c</sup>	16 o.c.	20 o.c.	24 o.c.	32 o.c.	48 o.c.

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

- Spans limited to value shown because of possible effects of concentrated loads.

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Allowable uniform loads based on deflection of  $\frac{1}{360}$  of span is 100 pounds per square foot except allowable total uniform load for  $1\frac{1}{8}$ -inch wood structural panels over joists spaced 48 inches on center is 65 pounds per square foot. Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking, unless  $\frac{1}{4}$ -inch minimum thickness underlayment or  $1\frac{1}{2}$  inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is  $\frac{3}{4}$ -inch wood strip.

- b. Applicable to all grades of sanded exterior-type plywood. See [DOC PS 1](#) for plywood species groups.
- c. Applicable to Underlayment grade, C-C (Plugged) plywood, and Single Floor grade wood structural panels.

**TABLE 2304.8(5)**

**ALLOWABLE LOAD (PSF) FOR WOOD STRUCTURAL PANEL ROOF SHEATHING CONTINUOUS OVER TWO OR MORE SPANS AND STRENGTH AXIS PARALLEL TO SUPPORTS (Plywood structural panels are five-ply, five-layer unless otherwise noted)<sup>a</sup>**

PANEL GRADE	THICKNESS (inch)	MAXIMUM SPAN (inches)	LOAD AT MAXIMUM SPAN (psf)	
			Live	Total
Structural I sheathing	$\frac{7}{16}$	24	20	30
	$\frac{15}{32}$	24	35 <sup>b</sup>	45 <sup>b</sup>
	$\frac{1}{2}$	24	40 <sup>b</sup>	50 <sup>b</sup>
	$\frac{19}{32}, \frac{5}{8}$	24	70	80
	$\frac{23}{32}, \frac{3}{4}$	24	90	100
Sheathing, other grades covered in <a href="#">DOC PS 1</a> or <a href="#">DOC PS 2</a>	$\frac{7}{16}$	16	40	50
	$\frac{15}{32}$	24	20	25
	$\frac{1}{2}$	24	25	30
	$\frac{19}{32}$	24	40 <sup>b</sup>	50 <sup>b</sup>
	$\frac{5}{8}$	24	45 <sup>b</sup>	55 <sup>b</sup>
	$\frac{23}{32}, \frac{3}{4}$	24	60 <sup>b</sup>	65 <sup>b</sup>

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

- a. Uniform load deflection limitations  $\frac{1}{180}$  of span under live load plus dead load,  $\frac{1}{240}$  under live load only. Edges shall be blocked with lumber or other approved type of edge supports.
- b. For composite and four-ply plywood structural panel, load shall be reduced by 15 pounds per square foot.

#### **2304.8.1 Structural floor sheathing.**

Structural floor sheathing shall be designed in accordance with the general provisions of this code.

Floor sheathing conforming to the provisions of [Table 2304.8\(1\)](#), [2304.8\(2\)](#), [2304.8\(3\)](#) or [2304.8\(4\)](#) shall be deemed to meet the requirements of this section.

#### **2304.8.2 Structural roof sheathing.**

Structural roof sheathing shall be designed in accordance with the general provisions of this code and the special provisions in this section.

Roof sheathing conforming to the provisions of [Table 2304.8\(1\)](#), [2304.8\(2\)](#), [2304.8\(3\)](#) or [2304.8\(5\)](#) shall be deemed to meet the requirements of this section. *Wood structural panel* roof sheathing shall be of a type manufactured with exterior glue (Exposure 1 or Exterior).

#### **2304.9 Lumber decking.**

Lumber decking shall be designed and installed in accordance with the general provisions of this code and [Sections 2304.9.1 through 2304.9.5.3](#). [Other lumber decking patterns and connection designs shall be substantiated through engineering analysis.](#)

##### **2304.9.1 General.**

Each piece of lumber decking shall be square-end trimmed. Where random lengths are furnished, each piece shall be square end trimmed across the face so that not less than 90 percent of the pieces are within 0.5 degrees (0.00873 rad) of square. The

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ends of the pieces shall be permitted to be beveled up to 2 degrees (0.0349 rad) from the vertical with the exposed face of the piece slightly longer than the opposite face of the piece. Tongue-and-groove decking shall be installed with the tongues up on sloped or pitched roofs with pattern faces down.

**2304.9.2 Layup patterns.**

Lumber decking is permitted to be laid up following one of five standard patterns as defined in [Sections 2304.9.2.1 through 2304.9.2.5](#).

**2304.9.2.1 Simple span pattern.**

All pieces shall be supported on their ends (in other words, by two supports).

**2304.9.2.2 Two-span continuous pattern.**

All pieces shall be supported by three supports, and all end joints shall occur in line on alternating supports. Supporting members shall be designed to accommodate the *load* redistribution caused by this pattern.

**2304.9.2.3 Combination simple and two-span continuous pattern.**

Courses in end spans shall be alternating simple-span pattern and two-span continuous pattern. End joints shall be staggered in adjacent courses and shall bear on supports.

**2304.9.2.4 Cantilevered pieces intermixed pattern.**

The decking shall extend across not fewer than three spans. Pieces in each starter course and every third course shall be simple span pattern. Pieces in other courses shall be cantilevered over the supports with end joints at alternating quarter or third points of the spans. Each piece shall bear on one support or more.

**2304.9.2.5 Controlled random pattern.**

The decking shall extend across not fewer than three spans. End joints of pieces within 6 inches (152 mm) of the end joints of the adjacent pieces in either direction shall be separated by not fewer than two intervening courses. In the end bays, each piece shall bear on one support or more. Where an end joint occurs in an end bay, the next piece in the same course shall continue over the first inner support for not less than 24 inches (610 mm). The details of the controlled random pattern shall be as specified for each decking material in [Section 2304.9.3.3](#), [2304.9.4.3](#) or [2304.9.5.3](#).

