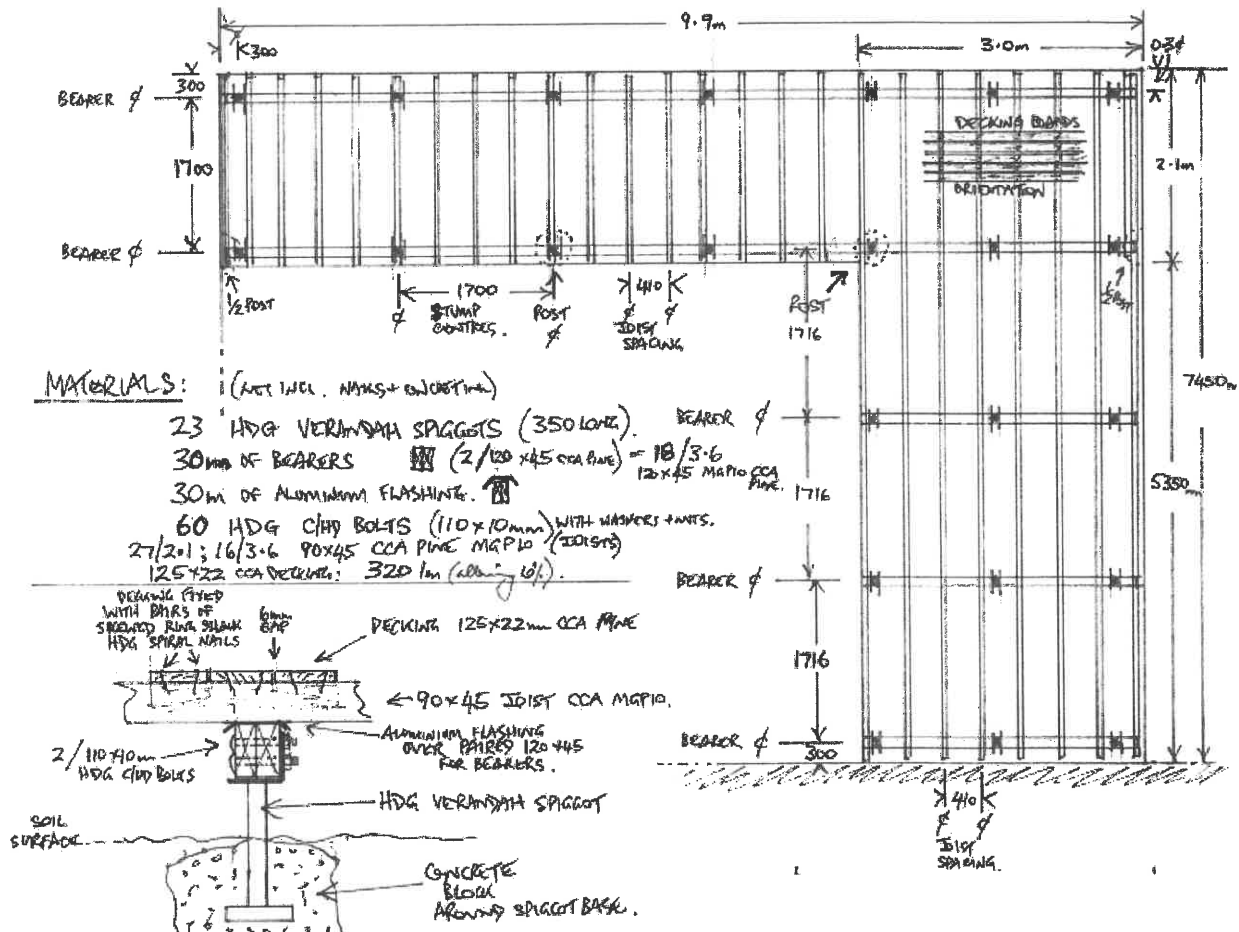


**Residential Wood
Deck Construction Guide**
Based on the 2018 International Residential Code



The provisions and details contained in this document are based on Section R507 of the 2018 International Residential Code (IRC). The prescriptive construction methods recommended meet or exceed minimum requirements of IRC Section R507. Provisions that are not found in the IRC are recommended as good industry practice. This document is not intended to preclude the use of other construction methods or materials. All construction and materials must be approved by the authority having jurisdiction.

This document is a guide for development of a construction package and shall not be accepted in lieu of construction drawings.

- This document applies to single level residential decks. Its purpose is to simplify design by limiting span and sizing charts to a few base dimensions. A construction package based upon the complete charts available in Section 507 is an option which could provide more material and design options
- Decks supporting large concentrated loads such as hot tubs and large planters are beyond the scope of this document and Section R507 of the 2018 International Residential Code and shall be designed in accordance with accepted engineering practice.
- Free access to the 2018 International Residential Code can be found here:
<https://codes.iccsafe.org/content/IRC2018>

R507.1 Decks. Wood-framed decks shall be in accordance with this section. For decks using materials and conditions not prescribed in this section, refer to Section R301.

R507.2.1 Wood materials. Wood materials shall be #2 grade or better lumber, preservative-treated in accordance with Section R317, or approved, naturally durable lumber, and termite protected where required in accordance with Section R318. Where design in accordance with Section R301 is provided, wood structural members shall be designed using the wet service factor defined in AWC NDS. Cuts, notches and drilled holes of preservative-treated wood members shall be treated in accordance with Section R317.1.1. All preservative-treated wood products in contact with the ground shall be labeled for such usage.

R507.2.2 Plastic composite deck boards, stair treads, guards, or handrails. Plastic composite exterior deck boards, stair treads, guards and handrails shall comply with the requirements of ASTM D7032. Plastic composite deck boards and stair treads, or their packaging, shall bear a label that indicates compliance with ASTM D7032 and includes the allowable load and maximum allowable span determined in accordance with ASTM D7032. Plastic or composite handrails and guards, or their packaging, shall bear a label that indicates compliance with ASTM D7032 and includes the maximum allowable span determined in accordance with ASTM D7032. Plastic composite deck boards, stair treads, guards and hand-rails shall be installed in accordance with this code and the manufacturer's instructions.

R507.2.3 Fasteners and connectors. Metal fasteners and connectors used for all decks shall be in accordance with Section R317.3 and Table R507.2.3.

- A framing plan shows the deck width, deck length; location of joist and beams; location of ledger board, posts, and footings; and the type, size and spacing of the ledger board fasteners. See Figure 1 for an example of a typical framing plan.

