

## Building Loads

In this chapter we will consider the variety of forces acting on a building's frame. Understanding these forces (*loads* in building parlance), we can calculate the total load on an individual framing member. Being able to calculate loads is a powerful tool. It is the key that allows us to use span tables.

Building loads are the forces a building frame must support or resist. Building codes recognize five types of load:

- Dead—the weight of the building materials.
- Live—the weight due to occupancy; i.e., the weight of people, furnishings, and stored materials.
- Snow—the weight of snow on the roof.
- Wind—the force of the wind against exterior building surfaces, including the roof.
- Seismic—the force of the reaction of the building to the acceleration of the earth beneath.

### Dead Loads

For a floor or roof, the dead load in pounds per square foot (psf) is found by adding the weights of the materials of which it is constructed using the table at right.

*Example 1:* A first floor framed with 2x8 joists, spaced 16 inches on-center, and covered with  $\frac{5}{8}$ -inch plywood and wall-to-wall carpet weighs  $2.2 \text{ psf} + 1.8 \text{ psf} + 0.6 \text{ psf} = 4.6 \text{ psf}$ .

*Example 2:* A second floor framed with 2x6 joists, spaced 16 inches on-center, with  $\frac{1}{2}$ -inch drywall ceiling below and floored with  $\frac{1}{2}$ -inch plywood and  $\frac{3}{4}$ -inch hardwood above, weighs  $1.7 \text{ psf} + 2.2 \text{ psf} + 1.5 \text{ psf} + 3.0 \text{ psf} = 8.4 \text{ psf}$ .

*Example 3:* A roof with 2x8 joists 16 inches on-center, 6-inch fiberglass batts,  $\frac{1}{2}$ -inch plywood sheathing, and asphalt shingles weighs  $2.2 \text{ psf} + 1.8 \text{ psf} + 1.5 \text{ psf} + 2.5 \text{ psf} = 8.0 \text{ psf}$ .

### Weights of Building Materials

Component	Material	psf
Framing	2x4 @ 16" oc	1.1
	2x4 @ 24" oc	0.7
2x6 @ 16" oc		1.7
	2x6 @ 24" oc	1.1
2x8 @ 16" oc		2.2
	2x8 @ 24" oc	1.5
2x10 @ 16" oc		2.8
	2x10 @ 24" oc	1.9
Flooring	Softwood, per inch	3.0
	Hardwood, per inch	4.0
1/2" Plywood		1.5
	5/8" Plywood	1.8
3/4" Plywood		2.3
	1 1/8" Plywood	3.4
Sheet vinyl		1.5
	Carpet and pad	0.6
3/4" Tile		10.0
	3/4" Gypcrete	6.5
Concrete, per inch		12.0
	Stone, per inch	13.0
Ceiling	1/2" Drywall	2.2
	Plaster, per inch	8.0
Roofing	Acoustic tile	1.0
	Asphalt shingles	2.5
Asphalt roll roofing		1.2
	Asphalt, built-up	6.0
Wood shingles		3.0
	Wood shakes	6.0
Roman tile		12.0
	Spanish tile	19.0
Slate, 3/8"		12.0
	Steel	2.0
Insulation	Fiberglass wool, per inch	0.3
	Fiberglass board, per inch	1.5
	Foam, per inch	0.2

### Live Loads

Minimum live load capacities are specified by building code. The table at right lists the IRC requirements for one- and two-family residential construction. The roof loads shown assume a maximum loaded area of 200 square feet per rafter.

### Live Loads (IRC)

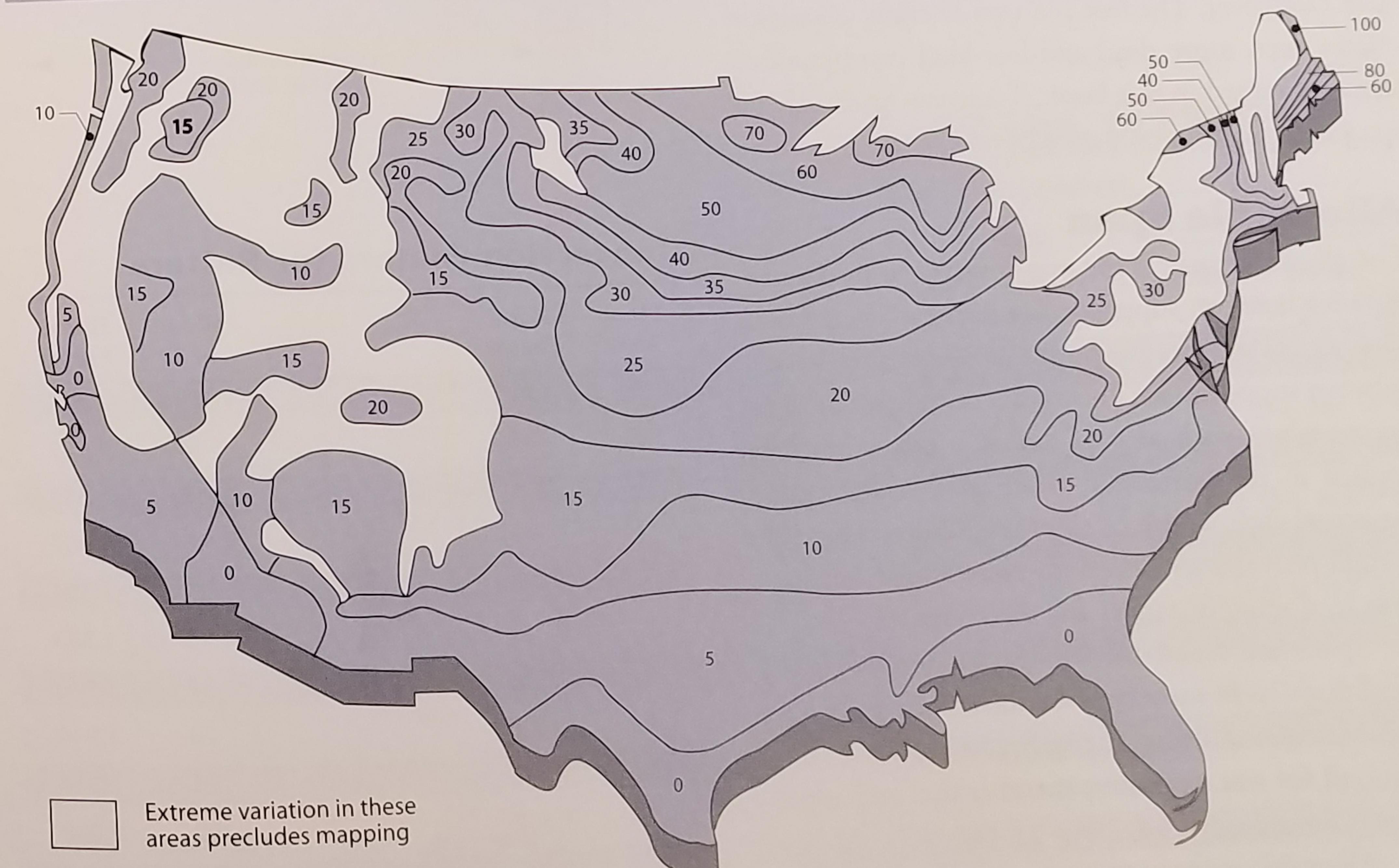
Area	psf
Attics with storage	20
Attics without storage	10
Decks	40
Exterior balconies	60
Fire escapes	40
Passenger vehicle garages	50
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40
Roof, rise < 4" per foot	20
rise 4"-12" per foot	16
rise >12" per foot	12

