DECKS
TABLE OF CONTENTS

All information in this handout pertains to 1 and 2 family residential decks. The Town of Plainville is offering this informational handout as representative of typical issues/questions that may arise on a typical job. The Town assumes no responsibility for any errors, omissions and the installer is required to follow applicable codes. No handout could possibly cover all situations, nor is it intended to.

Please refer to the 2005 Connecticut State Building Code with the 2005 Amendments (12/31/05) for complete details.

Submit deck plans that show the following:

1. Indicate existing condition and material that ledger board will be attached to (is it concrete, hickory beam, 2x rim or 1-1/4 rim, etc.).
2. Intended use and loading (40 lbs LL/10DL).
3. Plan view of deck, house and pier/post locations.
4. Joist spans, size, species, grade, and pressure treatment.
5. Ledger to house band joist connection – include ledger material and thickness, flashing detail and material – include fasteners, type, size and number or spacing.
6. Deck joists to ledger – include fasteners, type, etc.
7. Deck joists to girder/beam connection – include fasteners, type, size and number or spacing.
8. Built-up girder/beam connection – include fasteners, type, size and number or spacing.
9. Girder/beam to posts connection – include fasteners, type, size and number or spacing.
10. Posts to pier connection – include fasteners, type, size and number or spacing.
11. Provide type of protection of fasteners and connectors against corrosion (ASTM A153, 316 stainless, etc.).
12. Guardrail and stair handrail details showing spacing of pickets and sizes of openings. Connections between top rail and posts shall be specified. For plastic, vinyl or wood-plastic composite railing systems, a copy of the ICC-ES Evaluation Report for the specific product to be used – available from the manufacturer or at www.icc-es.org/Evaluation_reports/index.shtml - should be included as part of the deck plan submittal.
13. Connection detail of rail post to deck support structure for both wood and plastic railing systems that utilize a sleeve, which slides over a solid-sawn 4" x 4" post. (Note: some Evaluation Reports rely on a professional to design the guardrail post to deck connection in accordance with state law, regulations and local codes).
14. Stair details showing riser heights tread widths, openings between treads, illumination and graspable handrail, that returns top and bottom.
15. Post size, species or species group and grade, and preservative pressure treatment type and retention.
16. Footing size and depth to bottom of footer.
17. Detail of the lateral bracing system if the deck construction does not provide adequate support against lateral loads. (Note: the IRC does not give values for lateral loads for decks, so the designer must address the issue based on assumed loads and analysis, experience and judgment).

DECK INFORMATION

5/2/05

IMPORTANT NOTES:

1. If you plan to install a hot tub, spa, pool, screen room, sunroom or future addition on proposed deck, this handout does not apply.
2. If proposed deck is in area of electric or gas service, oil fill and vent or other utilities, additional requirements apply and are outside the scope of this handout. Contact Building Department for additional information as needed.
3. If any direct vent exhaust is located in area of proposed deck, then additional requirements apply. Refer to manufacturer's installation instructions of equipment for required clearances.
4. Wood must be pressure treated or naturally decay resistant.
5. Fasteners must be compatible with wood used. See attached handout on fastener requirements.
6. Piers are required to be 42" deep for frost protection. Piers are to be designed to carry all loads.
7. Posts must be of sufficient size to support loads and positively attached to piers.
8. Beams must be positively attached to posts with gussets or hardware designed for this purpose.
9. All splices in beams must be supported by posts. No mid-span splices. Beams required to have minimum 1-1/2" bearing on wood and 3" on concrete.
10. Joists shall be supported by properly sized hanger, or minimum 2" x 2" ledger strip.
11. If deck is greater than 5' high, depending on size and structural details, diagonal bracing may be required at posts.
12. Freestanding decks need not have frost-protected footings.
13. If deck is freestanding, then diagonal bracing will be required.
14. Flashing material example: Copper with plastic laminate on deck side. Provide a specific product name.
15. Be sure to use the proper fastening hardware per Manufacturer's Specifications and Code Requirements.
16. Install decking material and guardrail systems per Manufacturer's Specifications.
17. Provide a minimum 2" space from the chimney to framing/deck material.
18. For further "deck details," please go to www.fairfaxcounty.gov/decks/
19. The owner/contractor is responsible to call the building department to arrange for the following mandatory inspections:
    A. Pier holes prior to placing concrete.
    B. Framing prior to placement of deck.
    C. A final inspection for a Certificate of Compliance

2/2/06

IMPORTANT INFORMATION REGARDING DECKS AND HARDWARE

Connecticut State Building Code Section R319.2 amends the 2003 International Residential Code regarding fasteners allowed to be used on pressure preservative and fire retardant wood as follows:

(Amd) **R319.3** Fasteners and weight bearing connecting devices used for pressure preservative and fire-retardant treated wood shall be of stainless steel, silicon bronze, copper, G185 galvanized steel, or shall be hot-dipped after fabrication. **Exception:** one-half inch diameter or greater steel bolts in normally dry locations.