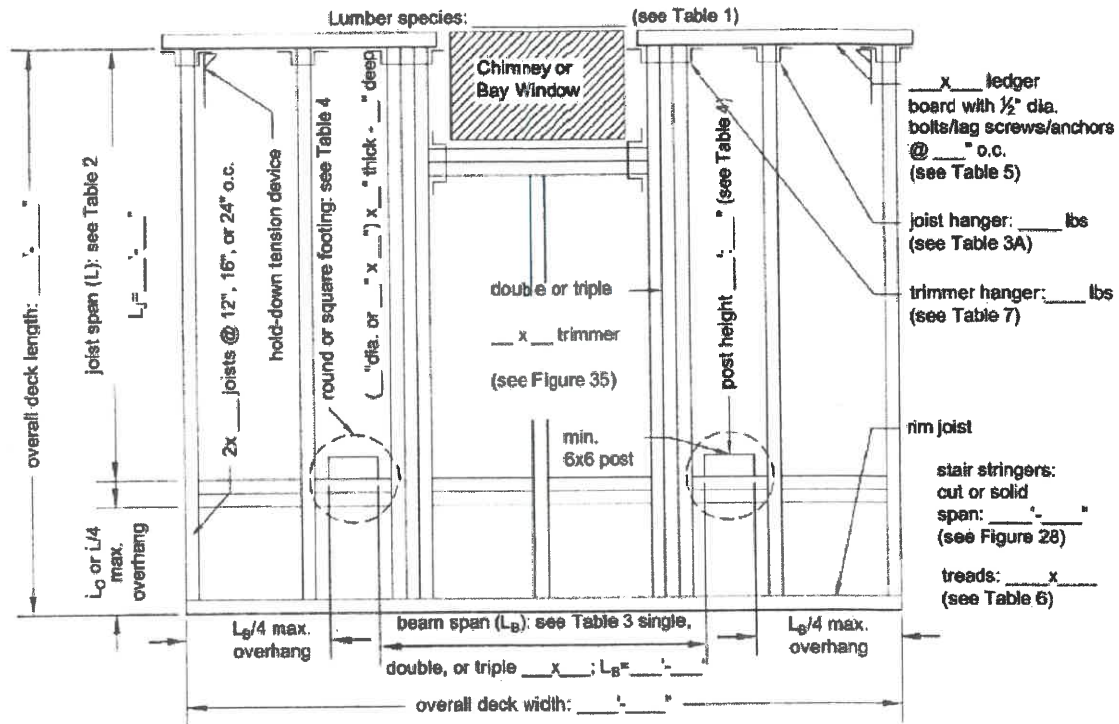


Figure 1 – Example framing plan

Footings

R507.3 Footings. Decks shall be supported on concrete footings or other approved structural systems designed to accommodate all loads in accordance with Section R301. Deck footings shall be sized to carry the imposed loads from the deck structure to the ground as shown in Figure R507.3.

- The footing shall bear on undisturbed soil and extend at least a minimum of 12" below the undisturbed ground surface. Deck footings adjacent to exterior dwelling foundation walls must bear at the same elevation as the footing of the house foundation. See Figure R507.3 and Table R507.3.1 for footing width, thickness, and post attachment options. A detail showing this information shall be included in the construction package.
- Free-standing decks, where all of the following criteria are met, will be exempt from the footing requirements: 1) Joist bear directly on precast concrete pier blocks on grade without support beams or posts. 2) The area of the deck does not exceed 200 sq ft. 3) The walking surface of the deck is not more than 20" above grade at any point within 36" measured horizontally from the edge.

R507.4.1 Deck post to deck footing connection. Where posts bear on concrete footings in accordance with Section R403 and Figure R507.3, lateral restraint shall be provided by manufactured connectors or a minimum post embedment of 12 inches in surrounding soils or concrete piers.

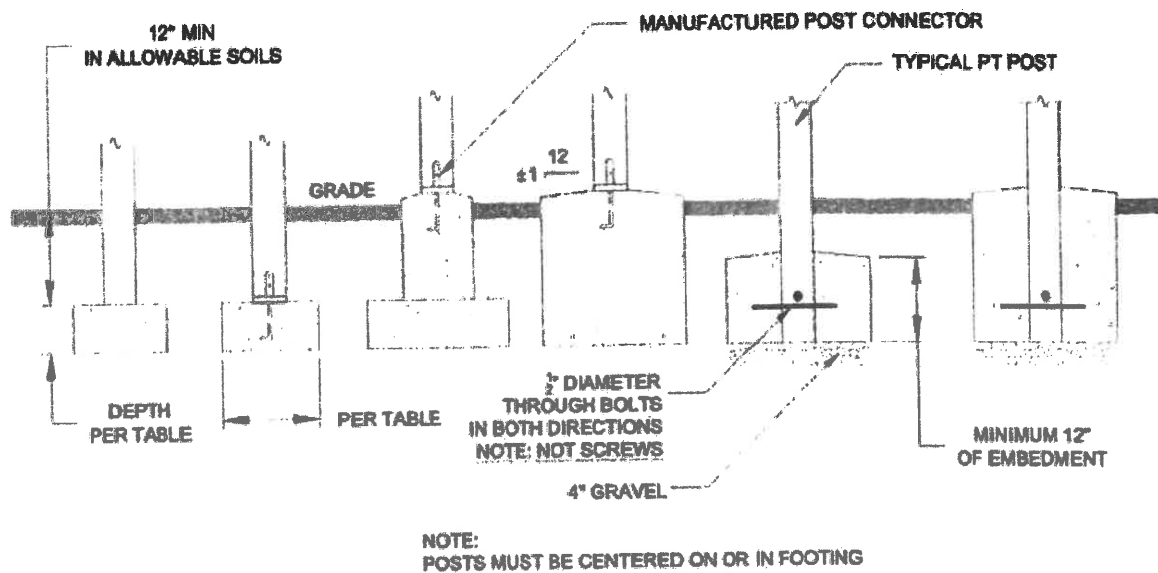


TABLE R507.3.1 (Simplified)
Minimum Footing Size for Decks

Footing supporting deck only (50psf TL)					Footing supporting deck and roof-ceiling assembly (70psf TL)				
Beam Span ^b	Joist Span	Round Footing Diameter ^a	Side of square footing ^a	Footing thickness ^a	Beam Span ^b	Joist Span	Round Footing Diameter ^a	Side of square footing ^a	Footing thickness ^a
6'	≤ 10'	21"	19"	6"	6'	≤ 10'	24"	21"	8"
	≤ 14'	24"	21"	8"		≤ 14'	28"	25"	9"
	≤ 18'	27"	24"	9"		≤ 18'	31"	28"	11"
8'	≤ 10'	24"	21"	8"	8'	≤ 10'	28"	25"	9"
	≤ 14'	27"	24"	9"		≤ 14'	31"	28"	11"
	≤ 18'	32"	28"	11"		≤ 18'	37"	33"	13"
10'	≤ 10'	27"	24"	9"	10'	≤ 10'	31"	28"	11"
	≤ 14'	32"	28"	11"		≤ 14'	37"	33"	13"
	≤ 18'	-	-	-		≤ 18'	-	-	-
12'	≤ 10'	30"	26"	10"	12'	≤ 10'	34"	30"	12"
	≤ 14'	-	-	-		≤ 14'	-	-	-
	≤ 18'	-	-	-		≤ 18'	-	-	-
14'	≤ 10'	32"	28"	11"	14'	≤ 10'	37"	33"	13"
	≤ 14'	-	-	-		≤ 14'	-	-	-
	≤ 18'	-	-	-		≤ 18'	-	-	-

Note a: Footing sizes assume soil bearing capacity of 1,500 psf. Corner post footing widths may be multiplied by 0.75. Minimum concrete compressive strength = 2,500 psi.