### Snow Loads

The snow load on a roof is taken over its horizontal projection; i.e., its span. It is thus the same as the ground snow load. The map below is simplified from the Ground Snow Load in the International Residential Code.

Important: if you live in one of the unshaded (mountainous) areas, consult your code official.

### Ground Snow Loads, PSF



## Span Tables for U.S. Species

The span tables on pp. 127–147 are adapted from *The U.S. Span Book for Major Lumber Species*. The book, available from the Canadian Wood Council, was created in conformance with the procedures of U.S. grading and building authorities and with the design methods of the American Forest and Paper Association's *National Design Specification for Wood Construction*.

The book provides a convenient reference for the common species of U.S. and Canadian dimension lumber, fully in accord with U.S. building codes and Federal Housing Administration (FHA) requirements. It is important to note, however, that the tables apply only to construction in the United States.

### Online Span Calculator

For those who prefer computers to books, the Canadian Wood Council offers a handy on-line span calculator. The free and user-friendly calculator allows even more dead-and-live load combinations than contained in this book. To access *SpanCalc*, go to: [www.tuperry.com/spancalc/index.html](http://www.tuperry.com/spancalc/index.html).

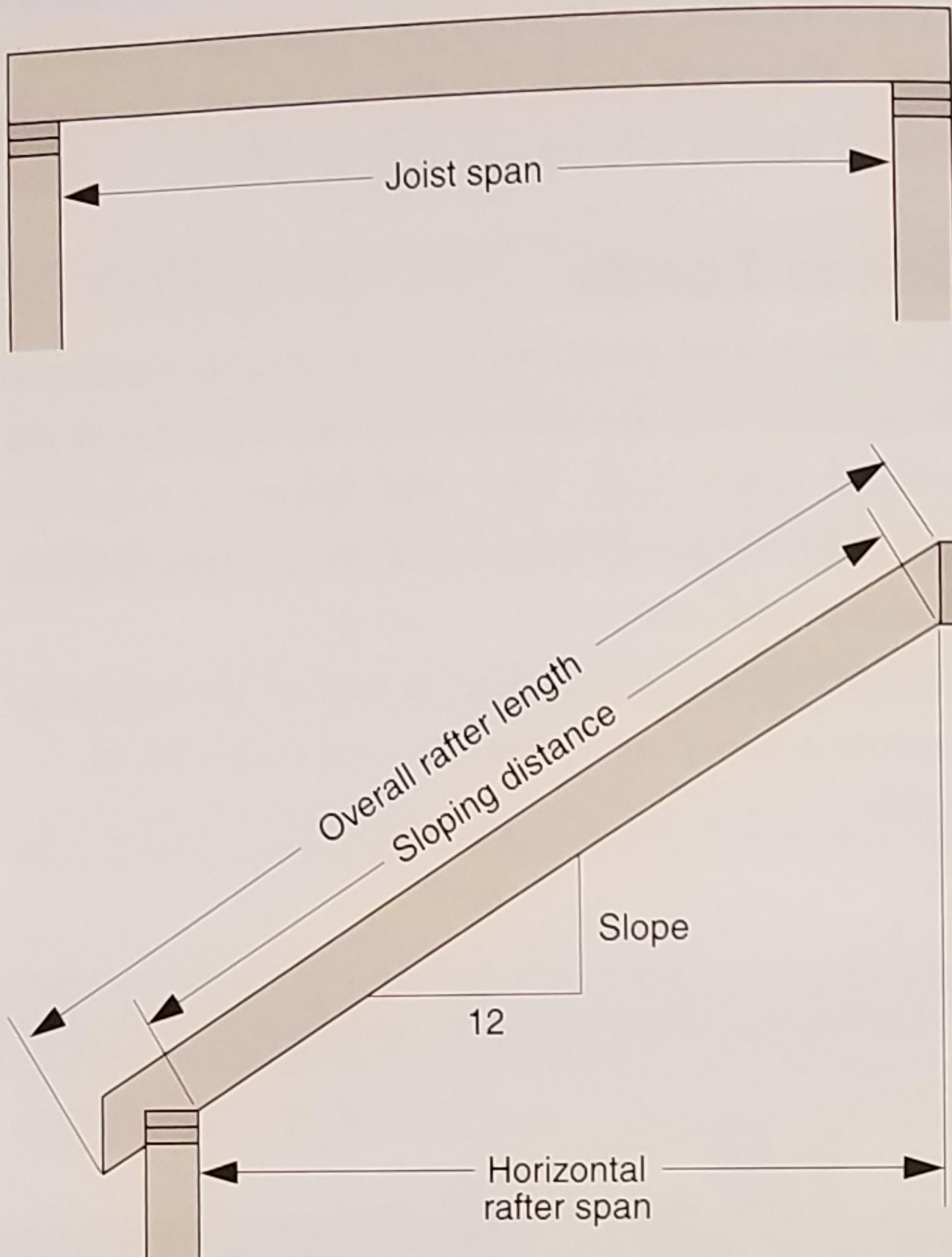
### Allowable Span

The allowable span is the maximum clear horizontal distance between supports. For horizontal members such as joists, the clear span is the actual length between supports (see illustration at right). For sloping members such as roof rafters, a factor must be applied to the horizontal rafter span to determine the actual clear length or sloping distance. The table at right provides a method for converting horizontal span to sloping distance, and vice versa.

Spans are based on the use of lumber in dry conditions, as in most covered structures. They have been calculated using strength and stiffness values adjusted for size, repetitive member use, and appropriate duration of load.