Decking that cantilevers beyond a support for a horizontal distance greater than 18 inches (457 mm), 24 inches (610 mm) or 36 inches (914 mm) for 2-inch (51 mm), 3-inch (76 mm) and 4-inch (102 mm) nominal thickness decking, respectively, shall comply with the following:

- 1. The maximum cantilevered length shall be 30 percent of the length of the first adjacent interior span.
- 2. A structural fascia shall be fastened to each decking piece to maintain a continuous, straight line.
- 3. End joints shall not be in the decking between the cantilevered end of the decking and the centerline of the first adjacent interior span.

**2304.9.3 Mechanically laminated decking.**

Mechanically laminated decking shall comply with [Sections 2304.9.3.1 through 2304.9.3.3](#).

**2304.9.3.1 General.**

Mechanically laminated decking consists of square-edged dimension lumber laminations set on edge and nailed to the adjacent pieces and to the supports.

**2304.9.3.2 Nailing.**

The length of nails connecting laminations shall be not less than two and one-half times the net thickness of each lamination. Where decking supports are 48 inches (1219 mm) on center or less, side nails shall be installed not more than 30 inches (762 mm) on center alternating between top and bottom edges, and staggered one-third of the spacing in adjacent laminations. Where supports are spaced more than 48 inches (1219 mm) on center, side nails shall be installed not more than 18 inches (457 mm) on center alternating between top and bottom edges and staggered one-third of the spacing in adjacent laminations. For mechanically laminated decking constructed with laminations of 2-inch (51 mm) nominal thickness, nailing in accordance with [Table 2304.9.3.2](#) shall be permitted. Two side nails shall be installed at each end of butt-jointed pieces.

Laminations shall be toenailed to supports with 20d or larger common nails. Where the supports are 48 inches (1219 mm) on center or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches (1219 mm) on center, alternate laminations shall be toenailed to every support. For mechanically laminated decking constructed with laminations of 2-inch (51 mm) nominal thickness, toenailing in accordance with [Table 2304.9.3.2](#) shall be permitted.

**TABLE 2304.9.3.2**  
**FASTENING SCHEDULE FOR MECHANICALLY LAMINATED DECKING USING LAMINATIONS OF 2-INCH NOMINAL THICKNESS**

MINIMUM NAIL SIZE (Length × Diameter) (inches)	MAXIMUM SPACING BETWEEN FACE NAILS <sup>a, b</sup> (inches)		NUMBER OF TOENAILS INTO SUPPORTS <sup>c</sup>
	Decking Supports ≤ 48 inches o.c.	Decking Supports > 48 inches o.c.	

4 × 0.192	30	18	1
4 × 0.162	24	14	2
4 × 0.148	22	13	2
3 <sup>1</sup> / <sub>2</sub> × 0.162	20	12	2
3 <sup>1</sup> / <sub>2</sub> × 0.148	19	11	2
3 <sup>1</sup> / <sub>2</sub> × 0.135	17	10	2
3 × 0.148	11	7	2
3 × 0.128	9	5	2
2 <sup>3</sup> / <sub>4</sub> × 0.148	10	6	2
2 <sup>3</sup> / <sub>4</sub> × 0.131	9	6	3
2 <sup>3</sup> / <sub>4</sub> × 0.120	8	5	3

For SI: 1 inch = 25.4 mm.

- a. Nails shall be driven perpendicular to the lamination face, alternating between top and bottom edges.
- b. Where nails penetrate through two laminations and into the third, they shall be staggered one-third of the spacing in adjacent laminations. Otherwise, nails shall be staggered one-half of the spacing in adjacent laminations.
- c. Where supports are 48 inches on center or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches on center, alternate laminations shall be toenailed to every support.

#### **2304.9.3.3 Controlled random pattern.**

There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on not fewer than two supports with end joints in these two courses occurring on alternate supports. Not more than seven intervening courses shall be permitted before this pattern is repeated.

#### **2304.9.4 Two-inch sawn tongue-and-groove decking.**

Two-inch (51 mm) sawn tongue-and-groove decking shall comply with [Sections 2304.9.4.1](#) through [2304.9.4.3](#).

##### **2304.9.4.1 General.**

Two-inch (51 mm) decking shall have a maximum moisture content of 15 percent. Decking shall be machined with a single tongue-and-groove pattern. Each decking piece shall be nailed to each support.

##### **2304.9.4.2 Nailing.**

Each piece of decking shall be toenailed at each support with one 16d common nail through the tongue and face-nailed with one 16d common nail.

##### **2304.9.4.3 Controlled random pattern.**

There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on not fewer than two supports with end joints in these two courses occurring on alternate supports. Not more than seven intervening courses shall be permitted before this pattern is repeated.

#### **2304.9.5 Three- and four-inch sawn tongue-and-groove decking.**

Three- and four-inch (76 mm and 102 mm) sawn tongue-and-groove decking shall comply with [Sections 2304.9.5.1](#) through [2304.9.5.3](#).

##### **2304.9.5.1 General.**

Three-inch (76 mm) and four-inch (102 mm) decking shall have a maximum moisture content of 19 percent. Decking shall be machined with a double tongue-and-groove pattern. Decking pieces shall be interconnected and nailed to the supports.

##### **2304.9.5.2 Nailing.**

Each piece shall be toenailed at each support with one 40d common nail and face-nailed with one 60d common nail. Courses shall be spiked to each other with 8-inch (203 mm) spikes at maximum intervals of 30 inches (762 mm) through predrilled edge holes penetrating to a depth of approximately 4 inches (102 mm). One spike shall be installed at a distance not exceeding 10 inches (254 mm) from the end of each piece.