Note b: Joist span for interior bearing beams = 1/2 left joist span + 1/2 right joist span (Figure 2)

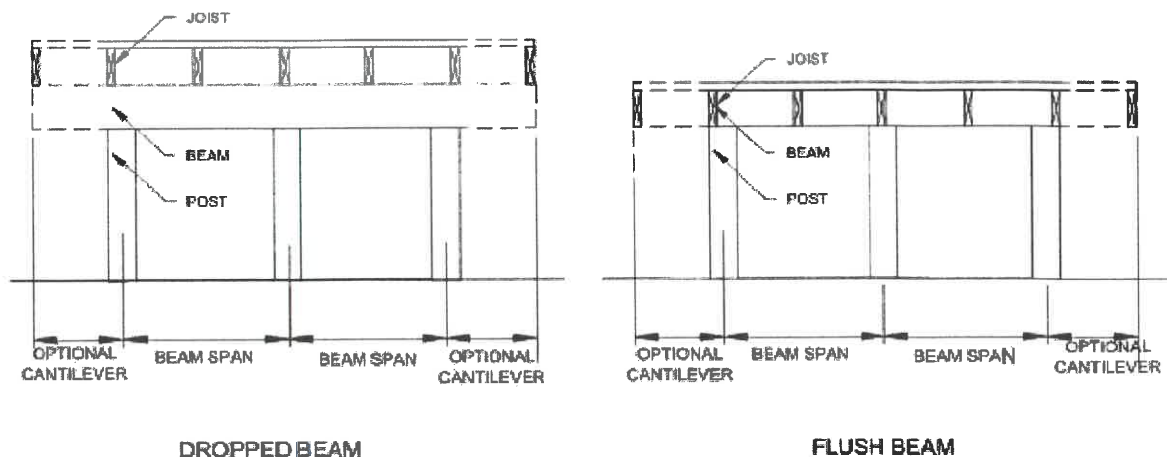
Deck Beams

R507.5 Deck Beams. Maximum allowable spans for wood deck beams, as shown in Figure R507.5, shall be in accordance with Table R507.5. Beam plies shall be fastened with two rows of 10d (3-inch x 0.128-inch) nails minimum at 16 inches on center along each edge. Beams shall be permitted to cantilever at each end up to one-fourth of the allowable beam span. Deck beams of other materials shall be permitted where designed in accordance with accepted engineering practices.

R507.5.1 Deck beam bearing. The ends of beams shall have not less than 1-1/2 inches of bearing on wood or metal and not less than 3 inches of bearing on concrete or masonry for the entire width of the beam. Where multiple-span beams bear on intermediate posts, each ply must have full bearing on the post in accordance with Figures R507.5.1(1) and R507.5.1(2).

R507.5.2 Deck beam connection to supports. Deck beams shall be attached to supports in a manner capable of transferring vertical loads and resisting horizontal displacement. Deck beam connections to wood posts shall be in accordance with Figures R507.5.1(1) and R507.5.1(2). Manufactured post-to-beam connectors shall be sized for the post and beam sizes. Bolts shall have washers under the head and nut.

- Deck beams shall be sized in accordance with Table R507.5, Figure R507.5 and Figure 2. Deck beams are permitted to cantilever past the post face $\frac{1}{4}$ of the approved beam span. Multiple-ply beams shall be constructed per Table R602.3(1) using 16d 3-1/2" nails @ 16"oc along each edge face nailed.



**FIGURE R507.5
TYPICAL DECK BEAM SPANS**

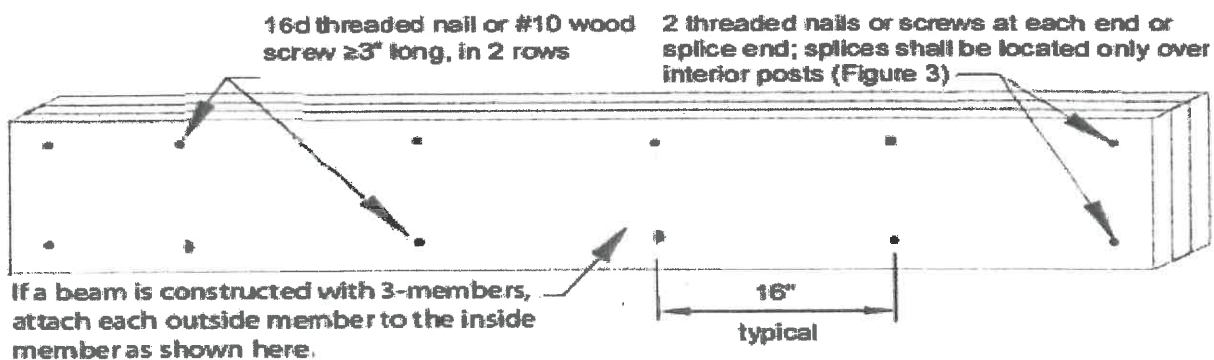


TABLE R507.5
DECK BEAM SPAN LENGTHS^{a, b, c} (feet + inches)

SPECIES ^a	SIZE ^d	DECK JOIST SPAN LESS THAN OR EQUAL TO: (feet)						
		6	8	10	12	14	16	18
Southern pine	1-2 x 6	4-11	4-0	3-7	3-3	3-0	2-10	2-8
	1-2 x 8	5-11	5-1	4-7	4-2	2-10	3-7	3-5
	1-2 x 10	7-0	6-0	5-5	4-11	4-7	4-3	4-0
	1-2 x 12	8-3	7-1	6-4	5-10	5-5	5-0	4-9
	2-2 x 6	6-11	5-11	5-4	4-10	4-6	4-3	4-0
	2-2 x 8	8-9	7-7	6-9	6-2	5-9	5-4	5-0
	2-2 x 10	10-4	9-0	8-0	7-4	6-9	6-4	6-0
	2-2 x 12	12-2	10-7	9-5	8-7	8-0	7-6	7-0
	3-2 x 6	8-2	7-5	6-8	6-1	5-8	5-3	5-0
	3-2 x 8	10-10	9-6	8-6	7-9	7-2	6-8	6-4
	3-2 x 10	13-0	11-3	10-0	9-2	8-6	7-11	7-6
	3-2 x 12	15-3	13-3	11-10	10-9	10-0	9-4	8-10

Note a: Ground snow load, live load = 40psf, dead load = 10psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever with a 220-pound load applied at the end.
 Note b: Exterior beams supporting deck joists from one side using total joist span, Interior beams supporting tributary length of joist span from two sides.
 Note c: Number 2 grade, wet service factor
 Note d: Beam depth shall be greater than or equal to the depth of joist with a flush beam condition.
 Note g: Beam cantilevers are limited to the adjacent beam's span divided by 4.