Allowable spans in some cases (e.g., ceiling joists) may exceed available lengths. Availability should be confirmed before specification for a project.

### Definition of Span



### Conversion Factors for Rafters

Slope in 12	Slope Factor	Slope in 12	Slope Factor
1	1.003	13	1.474
2	1.014	14	1.537
3	1.031	15	1.601
4	1.054	16	1.667
5	1.083	17	1.734
6	1.118	18	1.803
7	1.158	19	1.873
8	1.202	20	1.944
9	1.250	21	2.016
10	1.302	22	2.088
11	1.357	23	2.162
12	1.414	24	2.236

## Floor Joists

### Sleeping Rooms and Attics: 30 PSF Live, 10 PSF Dead

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)																	
		2 x 6			2 x 8			2 x 10			2 x 12								
Sel Str	GRADE	No.1	No.2	No.3	Sel Str	GRADE	No.1	No.2	No.3	Sel Str	GRADE	No.1	No.2	No.3	Sel Str	GRADE	No.1	No.2	No.3
Douglas fir-larch	12	12-6	12-0	11-10	9-11	16-6	15-10	15-7	12-7	21-0	20-3	19-10	15-5	25-7	24-8	23-4	17-10		
	16	11-4	10-11	10-9	8-7	15-0	14-5	14-2	10-11	19-1	18-5	17-5	13-4	23-3	21-4	20-3	15-5		
	19.2	10-8	10-4	10-1	7-10	14-1	13-7	13-0	10-0	18-0	16-9	15-11	12-2	21-10	19-6	18-6	14-1		
	24	9-11	9-7	9-3	7-0	13-1	12-4	11-8	8-11	16-8	15-0	14-3	10-11	20-3	17-5	16-6	12-7		
Hem-fir	12	11-10	11-7	11-0	9-8	15-7	15-3	14-6	12-4	19-10	19-5	18-6	15-0	24-2	23-7	22-6	17-5		
	16	10-9	10-6	10-0	8-5	14-2	13-10	13-2	10-8	18-0	17-8	16-10	13-0	21-11	21-1	19-8	15-1		
	19.2	10-1	9-10	9-5	7-8	13-4	13-0	12-5	9-9	17-0	16-7	15-6	11-10	20-8	19-3	17-11	13-9		
	24	9-4	9-2	8-9	6-10	12-4	12-1	11-4	8-8	15-9	14-10	13-10	10-7	19-2	17-2	16-1	12-4		
Southern pine	12	12-3	12-0	11-10	10-5	16-2	15-10	15-7	13-3	20-8	20-3	19-10	15-8	25-1	24-8	24-2	18-8		
	16	11-2	10-11	10-9	9-0	14-8	14-5	14-2	11-6	18-9	18-5	18-0	13-7	22-10	22-5	21-1	16-2		
	19.2	10-6	10-4	10-1	8-3	13-10	13-7	13-4	10-6	17-8	17-4	16-5	12-5	21-6	21-1	19-3	14-9		
	24	9-9	9-7	9-4	7-4	12-10	12-7	12-4	9-5	16-5	16-1	14-8	11-1	19-11	19-6	17-2	13-2		

### All Rooms Except Sleeping Rooms and Attics: 40 PSF Live, 10 PSF Dead

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)												2 x 12					
		2 x 6			2 x 8			2 x 10			2 x 12			Sel Str	GRADE	No.1	No.2	No.3	
Sel Str	GRADE	No.1	No.2	No.3	Sel Str	GRADE	No.1	No.2	No.3	Sel Str	GRADE	No.1	No.2	No.3	Sel Str	GRADE	No.1	No.2	No.3
Douglas fir-larch	12	11-4	10-11	10-9	8-11	15-0	14-5	14-2	11-3	19-1	18-5	18-0	13-9	23-3	22-0	20-11	16-0		
	16	10-4	9-11	9-9	7-8	13-7	13-1	12-9	9-9	17-4	16-5	15-7	11-11	21-1	19-1	18-1	13-10		
	19.2	9-8	9-4	9-2	7-0	12-10	12-4	11-8	8-11	16-4	15-0	14-3	10-11	19-10	17-5	16-6	12-7		
	24	9-0	8-8	8-3	6-3	11-11	11-0	10-5	8-0	15-2	13-5	12-9	9-9	18-5	15-7	14-9	11-3		
Hem-fir	12	10-9	10-6	10-0	8-8	14-2	13-10	13-2	11-0	18-0	17-8	16-10	13-5	21-11	21-6	20-4	15-7		
	16	9-9	9-6	9-1	7-6	12-10	12-7	12-0	9-6	16-5	16-0	15-2	11-8	19-11	18-10	17-7	13-6		
	19.2	9-2	9-0	8-7	6-10	12-1	11-10	11-3	8-8	15-5	14-10	13-10	10-7	18-9	17-2	16-1	12-4		
	24	8-6	8-4	7-11	6-2	11-3	10-10	10-2	7-9	14-4	13-3	12-5	9-6	17-5	15-5	14-4	11-0		
Southern pine	12	11-2	10-11	10-9	9-4	14-8	14-5	14-2	11-11	18-9	18-5	18-0	14-0	22-10	22-5	21-9	16-8		
	16	10-2	9-11	9-9	8-1	13-4	13-1	12-10	10-3	17-0	16-9	16-1	12-2	20-9	20-4	18-10	14-6		
	19.2	9-6	9-4	9-2	7-4	12-7	12-4	12-1	9-5	16-0	15-9	14-8	11-1	19-6	19-2	17-2	13-2		
	24	8-10	8-8	8-6	6-7	11-8	11-5	11-0	8-5	14-11	14-7	13-1	9-11	18-1	17-5	15-5	11-10		