##### **2304.9.5.3 Controlled random pattern.**

There shall be a minimum distance of 48 inches (1219 mm) between end joints in adjacent courses. Pieces not bearing on a support are permitted to be located in interior bays provided that the adjacent pieces in the same course continue over the support for not less than 24 inches (610 mm). This condition shall not occur more than once in every six courses in each interior bay.

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### 2304.10 Connectors and fasteners.

Connectors and fasteners shall comply with the applicable provisions of Sections 2304.10.1 through 2304.10.8.

#### 2304.10.1 Connection fire-resistance rating.

Fire-resistance ratings for connections in Type IV-A, IV-B, or IV-C construction shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is part of the fire resistance test.
2. Engineering analysis that demonstrates that the temperature rise at any portion of the connection is limited to an average temperature rise of 250°F (139°C), and a maximum temperature rise of 325°F (181°C), for a time corresponding to the required fire-resistance rating of the structural element being connected. For the purposes of this analysis, the connection includes connectors, fasteners, and portions of wood members included in the structural design of the connection.

#### 2304.10.2 Fastener requirements.

Connections for wood members shall be designed in accordance with the appropriate methodology in Section 2302.1. The number and size of fasteners connecting wood members shall be not less than that set forth in Table 2304.10.2.

**TABLE 2304.10.2**  
**FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER <sup>9</sup>	SPACING AND LOCATION
<b>Roof</b>		
1. Blocking between ceiling joists, rafters or trusses to top plate or other framing below	4-8d box (2 <sup>1</sup> / <sub>2</sub> " x 0.113"); or	Each end, toenail
	3-8d common (2 <sup>1</sup> / <sub>2</sub> " x 0.131"); or	
	3-10d box (3" x 0.128"); or	
	3-3" x 0.131" nails; or	
	3-3" 14 gage staples, 7/16" crown	
Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2 <sup>1</sup> / <sub>2</sub> " x 0.131")	Each end, toenail
	2-3" x 0.131" nails	
	2-3" 14 gage staples	
	2-16 d common (3 <sup>1</sup> / <sub>2</sub> " x 0.162")	End nail
	3-3" x 0.131" nails	
Flat blocking to truss and web filler	3-3" 14 gage staples	Face nail
	16d common (3 <sup>1</sup> / <sub>2</sub> " x 0.162") @ 6" o.c.	
	3" x 0.131" nails @ 6" o.c.	
2. Ceiling joists to top plate	3" x 14 gage staples @ 6" o.c	Each joist, toenail
	4-8d box (2 <sup>1</sup> / <sub>2</sub> " x 0.113"); or	
	3-8d common (2 <sup>1</sup> / <sub>2</sub> " x 0.131"); or	
	3-10d box (3" x 0.128"); or	
	3-3" x 0.131" nails; or	
3. Ceiling joist not attached to parallel rafter, laps over partitions (no thrust) (see Section 2308.7.3.1, Table 2308.7.3.1)	3-3" 14 gage staples, 7/16" crown	Face nail
	3-16d common (3 <sup>1</sup> / <sub>2</sub> " x 0.162"); or	
	4-10d box (3" x 0.128"); or	
	4-3" x 0.131" nails; or	
4. Ceiling joist attached to parallel rafter (heel joint) (see Section 2308.7.3.1, Table 2308.7.3.1)	4-3" 14 gage staples, 7/16" crown	Face nail
	Per Table 2308.7.3.1	
5. Collar tie to rafter	3-10d common (3" x 0.148"); or	Face nail
	4-10d box (3" x 0.128"); or	
	4-3" x 0.131" nails; or	
	4-3" 14 gage staples, 7/16" crown	
6. Rafter or roof truss to top plate (See Section 2308.7.5, Table 2308.7.5)	3-10 common (3" x 0.148"); or	2 toenails on one side and 1 toenail on opposite side of rafter or truss <sup>c</sup>
	3-16d box (3 <sup>1</sup> / <sub>2</sub> " x 0.135"); or	
	4-10d box (3" x 0.128"); or	
	4-3" x 0.131 nails; or	
	4-3" 14 gage staples, 7/16" crown	
	2-16d common (3 <sup>1</sup> / <sub>2</sub> " x 0.162"); or	End nail
	3-16d box (3 <sup>1</sup> / <sub>2</sub> " x 0.135"); or	
	3-10d box (3" x 0.128"); or	
	3-3" x 0.131" nails; or	