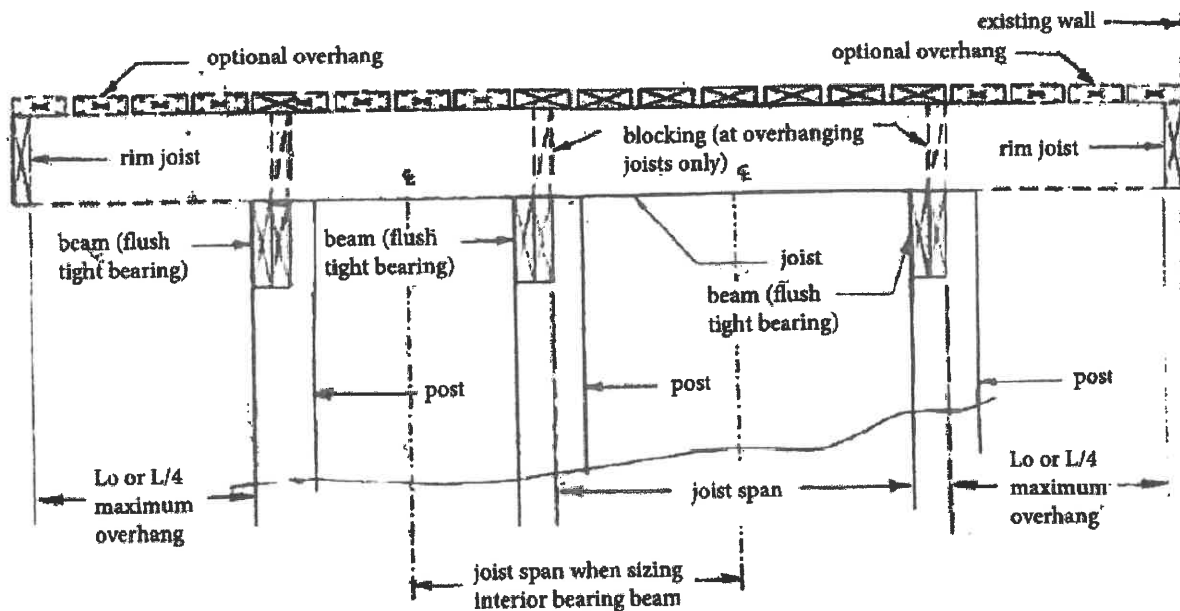
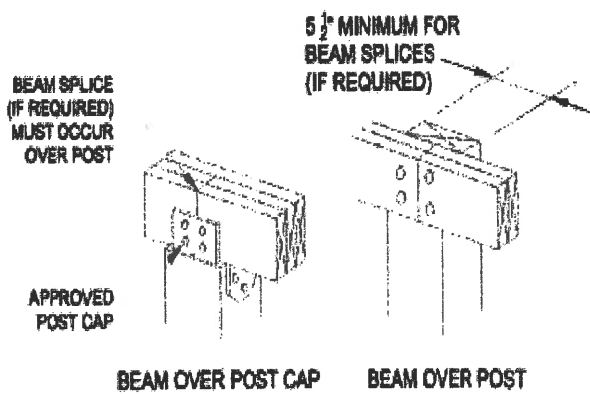
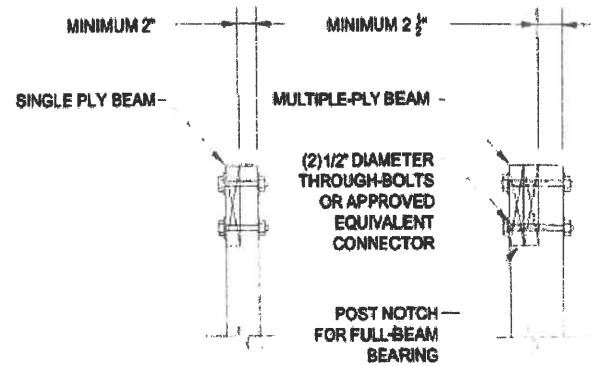


Figure 2
Joist Span and Beam Sizing



**FIGURE R507.5.1(1)
DECK BEAM TO DECK POST**



**FIGURE R507.5.1(2)
NOTCHED POST-TO-BEAM CONNECTION**

Deck Posts

R507.4 Deck posts. For single-level wood-framed decks with beams sized in accordance with Table R507.5, deck post size shall be in accordance with Table R507.4.

- Deck post shall be size in accordance with Table R507.4 measured from grade or the top of foundation, whichever is highest, to the underside of the beam. Posts shall be centered on footings. Beam attachment shall be by notching as shown in Figure R507.5.1(1) and R507.5.1(2) or by approved post cap as shown in Figure R507.5.1(1). All 3-ply beams shall be attached to the post by an approved post cap. ***Attachment to the side of a beam without notching is prohibited (Figure 3).***

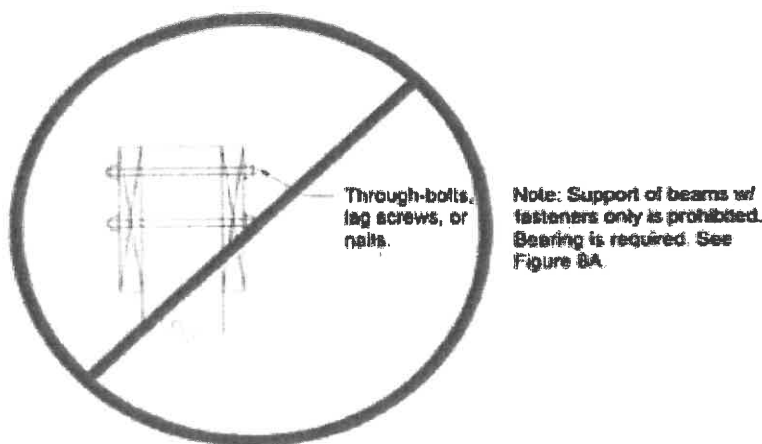


Figure 3 – Prohibited Attachment

Deck Joists

R507.6 Deck joists. Maximum allowable spans for wood deck joists, as shown in Figure R507.6, shall be in accordance with Table R507.6. The maximum joist spacing shall be limited by the decking materials in accordance with Table R507.7. The maximum joist cantilever shall be limited to $\frac{1}{4}$ of the joist span or the maximum cantilever length specified in Table R507.6, whichever is less.

R507.6.1 Deck joist bearing. The ends of joists shall have not less than 1-1/2" of bearing on wood or metal and not less than 3" of bearing on concrete or masonry over its entire width. Joists bearing on top of a multiple-ply beam or ledger shall be fastened in accordance with Table R602.3(1). Joists bearing on top of a single-ply beam or ledger shall be attached by a mechanical connector. ***Joist framing into the side of a beam or ledger board shall be supported by approved joist hangers.***

R507.6.2 Deck joist lateral restraint. Joist ends and bearing locations shall be provided with lateral resistance to prevent rotation. Where lateral restraint is provided by joist hangers or blocking between joists, their depth shall equal not less than 60% of the joist depth. Where lateral restraint is provided by rim joists, they shall be secured to the end of each joist with not fewer than three 10d 3" nails or three #10 x 3" long wood screws.

- Each joist shall be attached to the beam per Table R602.3(1) or by mechanical fastener. Examples of attachment can be found in Figure 4. Joist may bear directly on the beam and overhang past the face of the beam $\frac{1}{4}$ the approved beam span or the maximum cantilever length specified in Table R507.6, whichever is less and blocking is provided between the joist at the point of bearing. Joist bearing on single-ply beams or ledger shall be attached by a mechanical connector. Joist hangers shall have a depth of at least 60% of the joist depth. ***Do not use clip angles or brackets to support joists.***