It is very important that when you purchase hardware, including lag screws, washers, joist hangers, screws and all other fasteners in contact with pressure treated wood, it must meet these standards, **or excessive corrosion will result**.

In addition, aluminum flashing **cannot come in contact with preservative treated wood** unless it is coated with a material to prevent contact with lumber.

Do not use old hardware on new preservative treated lumber either. There is a wealth of information available on the internet if you wish to further research this issue.

As an example: If purchasing Simpson hardware for a 2" x 8" joist hanger, their designation of LUS 28 would not be acceptable, but would have to be stamped with LUS28Z.

The "Z" designation shows G185 standard is met and "HDG" designation shows hot dipped galvanized standard is met.

Of course, you may also use the other materials including stainless steel, copper or silicon bronze, but this material is typically more expensive.

2/2/06

CODE AND COMMENTARY FOR DECKS

1. Piers/footings to be a minimum 42" (Amend R301.2.1.1) below finished grade and (R403.1.4.1) 400 sq. ft. exception (see attached). Stair stringers to be frost protected if deck is attached to house.
2. Landings at exterior doors (R311.4.3) (see attached).
3. Landings for stairways (2311.5.4).
4. Stairway walking surface (R311.5.5).
5. Minimum 36" width stairway (R311.5.1) (see attached).
6. Maximum rise for a stair is 8-1/4" (R311.5.3.1) (see attached).
7. Minimum tread (nosing to nosing) is 9" (R311.5.3.2) (see attached).
8. A 4" sphere cannot pass through an open riser (R311.5.3.3) (see attached).
9. A handrail shall be provided for stairs with four (4) or more continuous risers (R311.5.6) (see attached).
10. Maximum height of handrail is 38", minimum height is 34" (R311.5.6.2) (see attached).
11. The handrail shall be of a graspable type (R311.5.6.3) (see attached).
12. If the deck is more than 30" above finished grade or a floor, then it shall have guardrails a minimum of 36" high (R312.1)(see attached).
13. A 4" sphere cannot pass through any part of the above-mentioned guardrail (312.2) (see attached).
14. The ledger board (if attached to house) is to be connected per code and the manufacturer's installation specifications (engineered rim)(R502.2.1) (see attached).
15. Cantilever's – see attached Table R502.3.3(2).
16. Stairway illumination (R303.6) (see attached).

R403.1.4.1 Frost Protection. Except where otherwise protected from frost, foundation walls, piers and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending below the frost line specified in Table R301.2(1);
2. Constructing in accordance with Section R403.3;
3. Constructing in accordance with ASCE 32-01; and
4. Erected on solid rock.

Exceptions:

1. Freestanding accessory structures with an area of 400 square feet (37 m) or less and an eave height of 10 feet (3048 mm) or less shall not be required to be protected
2. Decks not supported by a dwelling need not be provided with footings that extend below the frost line.

Footings shall not bear on frozen soil unless such frozen condition is of a permanent character.

(Amd) 311.4.3 Landings at exterior doors. There shall be a floor or landing a minimum of 3 feet in the direction of travel and 3 feet in width, or a width equal to the width of any adjacent stair, whichever is greater, on each side of each exterior door. The landing on the exterior side of doors shall not be more than 8-1/4 inches below the top of the threshold provided that the door, other than an exterior storm or screen door, does not swing over the landing. In the event that the door, other than an exterior storm or screen door, swings over the landing, the landing shall not be more that 1.5 inches below the top of the threshold.

Exception: At other than the required exit door, a landing is not required for the exterior side of the door where a stairway of three or fewer risers, including the top riser from the dwelling to the top tread, is located on the exterior side of the door.