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7. Roof rafters to ridge valley or hip rafters; or roof rafter to 2-inch ridge beam	3-3" 14 gage staples, $\frac{7}{16}$ " crown	Toenail
	3-10d common ( $3\frac{1}{2}$ " $\times$ 0.148"); or	
	4-16d box ( $3\frac{1}{2}$ " $\times$ 0.135"); or	
	4-10d box (3" $\times$ 0.128"); or	
	4-3" $\times$ 0.131" nails; or	
	4-3" 14 gage staples, $\frac{7}{16}$ " crown	
<b>Wall</b>		
8. Stud to stud (not at braced wall panels)	16d common ( $3\frac{1}{2}$ " $\times$ 0.162");	24" o.c. face nail
	10d box (3" $\times$ 0.128"); or	16" o.c. face nail
	3" $\times$ 0.131" nails; or	
	3-3" 14 gage staples, $\frac{7}{16}$ " crown	
9. Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d common ( $3\frac{1}{2}$ " $\times$ 0.162")	16" o.c. face nail
	16d box ( $3\frac{1}{2}$ " $\times$ 0.135"); or	12" o.c. face nail
	3" $\times$ 0.131" nails; or	
	3-3" 14 gage staples, $\frac{7}{16}$ " crown	
10. Built-up header (2" to 2" header)	16d common ( $3\frac{1}{2}$ " $\times$ 0.162")	16" o.c. each edge, face nail
	16d box ( $3\frac{1}{2}$ " $\times$ 0.135")	12" o.c. each edge, face nail
11. Continuous header to stud	4-8d common ( $2\frac{1}{2}$ " $\times$ 0.131"); or	Toenail
	4-10d box (3" $\times$ 0.128"); or	
	5-8d box ( $2\frac{1}{2}$ " $\times$ 0.113")	
12. Top plate to top plate	16d common ( $3\frac{1}{2}$ " $\times$ 0.162")	16" o.c. face nail
	10d box (3" $\times$ 0.128"); or	12" o.c. face nail
	3" $\times$ 0.131" nails; or	
	3" 14 gage staples, $\frac{7}{16}$ " crown	
13. Top plate to top plate, at end joints	8-16d common ( $3\frac{1}{2}$ " $\times$ 0.162"); or	Each side of end joint, face nail (minimum 24" lap splice length each side of end joint)
	12-16d box ( $3\frac{1}{2}$ " $\times$ 0.135"); or	
	12-10d box (3" $\times$ 0.128"); or	
	12-3" $\times$ 0.131" nails; or	
14. Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	12-3" 14 gage staples, $\frac{7}{16}$ " crown	16" o.c. face nail
	16d common ( $3\frac{1}{2}$ " $\times$ 0.162")	
	16d box ( $3\frac{1}{2}$ " $\times$ 0.135"); or	
	3" $\times$ 0.131" nails; or	
15. Bottom plate to joist, rim joist, band joist or blocking at braced wall panels	3" 14 gage staples, $\frac{7}{16}$ " crown	16" o.c. face nail
	2-16d common ( $3\frac{1}{2}$ " $\times$ 0.162"); or	
	3-16d box ( $3\frac{1}{2}$ " $\times$ 0.135"); or	
	4-3" $\times$ 0.131" nails; or	
16. Stud to top or bottom plate	4-3" 14 gage staples, $\frac{7}{16}$ " crown	Toenail
	3-16d box ( $3\frac{1}{2}$ " $\times$ 0.135"); or	
	4-8d common ( $2\frac{1}{2}$ " $\times$ 0.131"); or	
	4-10d box (3" $\times$ 0.128"); or	
	4-3" $\times$ 0.131" nails; or	
	4-8d box ( $2\frac{1}{2}$ " $\times$ 0.113"); or	End nail
	4-3" 14 gage staples, $\frac{7}{16}$ " crown	
	2-16d common ( $3\frac{1}{2}$ " $\times$ 0.162"); or	
	3-16d box ( $3\frac{1}{2}$ " $\times$ 0.135"); or	
	3-10d box (3" $\times$ 0.128"); or	
17. Top plates, laps at corners and intersections	3-3" $\times$ 0.131" nails; or	Face nail
	3-3" 14 gage staples, $\frac{7}{16}$ " crown	
	3-8d box ( $2\frac{1}{2}$ " $\times$ 0.113"); or	
	2-8d common ( $2\frac{1}{2}$ " $\times$ 0.131"); or	
18. 1" brace to each stud and plate	2-10d box (3" $\times$ 0.128"); or	Face nail

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	2-3" x 0.131" nails; or 2-3" 14 gage staples, 7/16" crown	
19. 1" x 6" sheathing to each bearing	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128"); or 2-1 3/4" 16 gage staples, 1" crown	Face nail
20. 1" x 8" and wider sheathing to each bearing	3-8d common (2 1/2" x 0.131"); or 3-8d box (2 1/2" x 0.113"); or 3-10d box (3" x 0.128"); or 3-1 3/4" 16 gage staples, 1" crown Wider than 1" x 8" 3-8d common (2 1/2" x 0.131"); or 4-8d box (2 1/2" x 0.113"); or 3-10d box (3" x 0.128"); or 4-1 3/4" 16 gage staples, 1" crown	Face nail
<b>Floor</b>		
21. Joist to sill, top plate, or girder	4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or floor 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Toenail
22. Rim joist, band joist, or blocking to top plate, sill or other framing below	8d box (2 1/2" x 0.113") 8d common (2 1/2" x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	4" o.c., toenail 6" o.c., toenail
23. 1" x 6" subfloor or less to each joist	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 2-1 3/4" 16 gage staples, 1" crown	Face nail
24. 2 subfloor to joist or girder	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162")	Blind and face nail
25. 2" planks (plank & beam - floor & roof)	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162")	Each bearing, face nail
26. Built-up girders and beams, 2" lumber layers	20d common (4" x 0.192")	32" o.c., face nail at top and bottom staggered on opposite sides
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	24" o.c. face nail at top and bottom staggered on opposite sides
	And: 2-20d common (4" x 0.192"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Ends and at each splice, face nail
27. Ledger strip supporting joists or rafters	3-16d common (3 1/2" x 0.162"); or 4-16d box (3 1/2" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Each joist or rafter, face nail
28. Joist to band joist or rim joist	3-16d common (3 1/2" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	End nail
29. Bridging or blocking to joist, rafter or truss	2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128"); or 2-3" x 0.131" nails; or 2-3" 14 gage staples, 7/16" crown	Each end, toenail