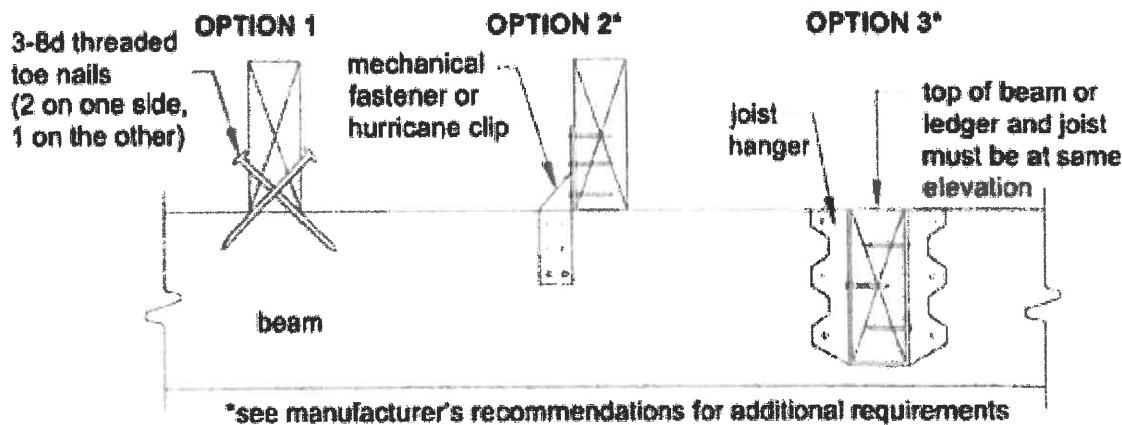
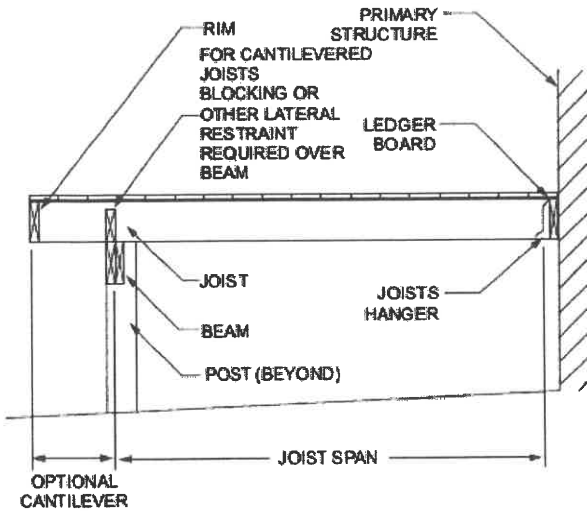
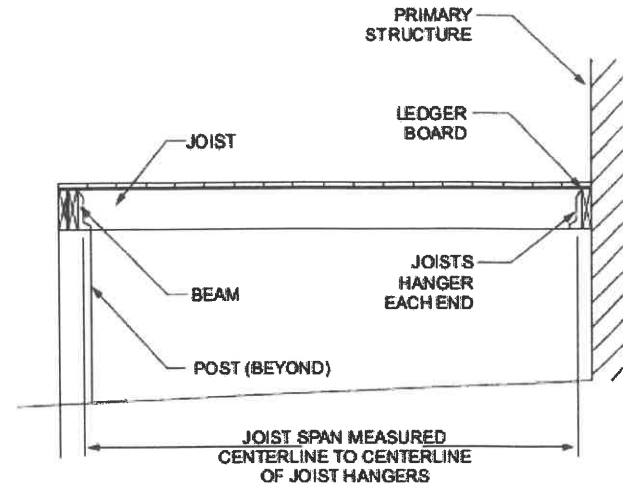


Figure 4 – Joist to beam attachment

- All decking material shall be composed of dimension lumber (2" nominal thickness) or span rated decking in accordance with the American Lumber Standard Committee Policy for Evaluation of Recommended Spans for Span Rated Decking Products (November 5, 2004). Attach decking to each joist with two 8d threaded nails or two #8 screws. Space decking boards approximately $\frac{1}{8}$ " apart. See Figure 11 for decking connection requirements at the rim joist. Decking placement may range from an angle perpendicular to the joists to an angle of 45° to the joists. Each segment of decking must bear on a minimum of 3 joists (or 3 supports).

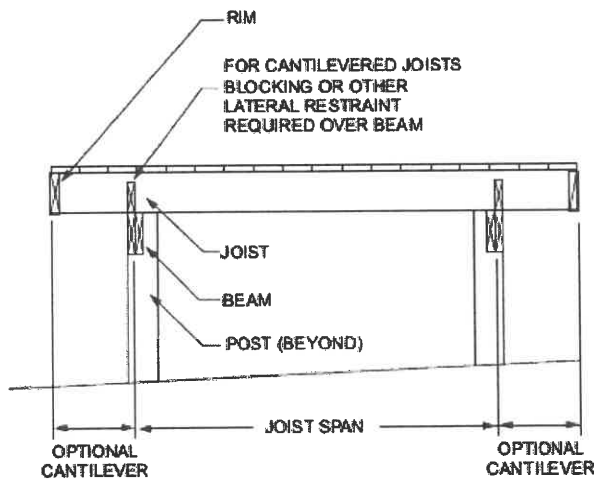


CANTILEVERED JOISTS WITH DROPPED BEAM

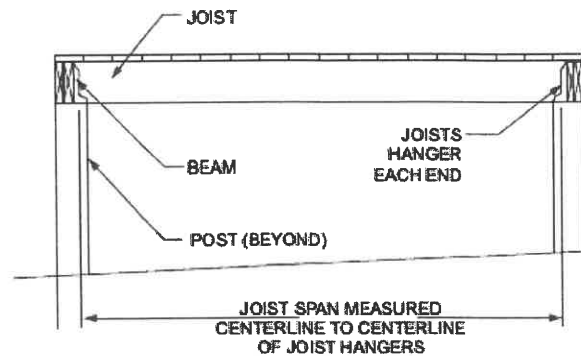


JOISTS WITH FLUSH BEAM

**FIGURE R507.6
TYPICAL DECK JOIST SPANS
(LEDGER CONNECTION)**



JOISTS ON FREE-STANDING DECK
WITH DROPPED BEAM



JOISTS ON FREE-STANDING DECK
WITH FLUSH BEAM

**FIGURE R507.6
TYPICAL DECK JOIST SPANS**

**TABLE R507.6
DECK JOIST SPANS FOR COMMON LUMBER SPECIES (ft. - in.)**

SPECIES ^a	SIZE	ALLOWABLE JOIST SPAN ^b			MAXIMUM CANTILEVER ^{c,f}		
		SPACING OF DECK JOISTS (inches)			SPACING OF DECK JOISTS WITH CANTILEVERS ^e (inches)		
		12	16	24	12	16	24
Southern pine	2 x 6	9-11	9-0	7-7	1-3	1-4	1-6
	2 x 8	13-1	11-10	9-8	2-1	2-3	2-5
	2 x 10	16-2	14-0	11-5	3-4	3-6	2-10
	2 x 12	18-0	16-6	13-6	4-6	4-2	3-4

Note a: Number 2 grade, wet service factor

Note b: Ground snow load, live load = 40psf, dead load = 10psf, L/Δ = 360

Note c: Ground snow load, live load = 40psf, dead load = 10psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever with a 220-pound load applied at the end.

Note f: Cantilevered spans not exceeding the nominal depth of the joist are permitted.

**TABLE R507.7
MAXIMUM JOIST SPACING FOR DECKING**

DECKING MATERIAL TYPE AND NOMINAL SIZE	MAXIMUM ON-CENTER JOIST SPACING	
	Decking perpendicular to joist	Decking diagonal to joist ^a
1 1/4-inch-thick wood	16 inches	12 inches
2-inch-thick wood	24 inches	16 inches
Plastic composite	In accordance with Section R507.2	In accordance with Section R507.2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.01745 rad.

a. Maximum angle of 45 degrees from perpendicular for wood deck boards.

Ledger Connections

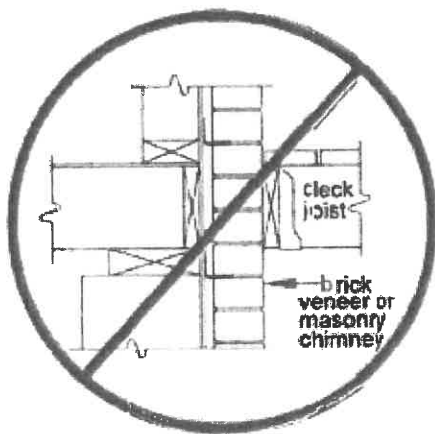
R507.9.1.1 Ledger details. Deck ledgers shall be a minimum 2" x 8", pressure-preservative-treated Southern pine, incised pressure-preservative-treated hem-fir, or approved, naturally durable, #2 grade or better lumber. *Deck ledgers shall not support concentrated loads from beams or girders. Deck ledgers shall not be supported on or through stone or masonry veneer.*

R507.9.1.2 Band joist details. Band joists supporting a ledger shall be a minimum 2" nominal, solid-sawn, spruce-pine-fir or better lumber or a minimum 1" x 9-1/2" dimensional, Douglas fir or better, laminated veneer lumber. Band joists shall bear fully on the primary structure capable of supporting all required loads.