## Ceiling Joists

Drywall—No Future Rooms and No Attic Storage: 10 PSF Live, 5 PSF Dead

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)															
		2 x 4			2 x 6			2 x 8			2 x 10						
Sel Str	No.1	No.2	No.3	Sel Str	No.1	No.2	No.3	Sel Str	No.1	No.2	No.3	Sel Str	No.1				
Douglas fir-larch	12	13-2	12-8	12-5	11-1	20-8	19-11	19-6	16-3	27-2	26-2	25-8	20-7	34-8	33-5	32-9	25-2
	16	11-11	11-6	11-3	9-7	18-9	18-1	17-8	14-1	24-8	23-10	23-4	17-10	31-6	30-0	28-6	21-9
	19.2	11-3	10-10	10-7	8-9	17-8	17-0	16-8	12-10	23-3	22-5	21-4	16-3	29-8	27-5	26-0	19-10
	24	10-5	10-0	9-10	7-10	16-4	15-9	15-0	11-6	21-7	20-1	19-1	14-7	27-6	24-6	23-3	17-9
Hem-fir	12	12-5	12-2	11-7	10-10	19-6	19-1	18-2	15-10	25-8	25-2	24-0	20-1	32-9	32-1	30-7	24-6
	16	11-3	11-0	10-6	9-5	17-8	17-4	16-6	13-9	23-4	22-10	21-9	17-5	29-9	29-2	27-8	21-3
	19.2	10-7	10-4	9-11	8-7	16-8	16-4	15-7	12-6	21-11	21-6	20-6	15-10	28-0	27-1	25-3	19-5
	24	9-10	9-8	9-2	7-8	15-6	15-2	14-5	11-2	20-5	19-10	18-6	14-2	26-0	24-3	22-7	17-4
Southern pine	12	12-11	12-8	12-5	11-6	20-3	19-11	19-6	17-0	26-9	26-2	25-8	21-8	34-1	33-5	32-9	25-7
	16	11-9	11-6	11-3	10-0	18-5	18-1	17-8	14-9	24-3	23-10	23-4	18-9	31-0	30-5	29-4	22-2
	19.2	11-0	10-10	10-7	9-1	17-4	17-0	16-8	13-6	22-10	22-5	21-11	17-2	29-2	28-7	26-10	20-3
	24	10-3	10-0	9-10	8-2	16-1	15-9	15-6	12-0	21-2	20-10	20-1	15-4	27-1	26-6	23-11	18-1

Drywall—No Future Rooms and Limited Attic Storage: 20 PSF Live, 10 PSF Dead

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)															
		2 x 4			2 x 6			2 x 8			2 x 10						
Sel Str	No.1	No.2	No.3	Sel Str	No.1	No.2	No.3	Sel Str	No.1	No.2	No.3	Sel Str	No.1				
Douglas fir-larch	12	10-5	10-0	9-10	7-10	16-4	15-9	15-0	11-6	21-7	20-1	19-1	14-7	27-6	24-6	23-3	17-9
	16	9-6	9-1	8-11	6-10	14-11	13-9	13-0	9-11	19-7	17-5	16-6	12-7	25-0	21-3	20-2	15-5
	19.2	8-11	8-7	8-2	6-2	14-0	12-6	11-11	9-1	18-5	15-10	15-1	11-6	23-7	19-5	18-5	14-1
	24	8-3	7-8	7-3	5-7	13-0	11-2	10-8	8-1	17-2	14-2	13-6	10-3	21-3	17-4	16-5	12-7
Hem-fir	12	9-10	9-8	9-2	7-8	15-6	15-2	14-5	11-2	20-5	19-10	18-6	14-2	26-0	24-3	22-7	17-4
	16	8-11	8-9	8-4	6-8	14-1	13-7	12-8	9-8	18-6	17-2	16-0	12-4	23-8	21-0	19-7	15-0
	19.2	8-5	8-3	7-10	6-1	13-3	12-4	11-7	8-10	17-5	15-8	14-8	11-3	22-3	19-2	17-10	13-8
	24	7-10	7-7	7-1	5-5	12-3	11-1	10-4	7-11	16-2	14-0	13-1	10-0	20-6	17-1	16-0	12-3
Southern pine	12	10-3	10-0	9-10	8-2	16-1	15-9	15-6	12-0	21-2	20-10	20-1	15-4	27-1	26-6	23-11	18-1
	16	9-4	9-1	8-11	7-1	14-7	14-4	13-6	10-5	19-3	18-11	17-5	13-3	24-7	23-1	20-9	15-8
	19.2	8-9	8-7	8-5	6-5	13-9	13-6	12-3	9-6	18-2	17-9	15-10	12-1	23-2	21-1	18-11	14-4
	24	8-1	8-0	7-8	5-9	12-9	12-6	11-0	8-6	16-10	15-10	14-2	10-10	21-6	18-10	16-11	12-10

## Rafters

Snow Region, Light Roof, Drywall, No Attic Space: 20 PSF Live, 10 PSF Dead

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)														
		2 x 6			2 x 8			2 x 10			2 x 12					
Sel Str	No.1	No.2	No.3	Sel Str	No.1	No.2	No.3	Sel Str	No.1	No.2	No.3	Sel Str	No.1	No.2	No.3	
Douglas fir-larch	12	16-4		15-9	15-6	12-4	21-7		20-10	20-5	15-7	27-6		26-4	24-11	19-1
	16	14-11		14-4	14-0	10-8	19-7		18-8	17-8	13-6	25-0		22-9	21-7	16-6
	19.2	14-0		13-5	12-9	9-9	18-5		17-0	16-2	12-4	23-7		20-9	19-9	15-1
	24	13-0		12-0	11-5	8-9	17-2		15-3	14-5	11-0	21-10		18-7	17-8	13-6
Hem-fir	12	15-6		15-2	14-5	12-0	20-5		19-11	19-0	15-3	26-0		25-5	24-3	18-7
	16	14-1		13-9	13-1	10-5	18-6		18-2	17-2						

## Rafters

### Snow Region, Light Roof, Drywall, No Attic Space: 40 PSF Live, 10 PSF Dead

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)											
		2 x 6			2 x 8			2 x 10			2 x 12		
		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3	
Douglas fir-larch	12	13-2 12-6 12-3 9-6		17-2 16-6 15-10 12-1		21-10 20-4 19-4 14-9		26-7 23-7 22-5 17-1					
	16	11-10 11-5 10-10 8-3		15-7 14-5 13-8 10-6		19-10 17-8 16-9 12-9		24-2 20-5 19-5 14-10					
	19.2	11-1 10-5 9-10 7-7		14-8 13-2 12-6 9-7		18-8 16-1 15-3 11-8		22-9 18-8 17-9 13-6					
	24	10-4 9-4 8-10 6-9		13-7 11-9 11-2 8-7		17-4 14-5 13-8 10-5		20-5 16-8 15-10 12-1					
Hem-fir	12	12-3 12-0 11-5 9-4		16-2 15-10 15-1 11-9		20-8 20-1 18-9 14-5		25-1 23-4 21-9 16-8					
	16	11-2 10-11 10-5 8-1		14-8 14-3 13-4 10-3		18-9 17-5 16-3 12-6		22-10 20-2 18-10 14-6					
	19.2	10-6 10-3 9-7 7-4		13-10 13-0 12-2 9-4		17-8 15-11 14-10 11-5		21-6 18-5 17-3 13-2					
	24	9-9 9-2 8-7 6-7		12-10 11-8 10-10 8-4		16-5 14-3 13-3 10-2		19-9 16-6 15-5 11-10					
Southern pine	12	12-9 12-6 12-3 10-0		16-10 16-6 16-2 12-9		21-6 21-1 19-11 15-1		26-1 25-7 23-4 17-11					
	16	11-7 11-5 11-2 8-8		15-3 15-0 14-5 11-0		19-6 19-2 17-3 13-0		23-9 22-10 20-2 15-6					
	19.2	10-11 10-8 10-2 7-11		14-5 14-1 13-2 10-1		18-4 17-6 15-9 11-11		22-4 20-11 18-5 14-2					
	24	10-2 9-11 9-2 7-1		13-4 13-1 11-9 9-0		17-0 15-8 14-1 10-8		20-9 18-8 16-6 12-8					