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Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing <sup>a</sup>			
		Edges (inches )	Intermediate supports (inches)
30. <sup>3</sup> / <sub>8</sub> " – <sup>1</sup> / <sub>2</sub> "	6d common or deformed (2" × 0.113"); or <sup>2</sup> <sup>3</sup> / <sub>8</sub> " × 0.113" nail (subfloor and wall)	6	12
	8d common or deformed (2 <sup>1</sup> / <sub>2</sub> " × 0.131" × 0.281" head) (roof) or RSRS-01 (2 <sup>3</sup> / <sub>8</sub> " × 0.113") nail (roof) <sup>d</sup>	6 <sup>e</sup>	6 <sup>e</sup>
	1 <sup>3</sup> / <sub>4</sub> " 16 gage staple, <sup>7</sup> / <sub>16</sub> " crown (subfloor and wall)	4	8
	2 <sup>3</sup> / <sub>8</sub> " × 0.113" × 0.266" head nail (roof)	3 <sup>f</sup>	3 <sup>f</sup>
	1 <sup>3</sup> / <sub>4</sub> " 16 gage staple, <sup>7</sup> / <sub>16</sub> " crown (roof)	3 <sup>f</sup>	3 <sup>f</sup>
31. <sup>19</sup> / <sub>32</sub> " – <sup>3</sup> / <sub>4</sub> "	8d common (2 <sup>1</sup> / <sub>2</sub> " × 0.131"); or deformed (2" × 0.113") (subfloor and wall)	6	12
	8d common or deformed (2 <sup>1</sup> / <sub>2</sub> " × 0.131" × 0.281" head) (roof) or RSRS-01 (2 <sup>3</sup> / <sub>8</sub> " × 0.113") nail (roof) <sup>d</sup>	6 <sup>e</sup>	6 <sup>e</sup>
	2 <sup>3</sup> / <sub>8</sub> " × 0.113" × 0.266" head nail; or 2" 16 gage staple, <sup>7</sup> / <sub>16</sub> " crown	4	8
32. <sup>7</sup> / <sub>8</sub> " – 1 <sup>1</sup> / <sub>4</sub> "	10d common (3" × 0.148"); or	6	12
	deformed (2 <sup>1</sup> / <sub>2</sub> " × 0.131" × 0.281" head)		
Other exterior wall sheathing			
33. <sup>1</sup> / <sub>2</sub> " fiberboard sheathing <sup>b</sup>	1 <sup>1</sup> / <sub>2</sub> " × 0.120", galvanized roofing nail ( <sup>7</sup> / <sub>16</sub> " head diameter); or	3	6
	1 <sup>1</sup> / <sub>4</sub> " 16 gage staple with <sup>7</sup> / <sub>16</sub> " or		
	1" crown		
34. <sup>25</sup> / <sub>32</sub> " fiberboard sheathing <sup>b</sup>	1 <sup>3</sup> / <sub>4</sub> " × 0.120" galvanized roofing nail ( <sup>7</sup> / <sub>16</sub> " diameter head); or	3	6
	1 <sup>1</sup> / <sub>2</sub> " 16 gage staple with <sup>7</sup> / <sub>16</sub> " or		
	1" crown		
Wood structural panels, combination subfloor underlayment to framing			
35. <sup>3</sup> / <sub>4</sub> " and less	8d common (2 <sup>1</sup> / <sub>2</sub> " × 0.131"); or	6	12
	deformed (2" × 0.113"); or		
	deformed (2" × 0.120")		
36. <sup>7</sup> / <sub>8</sub> " – 1"	8d common (2 <sup>1</sup> / <sub>2</sub> " × 0.131"); or	6	12
	deformed (2 <sup>1</sup> / <sub>2</sub> " × 0.131"); or		
	deformed (2 <sup>1</sup> / <sub>2</sub> " × 0.120")		
37. 1 <sup>1</sup> / <sub>8</sub> " – 1 <sup>1</sup> / <sub>4</sub> "	10d common (3" × 0.148"); or	6	12
	deformed (2 <sup>1</sup> / <sub>2</sub> " × 0.131"); or		
	deformed (2 <sup>1</sup> / <sub>2</sub> " × 0.120")		
Panel siding to framing			
38. <sup>1</sup> / <sub>2</sub> " or less	6d corrosion-resistant siding (1 <sup>7</sup> / <sub>8</sub> " × 0.106"); or	6	12
	6d corrosion-resistant casing (2" × 0.099")		
39. <sup>5</sup> / <sub>8</sub> "	8d corrosion-resistant siding (2 <sup>3</sup> / <sub>8</sub> " × 0.128"); or	6	12
	8d corrosion-resistant casing (2 <sup>1</sup> / <sub>2</sub> " × 0.113")		
Interior paneling			
40. <sup>1</sup> / <sub>4</sub> "	4d casing (1 <sup>1</sup> / <sub>2</sub> " × 0.080"); or	6	12
	4d finish (1 <sup>1</sup> / <sub>2</sub> " × 0.072")		
41. <sup>3</sup> / <sub>8</sub> "	6d casing (2" × 0.099"); or 6d finish (2" × 0.092") (Panel supports at 24 inches)	6	12

For SI: 1 inch = 25.4 mm.

- a. Nails spaced at 6 inches at intermediate supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to [Section 2305](#). Nails for wall sheathing are permitted to be common, box or casing.

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- b. Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).
- c. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule and the ceiling joist is fastened to the top plate in accordance with this schedule, the number of toenails in the rafter shall be permitted to be reduced by one nail.
- d. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in [ASTM F1667](#).
- e. Tabulated fastener requirements apply where the ultimate design wind speed is less than 140 mph. For wood structural panel roof sheathing attached to gable-end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 4 inches on center where the ultimate design wind speed is greater than 130 mph in Exposure B or greater than 110 mph in Exposure C. Spacing exceeding 6 inches on center at intermediate supports shall be permitted where the fastening is designed per the AWC NDS.
- f. Fastening is only permitted where the ultimate design wind speed is less than or equal to 110 mph.
- g. Nails and staples are carbon steel meeting the specifications of [ASTM F1667](#). Connections using nails and staples of other materials, such as stainless steel, shall be designed by acceptable engineering practice or approved under Section 112.2.