R507.9.1.3 Ledger to band joist details. Fasteners used in deck ledger connections in accordance with Table R507.9.1.3(1) shall be hot-dipped galvanized or stainless steel and shall be installed in accordance with Table R507.9.1.3(2) and Figures R507.9.1.3(1) and R507.9.1.3(2).

R507.9.2 Lateral connection. Lateral loads shall be transferred to the ground or to a structure capable of transmitting them to the ground. Where the lateral load connection is provided in accordance with Figure R507.9.2(1), hold-down tension devices shall be installed in not less than two locations per deck, within 24" of each end of the deck. Each device shall have an allowable stress design capacity of not less than 1,500 pounds. Where the lateral load connections are provided in accordance with Figure R507.9.2(2), the hold-down tension devices shall be installed in not less than four locations per deck, and each device shall have an allowable stress design capacity of not less than 750 pounds.

- Ledger boards shall be a minimum nominal dimension of 2" x 8", equal or greater in depth of the deck joist but less than or equal to the house band or rim joist depth. *The house siding or exterior finish system must be removed prior to installation of the ledger board, attachment to or through exterior veneers (brick, masonry, stone), hollow masonry units, and to cantilevered floor overhangs or bay windows are prohibited and require non-ledger decks.* Approved corrosion resistant flashing is required at any ledger board connection to a wall of wood framed construction.



- A metal plate connected wood truss or web truss is an engineered, prefabricated structural component designed for each specific application. *Installing residential decks by ledger connection when the floor system uses engineered trusses requires a standard detail provided by the truss designer or conversion to a non-ledger deck.*

TABLE R507.9.1.3(1)
DECK LEDGER CONNECTION TO BAND JOIST^{a,b}
 (Deck live load = 40 psf, deck dead load = 10 psf, snow load ≤ 40 psf)

CONNECTION DETAILS	JOIST SPAN						
	6' and less	6'1" to 8'	8'1" to 10'	10'1" to 12'	12'1" to 14'	14'1" to 16'	16'1" to 18'
	On-center spacing of fasteners						
1/2-inch diameter lag screw with 1/2-inch maximum sheathing ^{c,d}	30	23	18	15	13	11	10
1/2-inch diameter bolt with 1/2-inch maximum sheathing ^e	36	36	34	29	24	21	19
1/2-inch diameter bolt with 1-inch maximum sheathing ^e	36	36	29	24	21	18	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

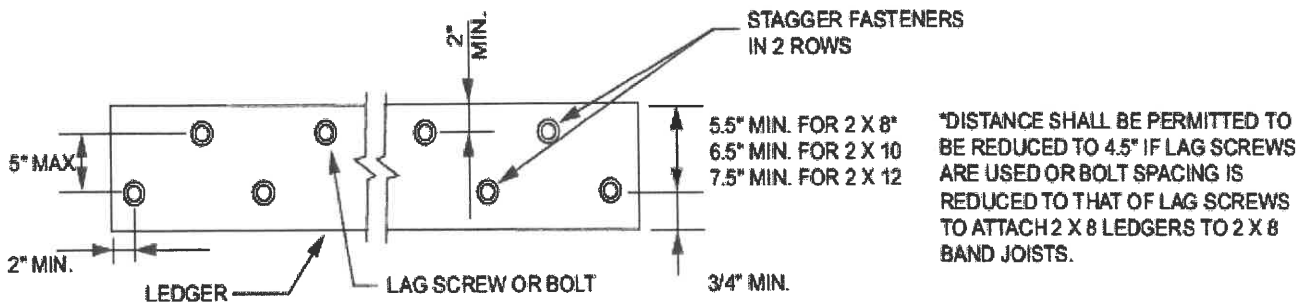
- Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.
- Snow load shall not be assumed to act concurrently with live load.
- The tip of the lag screw shall fully extend beyond the inside face of the band joist.
- Sheathing shall be wood structural panel or solid sawn lumber.
- Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to 1/2-inch thickness of stacked washers shall be permitted to substitute for up to 1/2 inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

TABLE R507.9.1.3(2)
PLACEMENT OF LAG SCREWS AND BOLTS IN DECK LEDGERS AND BAND JOISTS

MINIMUM END AND EDGE DISTANCES AND SPACING BETWEEN ROWS				
	TOP EDGE	BOTTOM EDGE	ENDS	ROW SPACING
Ledger ^a	2 inches ^d	3/4 inch	2 inches ^b	1 5/8 inches ^b
Band Joist ^c	3/4 inch	2 inches	2 inches ^b	1 5/8 inches ^b

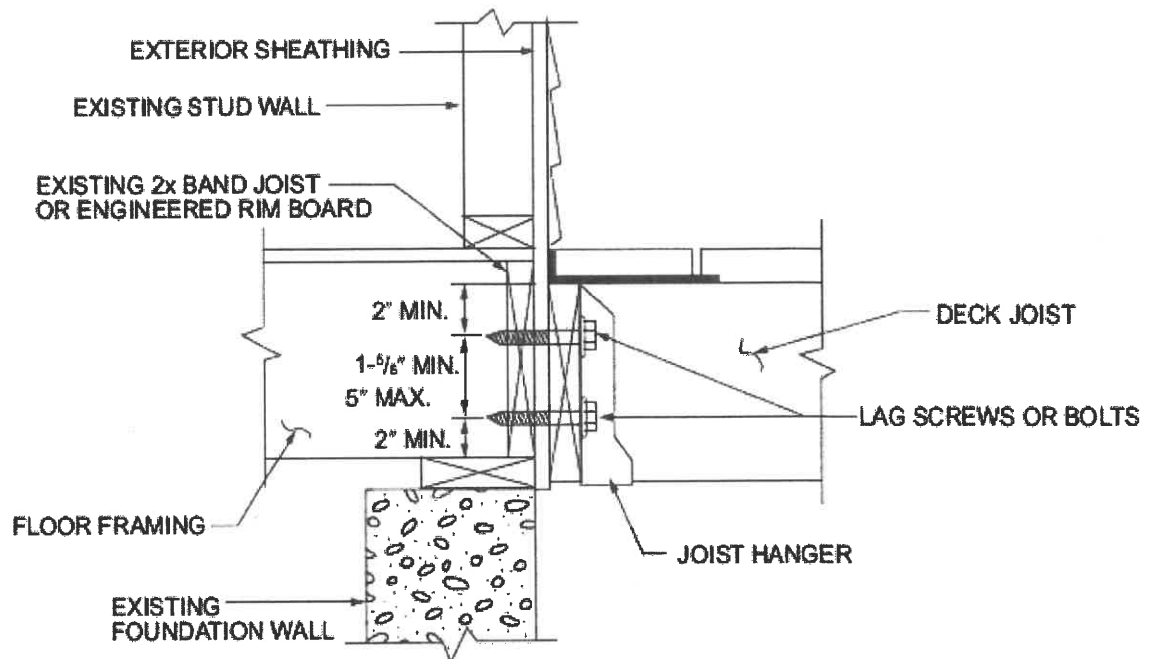
For SI: 1 inch = 25.4 mm.