## Rafters

### Snow Region, Heavy Roof, Drywall, No Attic Space: 20 PSF Live, 20 PSF Dead

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)											
		2 x 6			2 x 8			2 x 10			2 x 12		
		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3	
Douglas fir-larch	12	16-4 14-9 14-0 10-8		21-7 18-8 17-8 13-6		27-6 22-9 21-7 16-6		32-4 26-5 25-1 19-2					
	16	14-11 12-9 12-1 9-3		19-7 16-2 15-4 11-8		24-2 19-9 18-9 14-3		28-0 22-10 21-8 16-7					
	19.2	14-0 11-8 11-0 8-5		18-1 14-9 14-0 10-8		22-1 18-0 17-1 13-1		25-7 20-11 19-10 15-2					
	24	12-9 10-5 9-10 7-7		16-2 13-2 12-6 9-7		19-9 16-1 15-3 11-8		22-10 18-8 17-9 13-6					
Hem-fir	12	15-6 14-6 13-7 10-5		20-5 18-5 17-2 13-2		26-0 22-6 21-0 16-1		31-3 26-1 24-4 18-8					
	16	14-1 12-7 11-9 9-0		18-6 15-11 14-11 11-5		23-4 19-6 18-2 13-11		27-1 22-7 21-1 16-2					
	19.2	13-3 11-6 10-9 8-3		17-5 14-7 13-7 10-5		21-4 17-9 16-7 12-9		24-8 20-7 19-3 14-9					
	24	12-3 10-3 9-7 7-4		15-7 13-0 12-2 9-4		19-1 15-11 14-10 11-5		22-1 18-5 17-3 13-2					
Southern pine	12	16-1 15-9 14-5 11-2		21-2 20-10 18-8 14-3		27-1 24-9 22-3 16-10		32-11 29-6 26-1 20-0					
	16	14-7 14-4 12-6 9-8		19-3 18-1 16-2 12-4		24-7 21-5 19-3 14-7		29-11 25-7 22-7 17-4					
	19.2	13-9 13-1 11-5 8-10		18-2 16-6 14-9 11-3		23-2 19-7 17-7 13-4		28-1 23-4 20-7 15-10					
	24	12-9 11-9 10-2 7-11		16-10 14-9 13-2 10-1		21-6 17-6 15-9 11-11		25-9 20-11 18-5 14-2					

### Snow Region, Heavy Roof, Drywall, No Attic Space: 30 PSF Live, 20 PSF Dead

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)											
		2 x 6			2 x 8			2 x 10			2 x 12		
		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3	
Douglas fir-larch	12	14-4 13-2 12-6 9-6		18-10 16-8 15-10 12-1		24-1 20-4 19-4 14-9		28-11 23-7 22-5 17-1					
	16	13-0 11-5 10-10 8-3		17-2 14-5 13-8 10-6		21-7 17-8 16-9 12-9		25-1 20-5 19-5 14-10					
	19.2	12-3 10-5 9-10 7-7		16-1 13-2 12-6 9-7		19-9 16-1 15-3 11-8		22-10 18-8 17-9 13-6					
	24	11-4 9-4 8-10 6-9		14-5 11-9 11-2 8-7		17-8 14-5 13-8 10-5		20-5 16-8 15-10 12-1					
Hem-fir	12	13-6 13-0 12-2 9-4		17-10 16-6 15-4 11-9		22-9 20-1 18-9 14-5		27-8 23-4 21-9 16-8					
	16	12-3 11-3 10-6 8-1		16-2 14-3 13-4 10-3		20-8 17-5 16-3 12-6		24-2 20-2 18-10 14-6					
	19.2	11-7 10-3 9-7 7-4		15-3 13-0 12-2 9-4		19-1 15-11 14-10 11-5		22-1 18-5 17-3 13-2					
	24	10-9 9-2 8-7 6-7		13-11 11-8 10-10 8-4		17-1 14-3 13-3 10-2		19-9 16-6 15-5 11-10					
Southern pine	12	14-1 13-9 12-1											

## Rafters

**Snow Region, Light Roof, No Ceiling, 20 PSF Live, 10 PSF Dead**

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)											
		2 x 4			2 x 6			2 x 8			2 x 10		
		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3	
Douglas fir-larch	12	11-6 11-1 10-10 8-5		18-0 17-0 16-2 12-4		23-9 21-6 20-5 15-7		30-4 26-4 24-11 19-1					
	16	10-5 10-0 9-7 7-3		16-4 14-9 14-0 10-8		21-7 18-8 17-8 13-6		27-6 22-9 21-7 16-6					
	19.2	9-10 9-2 8-9 6-8		15-5 13-5 12-9 9-9		20-4 17-0 16-2 12-4		25-6 20-9 19-9 15-1					
	24	9-1 8-3 7-10 5-11		14-4 12-0 11-5 8-9		18-8 15-3 14-5 11-0		22-9 18-7 17-8 13-6					
	Hem-fir	10-10 10-7 10-1 8-3		17-0 16-8 15-8 12-0		22-5 21-3 19-10 15-3		28-7 26-0 24-3 18-7					
Hem-fir	12	10-10 10-7 10-1 8-3		17-0 16-8 15-8 12-0		22-5 21-3 19-10 15-3		28-7 26-0 24-3 18-7					
	16	9-10 9-8 9-2 7-1		15-6 14-6 13-7 10-5		20-5 18-5 17-2 13-2		26-0 22-6 21-0 16-1					
	19.2	9-3 9-1 8-6 6-6		14-7 13-3 12-5 9-6		19-2 16-10 15-8 12-0		24-6 20-6 19-2 14-8					
	24	8-7 8-1 7-7 5-10		13-6 11-10 11-1 8-6		17-10 15-0 14-0 10-9		22-0 18-4 17-2 13-2					
	Southern pine	11-3 11-1 10-10 8-9		17-8 17-4 16-8 12-11		23-4 22-11 21-6 16-5		29-9 28-7 25-8 19-5					
Southern pine	12	10-3 10-0 9-10 7-7		16-1 15-9 14-5 11-2		21-2 20-10 18-8 14-3		27-1 24-9 22-3 16-10					
	16	9-8 9-5 9-2 6-11		15-2 14-10 13-2 10-2		19-11 19-0 17-0 13-0		25-5 22-7 20-4 15-4					
	19.2	8-11 8-9 8-2 6-2		14-1 13-6 11-9 9-2		18-6 17-0 15-3 11-8		23-8 20-3 18-2 13-9					
	24												