#### **2304.10.3 Sheathing fasteners.**

Sheathing nails or other *approved* sheathing connectors shall be driven so that their head or crown is flush with the surface of the sheathing.

#### **2304.10.4 Joist hangers and framing anchors.**

Connections depending on joist hangers or framing anchors, ties and other mechanical fastenings not otherwise covered are permitted where *approved*. The vertical load-bearing capacity, torsional moment capacity and deflection characteristics of joist hangers shall be determined in accordance with [ASTM D7147](#).

#### **2304.10.5 Other fasteners.**

Clips, staples, glues and other *approved* methods of fastening are permitted where *approved*.

#### **2304.10.6 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood.**

Fasteners, including nuts and washers, and connectors in contact with *preservative-treated* and *fire-retardant-treated wood* shall be in accordance with [Sections 2304.10.6.1 through 2304.10.6.4](#). The coating weights for zinc-coated fasteners shall be in accordance with [ASTM A153](#). Stainless steel driven fasteners shall be in accordance with the material requirements of [ASTM F1667](#).

##### **2304.10.6.1 Fasteners and connectors for preservative-treated wood.**

Fasteners, including nuts and washers, in contact with *preservative-treated wood* shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Fasteners other than nails, staples, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with [ASTM B695](#), Class 55 minimum. Connectors that are used in exterior applications and in contact with *preservative-treated wood* shall have coating types and weights in accordance with the treated wood or connector manufacturer's recommendations. In the absence of manufacturer's recommendations, not less than [ASTM A653](#), Type G185 zinc-coated galvanized steel, or equivalent, shall be used.

**Exception:** Plain carbon steel fasteners, including nuts and washers, in SBX/DOT and zinc borate *preservative-treated wood* in an interior, dry environment shall be permitted.

##### **2304.10.6.2 Fastenings for wood foundations.**

Fastenings, including nuts and washers, for wood foundations shall be as required in [AWC PWF](#).

##### **2304.10.6.3 Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations.**

Fasteners, including nuts and washers, for *fire-retardant-treated wood* used in exterior applications or wet or damp locations shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel.

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Fasteners other than nails, staples, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with [ASTM B695](#), Class 55 minimum.

#### **2304.10.6.4 Fasteners for fire-retardant-treated wood used in interior applications.**

Fasteners, including nuts and washers, for *fire-retardant-treated wood* used in interior locations shall be in accordance with the manufacturer's recommendations. In the absence of manufacturer's recommendations, [Section 2304.10.6.3](#) shall apply.

#### **2304.10.7 Load path.**

Where wall framing members are not continuous from the foundation sill to the roof, the members shall be secured to ensure a continuous *load* path. Where required, sheet metal clamps, ties or clips shall be formed of galvanized steel or other *approved* corrosion-resistant material not less than 0.0329-inch (0.836 mm) base metal thickness.

#### **2304.10.8 Framing requirements.**

Wood columns and posts shall be framed to provide full end bearing. Alternatively, column-and-post end connections shall be designed to resist the full compressive *loads*, neglecting end-bearing capacity. Column-and-post end connections shall be fastened to resist lateral and net induced uplift forces.

#### **2304.11 Heavy timber construction.**

Where a structure, portion thereof or individual structural elements are required by provisions of this code to be of heavy timber, the *building elements* therein shall comply with the applicable provisions of [Sections 2304.11.1](#) through [2304.11.4](#). Minimum dimensions of heavy timber shall comply with the applicable requirements in [Table 2304.11](#) based on roofs or floors supported and the configuration of each structural element, or in [Sections 2304.11.2](#) through [2304.11.4](#). Lumber decking shall be in accordance with [Section 2304.9](#).

**TABLE 2304.11  
MINIMUM DIMENSIONS OF HEAVY TIMBER STRUCTURAL MEMBERS**

SUPPORTING	HEAVY TIMBER STRUCTURAL ELEMENTS	MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE		MINIMUM STRUCTURAL COMPOSITE LUMBER NET SIZE	
		Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
Floor loads only or combined floor and roof loads	Columns; Framed sawn or glued-laminated timber arches that spring from the floor line; Framed timber trusses	8	8	6 <sup>3</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>4</sub>	7	7 <sup>1</sup> / <sub>2</sub>
	Wood beams and girders	6	10	5	10 <sup>1</sup> / <sub>2</sub>	5 <sup>1</sup> / <sub>4</sub>	9 <sup>1</sup> / <sub>2</sub>
Roof loads only	Columns (roof and ceiling loads); Lower half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	8	5	8 <sup>1</sup> / <sub>4</sub>	5 <sup>1</sup> / <sub>4</sub>	7 <sup>1</sup> / <sub>2</sub>
	Upper half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	6	5	6	5 <sup>1</sup> / <sub>4</sub>	5 <sup>1</sup> / <sub>2</sub>
	Framed timber trusses and other roof framing; <sup>a</sup> Framed or glued-laminated arches that spring from the top of walls or wall abutments	4 <sup>b</sup>	6	3 <sup>b</sup>	6 <sup>7</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>2</sub> <sup>b</sup>	5 <sup>1</sup> / <sub>2</sub>

For SI: 1 inch = 25.4 mm.

- Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches nominal in thickness.
- Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches nominal in width.

#### **2304.11.1 Details of heavy timber structural members.**

Heavy timber structural members shall be detailed and constructed in accordance with [Sections 2304.11.1](#) through [2304.11.1.3](#).