- Lag screws or bolts shall be staggered from the top to the bottom along the horizontal run of the deck ledger in accordance with Figure R507.9.1.3(1).
- Maximum 5 inches.
- For engineered rim joists, the manufacturer's recommendations shall govern.
- The minimum distance from bottom row of lag screws or bolts to the top edge of the ledger shall be in accordance with Figure R507.9.1.3(1).



For SI: 1 inch = 25.4 mm.

FIGURE R507.9.1.3(1)
PLACEMENT OF LAG SCREWS AND BOLTS IN LEDGERS



For SI: 1 inch = 25.4 mm.

FIGURE R507.9.1.3(2)
PLACEMENT OF LAG SCREWS AND BOLTS IN BAND JOISTS

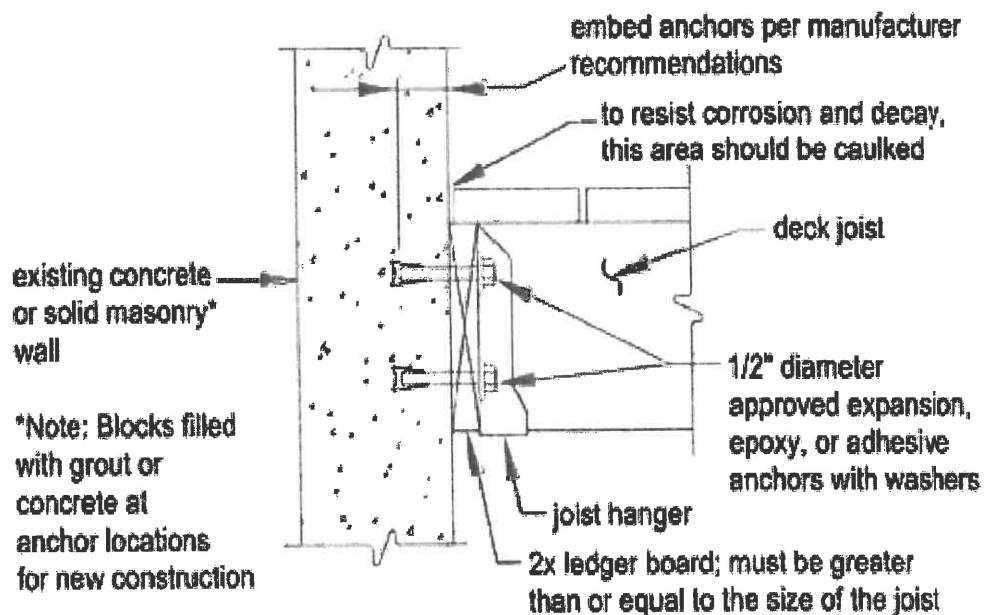


Figure 5
Ledger attachment to concrete or solid masonry foundation wall

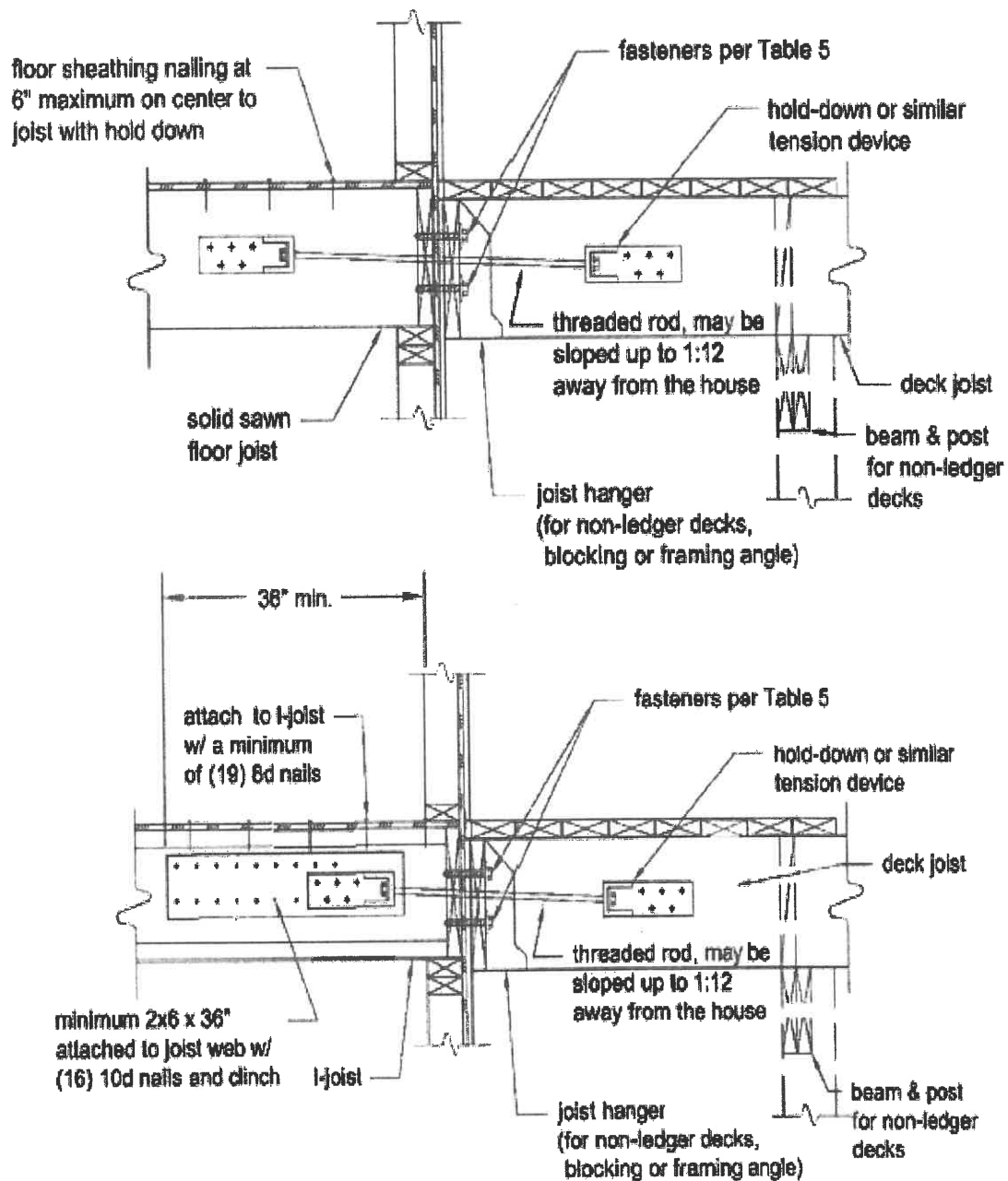


Figure 6
Lateral Load Device Installation – Floor Joist Parallel to Deck Joist

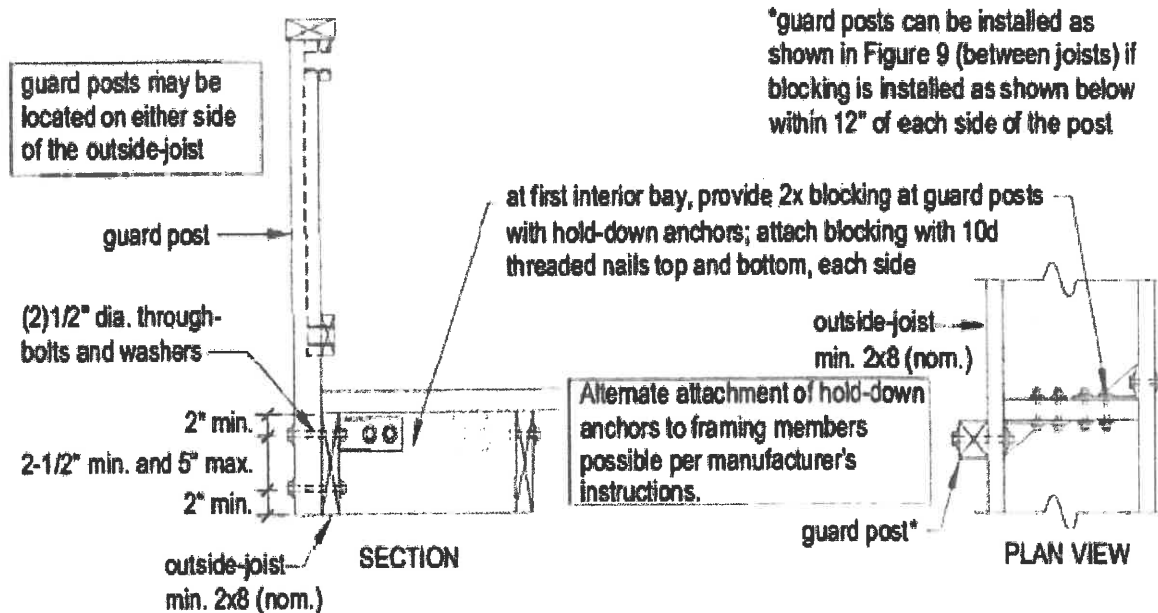


Figure 8
Guard Post attachment to outside joist example

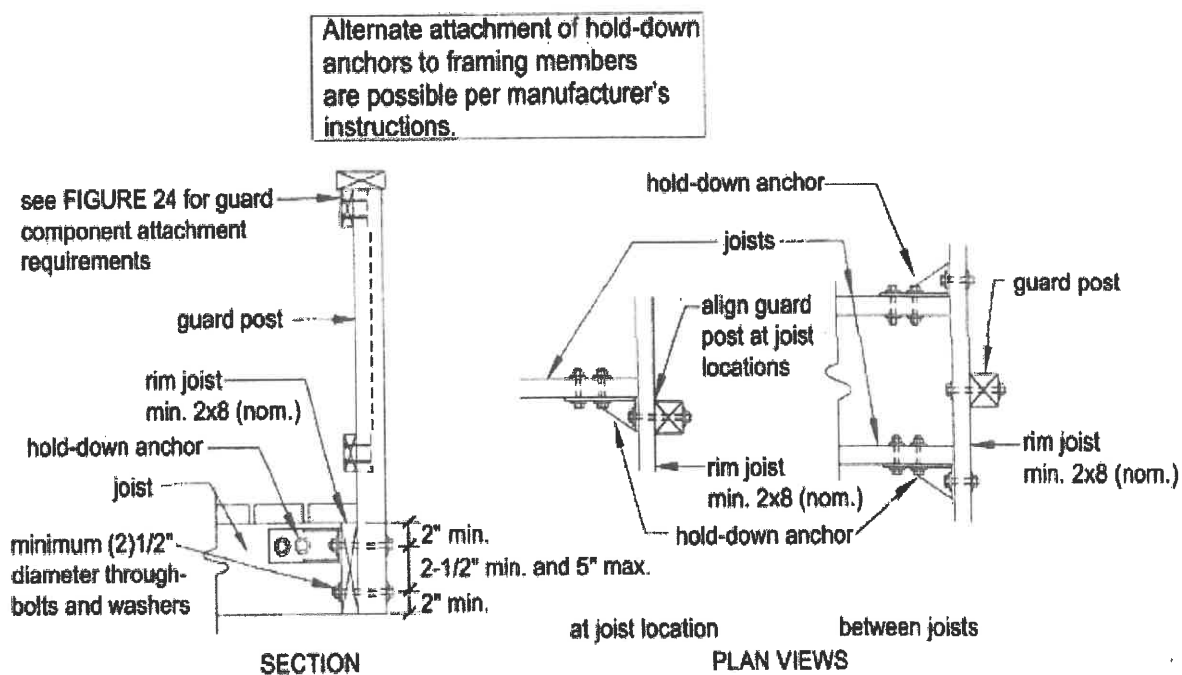


Figure 9
Guard Post attachment to rim joist example

Stair Requirements

R311.7.1 Width. Stairways shall be not less than 36" in clear width at all points above the permitted handrail height and below the required headroom height. The clear width of stairways at and below the handrail height, including treads and landings, shall be not less than 31-1/2" where a handrail is installed on one side and 27" where handrails are installed on both sides.

R311.7.3 Vertical rise. A flight of stairs shall not have a vertical rise larger than 151" between floor levels or landings.

R311.7.5.1 Risers. The riser height shall be not more than 7 3/4". The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8". Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30° from the vertical. At open risers, openings located more than 30", as measured vertically, to the floor or grade below shall not permit the passage of a 4-inch-diameter sphere.