**Snow Region, Light Roof, No Ceiling: 30 PSF Live, 10 PSF Dead**

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)											
		2 x 4			2 x 6			2 x 8			2 x 10		
		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3	
Douglas fir-larch	12	10-0 9-8 9-6 7-3		15-9 14-9 14-0 10-8		20-9 18-8 17-8 13-6		26-6 22-9 21-7 16-6					
	16	9-1 8-9 8-3 6-4		14-4 12-9 12-1 9-3		18-10 16-2 15-4 11-8		24-1 19-9 18-9 14-3					
	19.2	8-7 7-11 7-7 5-9		13-6 11-8 11-0 8-5		17-9 14-9 14-0 10-8		22-1 18-0 17-1 13-1					
	24	7-11 7-1 6-9 5-2		12-6 10-5 9-10 7-7		16-2 13-2 12-6 9-7		19-9 16-1 15-3 11-8					
	Hem-fir	9-6 9-3 8-10 7-1		14-10 14-6 13-7 10-5		19-7 18-5 17-2 13-2		25-0 22-6 21-0 16-1					
Hem-fir	12	8-7 8-5 8-0 6-2		13-6 12-7 11-9 9-0		17-10 15-11 14-11 11-5		22-9 19-6 18-2 13-11					
	16	8-1 7-10 7-4 5-8		12-9 11-6 10-9 8-3		16-9 14-7 13-7 10-5		21-4 17-9 16-7 12-9					
	19.2	7-6 7-0 6-7 5-0		11-10 10-3 9-7 7-4		15-7 13-0 12-2 9-4		19-1 15-11 14-10 11-5					
	Southern pine	9-10 9-8 9-6 7-7		15-6 15-2 14-5 11-2		20-5 20-0 18-8 14-3		26-0 24-9 22-3 16-10					
	24	8-5 8-3 7-11 6-0		13-3 13-0 11-5 8-10		17-5 16-6 14-9 11-3		22-3 19-7 17-7 13-4					

## Rafters

**Snow Region, Light Roof, No Ceiling: 40 PSF Live, 10 PSF Dead**

Species Group	Spacing in oc	Maximum Allowable Span (feet-inches)											
		2 x 4			2 x 6			2 x 8			2 x 10		
		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3		Sel Str No.1 No.2 No.3	
Douglas fir-larch	12	9-1 8-9 8-6 6-4		13-0 11-5 10-10 8-3		17-2 14-5 13-8 10-6		21-7 17-8 16-9 12-9					
	16	8-3 7-10 7-5 5-8		12-3 10-5 9-10 7-7		16-1 13-2 12-6 9-7		19-9 16-1 15-3 11-8					
	19.2	7-9 7-1 6-9 5-2		11-4 9-4 8-10 6-9		14-5 11-9 11-2 8-7		17-8 14-5 13-8 10-5					
	24	7-3 6-4 6-0 4-7		12-3 11-3 10-6 8-1		16-2 14-3 13-4 10-3		20-8 17-5 16-3 12-6					
	Hem-fir	8-7 8-5 8-0 6-4		13-6 13-0 12-2 9-4		17-10 16-6 15-4 11-9		19-1 15-11 14-10 11-5					
Southern pine	12	8-11 8-9 8-7 6-9		14-1 13-9 12-11 10-0		18-6 18-2 16-8 12-9		21-6 19-2 17-3 13-0					
	16	8-1 8-0 7-10 5-10		12-9 12-6 11-2 8-8		16-10 16-2 14-5 11-0		19-1 18-2 16-1 11-1					
	19.2	7-8 7-6 7-1 5-4		12-0 11-9 10-2 7-11		15-10 14-9 13-2 10-1		20-2 17-6 15-9 11-11					
	24	7-1 7-0 6-4 4-9		11-2 10-6 9-2 7-1		14-8 13-2 11-9 9-0		18-9 15-8 14-1 10-8					

| Species Group |
<th rowspan="2
| --- |

# Rafters

**Snow Region Heavy Roof, No Ceiling: 20 PSF Live, 20 PSF Dead**

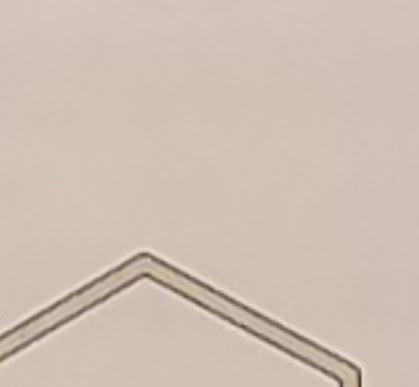
		Maximum Allowable Span (feet-inches)																		
Species Group	Spacing in oc	2 x 4				2 x 6				2 x 8				2 x 10						
		Sel Str	GRADE			Sel Str	GRADE			Sel Str	GRADE			Sel Str	GRADE					
			No.1	No.2	No.3		No.1	No.2	No.3		No.1	No.2	No.3		No.1	No.2	No.3			
Douglas fir-larch	12	11-6	10-1	9-7	7-3		18-0	14-9	14-0	10-8		22-10	18-8	17-8	13-6		27-11	22-9	21-7	16-6
	16	10-5	8-9	8-3	6-4		15-7	12-9	12-1	9-3		19-9	16-2	15-4	11-8		24-2	19-9	18-9	14-3
	19.2	9-9	7-11	7-7	5-9		14-3	11-8	11-0	8-5		18-1	14-9	14-0	10-8		22-1	18-0	17-1	13-1
	24	8-9	7-1	6-9	5-2		12-9	10-5	9-10	7-7		16-2	13-2	12-6	9-7		19-9	16-1	15-3	11-8
Hem-fir	12	10-10	9-11	9-3	7-1		17-0	14-6	13-7	10-5		22-1	18-5	17-2	13-2		26-11	22-6	21-0	16-1
	16	9-10	8-7	8-0	6-2		15-1	12-7	11-9	9-0		19-1	15-11	14-11	11-5		23-4	19-6	18-2	13-11
	19.2	9-3	7-10	7-4	5-8		13-9	11-6	10-9	8-3		17-5	14-7	13-7	10-5		21-4	17-9	16-7	12-9
	24	8-5	7-0	6-7	5-0		12-4	10-3	9-7	7-4		15-7	13-0	12-2	9-4		19-1	15-11	14-10	11-5
Southern pine	12	11-3	11-1	10-1	7-7		17-8	16-7	14-5	11-2		23-4	20-10	18-8	14-3		29-9	24-9	22-3	16-10
	16	10-3	9-8	8-9	6-7		16-1	14-4	12-6	9-8		21-2	18-1	16-2	12-4		26-11	21-5	19-3	14-7
	19.2	9-8	8-10	7-11	6-0		15-2	13-1	11-5	8-10		19-11	16-6	14-9	11-3		24-7	19-7	17-7	13-4
	24	8-11	7-11	7-1	5-4		14-1	11-9	10-2	7-11		18-3	14-9	13-2	10-1		22-0	17-6	15-9	11-11