##### **2304.11.1.1 Columns.**

Minimum dimensions of columns shall be in accordance with [Table 2304.11](#). Columns shall be continuous or superimposed throughout all stories and connected in an *approved* manner. Girders and beams at column connections shall be closely fitted

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around columns and adjoining ends shall be cross tied to each other, or intertied by caps or ties, to transfer horizontal *loads* across joints. Wood bolsters shall not be placed on tops of columns unless the columns support roof *loads* only. Where traditional heavy timber detailing is used, connections shall be by means of reinforced concrete or metal caps with brackets, by properly designed steel or iron caps, with pintles and base plates, by timber splice plates affixed to the columns by metal connectors housed within the contact faces, or by other *approved* methods.

#### **2304.11.1.2 Floor framing.**

Minimum dimensions of floor framing shall be in accordance with [Table 2304.11](#). *Approved* wall plate boxes or hangers shall be provided where wood beams, girders or trusses rest on masonry or concrete walls. Where intermediate beams are used to support a floor, they shall rest on top of girders, or shall be supported by an *approved* metal hanger into which the ends of the beams shall be closely fitted. Where traditional heavy timber detailing is used, these connections shall be permitted to be supported by ledgers or blocks securely fastened to the sides of the girders.

#### **2304.11.1.3 Roof framing.**

Minimum dimensions of roof framing shall be in accordance with [Table 2304.11](#). Every roof girder and not less than every alternate roof beam shall be anchored to its supporting member to resist forces as required in [Chapter 16](#).

#### **2304.11.2 Partitions and walls.**

Partitions and walls shall comply with [Section 2304.11.2.1](#) or [2304.11.2.2](#).

##### **2304.11.2.1 Exterior walls.**

*Exterior walls* shall be permitted to be *cross-laminated timber* not less than 4 inches (102 mm) in thickness meeting the requirements of [Section 2303.1.4](#).

##### **2304.11.2.2 Interior walls and partitions.**

Interior walls and partitions shall be of solid wood construction formed by not less than two layers of 1-inch (25 mm) matched boards or laminated construction 4 inches (102 mm) thick, or of 1-hour fire-resistance-rated construction.

#### **2304.11.3 Floors.**

Floors shall be without concealed [spaces](#) or with [concealed spaces complying with Section 602.4.4.3](#). Wood floors shall be constructed in accordance with [Section 2304.11.3.1](#) or [2304.11.3.2](#).

##### **2304.11.3.1 Cross-laminated timber floors.**

*Cross-laminated timber* shall be not less than 4 inches (102 mm) in actual thickness. *Cross-laminated timber* shall be continuous from support to support and mechanically fastened to one another. *Cross-laminated timber* shall be permitted to be connected to walls without a shrinkage gap providing swelling or shrinking is considered in the design. Corbelling of masonry walls under the floor shall be permitted to be used.

##### **2304.11.3.2 Sawn or glued-laminated plank floors.**

Sawn or glued-laminated plank floors shall be one of the following:

1. Sawn or glued-laminated planks, splined or tongue-and-groove, of not less than 3 inches (76 mm) nominal in thickness covered with 1-inch (25 mm) nominal dimension tongue-and-groove flooring, laid crosswise or diagonally,  $\frac{15}{32}$ -inch (12 mm) *wood structural panel* or  $\frac{1}{2}$ -inch (12.7 mm) *particleboard*.
2. Planks not less than 4 inches (102 mm) nominal in width set on edge close together and well spiked and covered with 1-inch (25 mm) nominal dimension flooring or  $\frac{15}{32}$ -inch (12 mm) *wood structural panel* or  $\frac{1}{2}$ -inch (12.7 mm) *particleboard*.

The lumber shall be laid so that continuous lines of joints will occur only at points of support. Floors shall not extend closer than  $\frac{1}{2}$  inch (12.7 mm) to walls. Such  $\frac{1}{2}$ -inch (12.7 mm) space shall be covered by a molding fastened to the wall and so arranged that it will not obstruct the swelling or shrinkage movements of the floor. Corbelling of masonry walls under the floor shall be permitted to be used in place of molding.

#### **2304.11.4 Roof decks.**

Roofs shall be without concealed spaces or with [concealed spaces complying with Section 602.4.4.3](#). Roof decks shall be constructed in accordance with [Section 2304.11.4.1](#) or [2304.11.4.2](#). Other types of decking shall be an alternative that provides equivalent *fire resistance* and structural properties. Where supported by a wall, *roof decks* shall be anchored to walls to resist forces determined in accordance with [Chapter 16](#). Such anchors shall consist of steel bolts, lags, screws or *approved* hardware of sufficient strength to resist prescribed forces.

##### **2304.11.4.1 Cross-laminated timber roofs.**

*Cross-laminated timber* roofs shall be not less than 3 inches (76 mm) nominal in thickness and shall be continuous from support to support and mechanically fastened to one another.

##### **2304.11.4.2 Sawn, wood structural panel, or glued-laminated plank roofs.**

Sawn, *wood structural panel*, or glued-laminated plank roofs shall be one of the following:

1. Sawn or glued laminated, splined or tongue-and-groove plank, not less than 2 inches (51 mm) nominal in thickness.
2.  $\frac{1}{8}$ -inch-thick (32 mm) *wood structural panel* (exterior glue).

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3. Planks not less than 3 inches (76 mm) nominal in width, set on edge close together and laid as required for floors.

#### **2304.12 Protection against decay and termites.**

Wood shall be protected from decay and termites in accordance with the applicable provisions of [Sections 2304.12.1](#) through [2304.12.4](#).