R311.7.5.2 Treads. The tread depth shall be not less than 10". The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8".

R311.7.6 Landings for stairways. There shall be a floor or landing at the top and bottom of each stairway. The width perpendicular to the direction of travel shall be not less than the width of the flight served. For landings of shapes other than square or rectangular, the depth at the walk line and the total area shall be not less than that of a quarter circle with a radius equal to the required landing width. Where the stairway has a straight run, the depth in the direction of travel shall be not less than 36".

R311.7.8 Handrails. Graspable handrails shall be provided on not less than one side of each flight of stairs with four or more risers. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34" and not more than 38". Handrails shall have a space of not less than 1 1/2" between the handrails and any wall or obstruction. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals.

R303.8 Exterior stairway illumination. Exterior stairways shall be provided with an artificial light source located at the top landing of the stairway. The light switch shall be operated from inside the house or by motion detected switches.

R311.5 Landing, deck, balcony and stair construction and attachment. Exterior landings, decks, balconies, stairs and similar facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces or shall be designed to be self-supporting. Attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

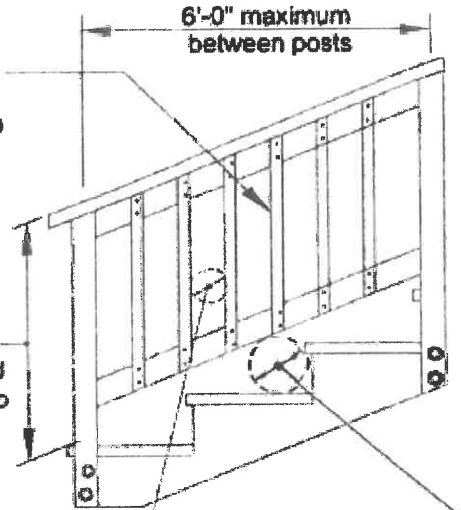
stair guard is required for stairs with a total rise of 30" or more; see **GUARD REQUIREMENTS** for more information

stair guard height: 34" min. measured from nosing of step

6'-0" maximum between posts

Openings for required guards on the sides of stair treads shall not allow a sphere 4-3/8" to pass through.

Triangular opening shall not permit the passage of a 6" diameter sphere.



Fasten handrails per manufacture recommendations