**Snow Region, Heavy Roof, No Ceiling: 30 PSF Live, 20 PSF Dead**

		Maximum Allowable Span (feet-inches)															
Species Group	Spacing in oc	2 x 4				2 x 6				2 x 8				2 x 10			
		Sel Str	No.1	No.2	No.3	Sel Str	No.1	No.2	No.3	Sel Str	No.1	No.2	No.3	Sel Str	No.1	No.2	No.3
Douglas fir-larch	12	10-0	9-0	8-6	6-6	15-9	13-2	12-6	9-6	20-5	16-8	15-10	12-1	24-11	20-4	19-4	14-9
	16	9-1	7-10	7-5	5-8	14-0	11-5	10-10	8-3	17-8	14-5	13-8	10-6	21-7	17-8	16-9	12-9
	19.2	8-7	7-1	6-9	5-2	12-9	10-5	9-10	7-7	16-2	13-2	12-6	9-7	19-9	16-1	15-3	11-8
	24	7-10	6-4	6-0	4-7	11-5	9-4	8-10	6-9	14-5	11-9	11-2	8-7	17-8	14-5	13-8	10-5
Hem-fir	12	9-6	8-11	8-4	6-4	14-10	13-0	12-2	9-4	19-7	16-6	15-4	11-9	24-1	20-1	18-9	14-5
	16	8-7	7-8	7-2	5-6	13-6	11-3	10-6	8-1	17-1	14-3	13-4	10-3	20-10	17-5	16-3	12-6
	19.2	8-1	7-0	6-7	5-0	12-4	10-3	9-7	7-4	15-7	13-0	12-2	9-4	19-1	15-11	14-10	11-5
	24	7-6	6-3	5-10	4-6	11-0	9-2	8-7	6-7	13-11	11-8	10-10	8-4	17-1	14-3	13-3	10-2
Southern pine	12	9-10	9-8	9-0	6-9	15-6	14-10	12-11	10-0	20-5	18-8	16-8	12-9	26-0	22-2	19-11	15-1
	16	8-11	8-8	7-10	5-10	14-1	12-10	11-2	8-8	18-6	16-2	14-5	11-0	23-8	19-2	17-3	13-0
	19.2	8-5	7-11	7-1	5-4	13-3	11-9	10-2	7-11	17-5	14-9	13-2	10-1	22-0	17-6	15-9	11-11
	24	7-10	7-1	6-4	4-9	12-3	10-6	9-2	7-1	16-2	13-2	11-9	9-0	19-8	15-8	14-1	10-8

# Headers in Exterior Bearing Walls

Roof Live Load, psf	Header Supporting	Size	Maximum Allowable Span (feet-inches)											
			20			30			40			50		
			Building Width, ft			Building Width, ft			Building Width, ft			Building Width, ft		
20	28	36	20	28	36	20	28	36	20	28	36	20	28	36
2-2x4	3-6	3-2	2-10	3-3	2-10	2-7	3-0	2-7	2-4	2-10	2-6	2-2		
2-2x6	5-5	4-8	4-2	4-10	4-2	3-9	4-5	3-10	3-5	4-1	3-7	3-2		
2-2x8	6-10	5-11	5-4	6-2	5-4	4-9	5-7	4-10	4-4	5-2	4-6	4-0		
2-2x10	8-5	7-3	6-6	7-6	6-6	5-10	6-10	5-11	5-4	6-4	5-6	4-11		
2-2x12	9-9	8-5	7-6	8-8	7-6	6-9	7-11	6-10	6-2	7-4	6-4	5-8		
														
3-2x8	8-4	7-5	6-8	7-8	6-8	5-11	7-0	6-1	5-5	6-6	5-8	5-0		
3-2x10	10-6	9-1	8-2	9-5	8-2	7-3	8-7	7-5	6-8	7-11	6-10	6-2		
3-2x12	12-2	10-7	9-5	10-11	9-5	8-5	9-11	8-7	7-8	9-2	8-0	7-2		
4-2x8	9-2	8-4	7-8	8-6	7-8	6-11	8-0	7-0	6-3	7-6	6-6	5-10		
4-2x10	11-8	10-6	9-5	10-10	9-5	8-5	9-11	8-7	7-8	9-2	7-11	7-1		
4-2x12	14-1	12-2	10-11	12-7	10-11	9-9	11-6	9-11	8-11	10-8	9-2	8-3		

		Maximum Allowable Span (feet-inches)											
Roof Live Load, psf	Header Supporting	20			30			40			50		
		Building Width, ft			Building Width, ft			Building Width, ft			Building Width, ft		
Size	20	28	36	20	28	36	20	28	36	20	28	36	20
2-2x4	3-1	2-9	2-5	2-10	2-6	2-3	2-8	2-4	2-1	2-6	2-2	2-0	
2-2x6	4-6	4-0	3-7	4-2	3-8	3-3	3-11	3-5	3-1	3-8	3-2	2-11	
2-2x8	5-9	5-0	4-6	5-3	4-8	4-2	4-11	4-4	3-11	4-8	4-1	3-8	
2-2x10	7-0	6-2	5-6	6-5	5-8	5-1	6-0	5-3	4-9	5-8	4-11	4-5	
2-2x12	8-1	7-1	6-5	7-6	6-7	5-11	7-0	6-1	5-6	6-7	5-9	5-2	
	3-2x8	7-2	6-3	5-8	6-7	5-10	5-3	6-2	5-5	4-10	5-10	5-1	4-7
	3-2x10	8-9	7-8	6-11	8-1	7-1	6-5	7-6	6-7	5-11	7-1	6-2	5-7
	3-2x12	10-2	8-11	8-0	9-4	8-2	7-5	8-9	7-8	6-11	8-3	7-2	6-6
	4-2x8	8-1	7-3	6-7	7-8	6-8	6-0	7-1	6-3	5-7	6-8	5-10	5-3
	4-2x10	10-1	8-10	8-0	9-4	8-2	7-4	8-8	7-7	6-10	8-2	7-2	6-5
	4-2x12	11-9	10-3	9-3	10-10	9-6	8-6	10-1	8-10	7-11	9-6	8-4	7-6