##### **2304.12.1 Locations requiring waterborne preservatives or naturally durable wood.**

Wood used above ground in the locations specified in [Sections 2304.12.1.1](#) through [2304.12.1.5](#) shall be *naturally durable wood* or *preservative-treated wood* using waterborne preservatives, in accordance with [AWPA U1](#) for above-ground use.

###### **2304.12.1.1 Joists, girders and subfloor.**

Wood joists or wood structural floors that are closer than 18 inches (457 mm) or wood girders that are closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation shall be of naturally durable or *preservative-treated wood*.

###### **2304.12.1.2 Wood supported by exterior foundation walls.**

Wood framing members, including wood sheathing, that are in contact with exterior foundation walls and are less than 8 inches (203 mm) from exposed earth shall be of naturally durable or *preservative-treated wood*.

###### **2304.12.1.3 Exterior walls below grade.**

Wood framing members and furring strips in direct contact with the interior of exterior masonry or concrete walls below grade shall be of naturally durable or *preservative-treated wood*.

###### **2304.12.1.4 Sleepers and sills.**

Sleepers and sills on a concrete or masonry slab that is in direct contact with earth shall be of naturally durable or *preservative-treated wood*.

###### **2304.12.1.5 Wood siding.**

Clearance between wood siding and earth on the exterior of a building shall be not less than 6 inches (152 mm) or less than 2 inches (51 mm) vertical from concrete steps, porch slabs, patio slabs and similar horizontal surfaces exposed to the weather except where siding, sheathing and wall framing are of naturally durable or *preservative-treated wood*.

##### **2304.12.2 Other locations.**

Wood used in the locations specified in [Sections 2304.12.2.1](#) through [2304.12.2.8](#) shall be *naturally durable wood* or *preservative-treated wood* in accordance with [AWPA U1](#). *Preservative-treated wood* used in interior locations shall be protected with two coats of urethane, shellac, latex epoxy or varnish unless waterborne preservatives are used. Prior to application of the protective finish, the wood shall be dried in accordance with the manufacturer's recommendations.

###### **2304.12.2.1 Girder ends.**

The ends of wood girders entering exterior masonry or concrete walls shall be provided with a  $\frac{1}{2}$ -inch (12.7 mm) airspace on top, sides and end, unless naturally durable or *preservative-treated wood* is used.

###### **2304.12.2.2 Posts or columns.**

Posts or columns supporting permanent structures and supported by a concrete or masonry slab or footing that is in direct contact with the earth shall be of naturally durable or *preservative-treated wood*.

**Exception:** Posts or columns that meet all of the following:

1. Are not exposed to the weather, or are protected by a roof, eave, overhang, or other covering if exposed to the weather.
2. Are supported by concrete piers or metal pedestals projected not less than 1 inch (25 mm) above the slab or deck and are separated from the concrete pier by an impervious moisture barrier.
3. Are located not less than 8 inches (203 mm) above exposed earth.

###### **2304.12.2.3 Supporting member for permanent appurtenances.**

Naturally durable or *preservative-treated wood* shall be utilized for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances where such members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering to prevent moisture or water accumulation on the surface or at joints between members.

**Exception:** [Sawn lumber in buildings](#) located in a geographical region where experience has demonstrated that climatic conditions preclude the need to use durable materials where the structure is exposed to the weather.

###### **2304.12.2.4 Supporting members for permeable floors and roofs.**

Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or *preservative-treated wood* unless separated from such floors or roofs by an impervious moisture barrier. The impervious moisture barrier system protecting the structure supporting floors shall provide positive drainage of water that infiltrates the moisture-permeable floor topping.

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#### **2304.12.2.5 Ventilation beneath balcony or elevated walking surfaces.**

Enclosed framing in exterior balconies and elevated walking surfaces that ~~have~~ *weather-exposed surfaces* shall be provided with openings that provide a net free cross-ventilation area not less than  $\frac{1}{150}$  of the area of each separate space.

Relocated

Relocated

#### **2304.12.2.6 Wood in contact with the ground or fresh water.**

Wood used in contact with exposed earth shall be naturally durable for both decay and termite resistance or preservative treated in accordance with [AWPA U1](#) for soil or fresh water use.

**Exception:** Untreated wood is permitted where such wood is continuously and entirely below the ground-water level or submerged in fresh water.

##### **2304.12.2.6.1 Posts or columns.**

Posts and columns that are supporting permanent structures and embedded in concrete that is exposed to the weather or in direct contact with the earth shall be of *preservative-treated wood*.

##### **2304.12.2.7 Termite protection.**

In geographical areas where hazard of termite damage is known to be very heavy, wood floor framing in the locations specified in [Section 2304.12.1.1](#) and exposed framing of exterior decks or balconies shall be of *naturally durable species* (*termite resistant*) or preservative treated in accordance with [AWPA U1](#) for the species, product preservative and end use or provided with *approved* methods of termite protection.

##### **2304.12.2.8 Wood used in retaining walls and cribs.**

Wood installed in retaining or crib walls shall be preservative treated in accordance with [AWPA U1](#) for soil and fresh water use.

##### **2304.12.3 Attic ventilation.**

For *attic* ventilation, see [Section 1202.2.2](#).

##### **2304.12.4 Under-floor ventilation (crawl space).**

For under-floor ventilation (crawl space), see [Section 1202.4](#).

#### **2304.13 Long-term loading.**

Wood members supporting concrete, masonry or similar materials shall be checked for the effects of long-term loading using the provisions of the [ANSI/AWC NDS](#). The total deflection, including the effects of long-term loading, shall be limited in accordance with [Section 1604.3.1](#) for these supported materials.

**Exception:** Horizontal wood members supporting masonry or concrete nonstructural floor or roof surfacing not more than 4 inches (102 mm) thick need not be checked for long-term loading.