## Headers in Exterior Bearing Walls

Maximum Allowable Span (feet-inches)													
Roof Live Load, psf		20			30			40			50		
Header Supporting	Size	Building Width, ft			Building Width, ft			Building Width, ft			Building Width, ft		
		20	28	36	20	28	36	20	28	36	20	28	36
	2-2x4	2-8	2-4	2-1	2-8	2-3	2-0	2-6	2-2	2-0	2-5	2-1	1-10
	2-2x6	3-11	3-5	3-0	3-10	3-4	3-0	3-8	3-2	2-11	3-6	3-0	2-9
	2-2x8	5-0	4-4	3-10	4-10	4-3	3-9	4-8	4-1	3-8	4-5	3-10	3-5
	2-2x10	6-1	5-3	4-8	5-11	5-2	4-7	5-8	4-11	4-5	5-5	4-8	4-3
	2-2x12	7-1	6-1	5-5	6-11	6-0	5-4	6-7	5-9	5-2	6-3	5-5	4-11
	3-2x8	6-3	5-5	4-10	6-1	5-3	4-9	5-10	5-1	4-7	5-6	4-10	4-4
	3-2x10	7-7	6-7	5-11	7-5	6-5	5-9	7-1	6-2	5-7	6-9	5-10	5-3
	3-2x12	8-10	7-8	6-10	8-8	7-6	6-8	8-3	7-2	6-6	7-10	6-10	6-1
	4-2x8	7-2	6-3	5-7	7-1	6-1	5-6	6-9	5-10	5-3	6-4	5-7	5-0
	4-2x10	8-9	7-7	6-10	8-7	7-5	6-8	8-3	7-2	6-5	7-9	6-9	6-1
	4-2x12	10-2	8-10	7-11	10-0	8-8	7-9	9-6	8-4	7-6	9-0	7-10	7-1

## Headers in Exterior Bearing Walls

Roof Live Load, psf	Header Supporting	Maximum Allowable Span (feet-inches)											
		20			30			40			50		
		Building Width, ft			Building Width, ft			Building Width, ft			Building Width, ft		
Size	Size	20	28	36	20	28	36	20	28	36	20	28	36
2-2x4	2-1	1-10	1-7		2-1	1-9	1-7	2-0	1-9	1-7	2-0	1-9	1-7
2-2x6	3-1	2-8	2-4		3-0	2-7	2-4	3-0	2-7	2-4	2-11	2-7	2-3
2-2x8	3-10	3-4	3-0		3-10	3-4	2-11	3-9	3-3	2-11	3-9	3-3	2-11
2-2x10	4-9	4-1	3-8		4-8	4-0	3-7	4-7	4-0	3-7	4-7	3-11	3-6
2-2x12	5-6	4-9	4-3		5-5	4-8	4-2	5-4	4-8	4-2	5-3	4-7	4-1
3-2x8	4-10	4-2	3-9		4-9	4-2	3-8	4-9	4-1	3-8	4-8	4-1	3-7
3-2x10	5-11	5-1	4-7		5-10	5-1	4-6	5-9	5-0	4-6	5-8	4-11	4-5
3-2x12	6-10	5-11	5-4		6-9	5-10	5-3	6-8	5-10	5-2	6-7	5-9	5-1
4-2x8	5-7	4-10	4-4		5-6	4-9	4-3	5-5	4-9	4-3	5-5	4-8	4-2
4-2x10	6-10	5-11	5-3		6-9	5-10	5-3	6-8	5-9	5-2	6-7	5-8	5-1
4-2x12	7-11	6-10	6-2		7-10	6-9	6-1	7-9	6-8	6-0	7-8	6-7	5-11

Maximum Allowable Span (feet-inches)													
Roof Live Load, psf		20			30			40			50		
Header Supporting	Size	Building Width, ft											
		20	28	36	20	28	36	20	28	36	20	28	36
	2-2x4	2-7	2-3	2-0	2-6	2-2	2-0	2-5	2-1	1-11	2-3	2-0	1-10
	2-2x6	3-9	3-3	2-11	3-8	3-3	2-11	3-6	3-1	2-10	3-4	2-11	2-8
	2-2x8	4-9	4-2	3-9	4-8	4-1	3-8	4-5	3-11	3-6	4-3	3-9	3-4
	2-2x10	5-9	5-1	4-7	5-8	5-0	4-6	5-5	4-9	4-4	5-2	4-7	4-1
	2-2x12	6-8	5-10	5-3	6-7	5-9	5-2	6-4	5-7	5-0	6-0	5-3	4-9
	3-2x8	5-11	5-2	4-8	5-10	5-1	4-7	5-7	4-11	4-5	5-4	4-8	4-2
	3-2x10	7-3	6-4	5-9	7-1	6-3	5-7	6-10	6-0	5-5	6-6	5-8	5-2
	3-2x12	8-5	7-4	6-7	8-3	7-3	6-6	7-11	6-11	6-3	7-6	6-7	6-0
	4-2x8	6-10	6-0	5-5	6-8	5-11	5-4	6-5	5-8	5-1	6-1	5-5	4-10
	4-2x10	8-4	7-4	6-7	8-2	7-2	6-6	7-10	6-11	6-3	7-6	6-7	5-11
	4-2x12	9-8	8-6	7-8	9-6	8-4	7-6	9-1	8-0	7-3	8-8	7-7	6-11

## Headers in Interior Bearing Walls

Header Supporting	Size	Building Width, ft			Header Supporting	Size	Building Width, ft				
		20					20				
		20	28	36			20	28	36		
2-2x4	3-5	2-10	2-6		2-2x4	2-11	1-11	1-9			
2-2x6	4-11	4-2	3-8		2-2x6	3-4	2-10	2-6			
2-2x8	6-3	5-4	4-8		2-2x8	4-3	3-7	3-3			
2-2x10	7-8	6-6	5-9		2						