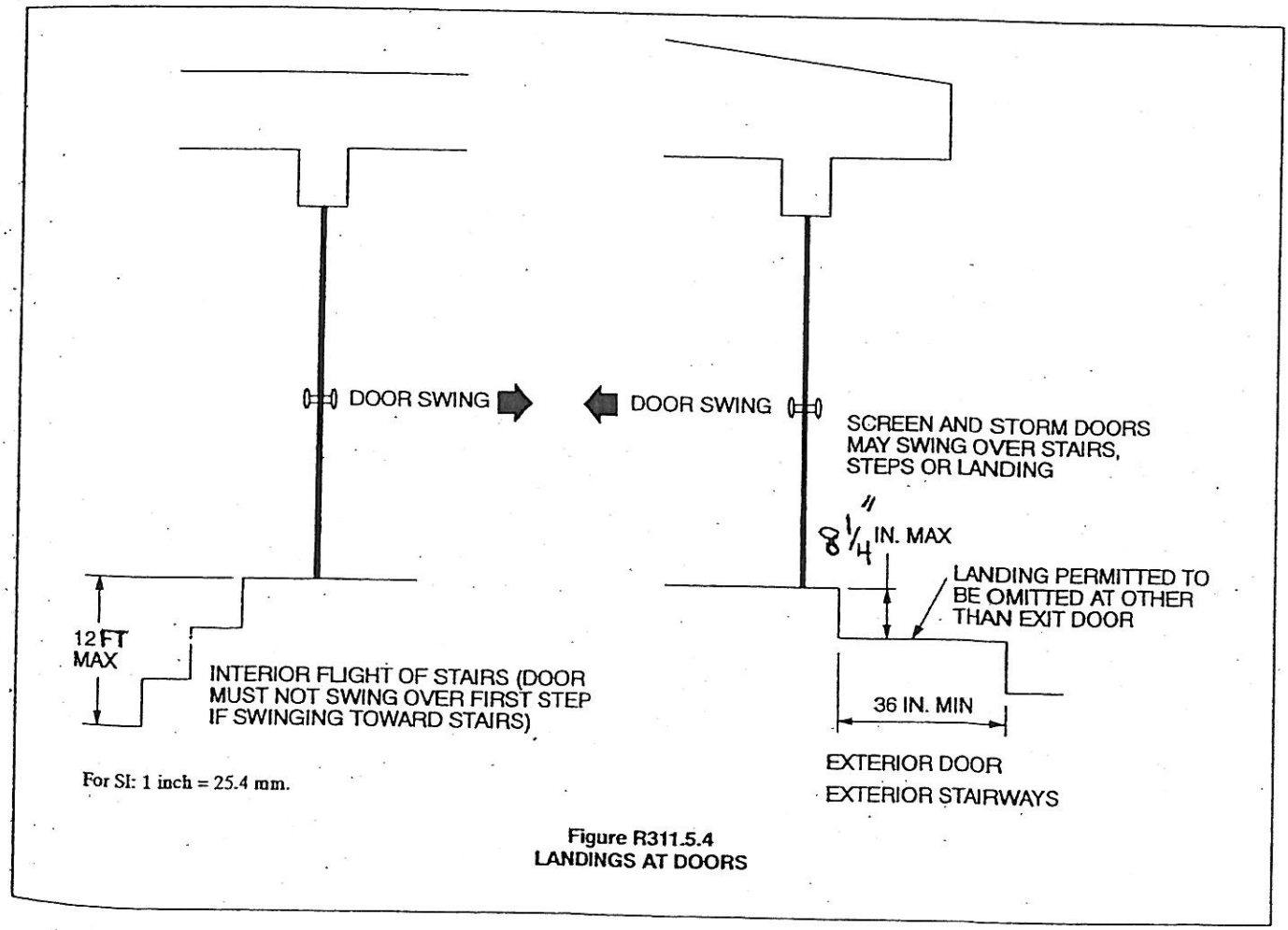


Figure R311.5.4
LANDINGS AT DOORS

R311.5.4 Landings for stairways. There shall be a floor or landing at the top and bottom of each stairway.

Exception: A floor or landing is not required at the top of an interior flight of stairs, provided a door does not swing over the stairs.

A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

The width of each landing shall not be less than the stairway served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

R311.5.5 Stairway walking surface. The walking surface of treads and landings of stairways shall be sloped no steeper than one unit vertical in 48 inches horizontal (2-percent slope).

R311.5 Stairways.

(Amd) R311.5.1 Width. Stairways shall not be less than 36 inches in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4.5 inches on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31.5 inches where a handrail is installed on one side and 27 inches where handrails are provided on both sides.

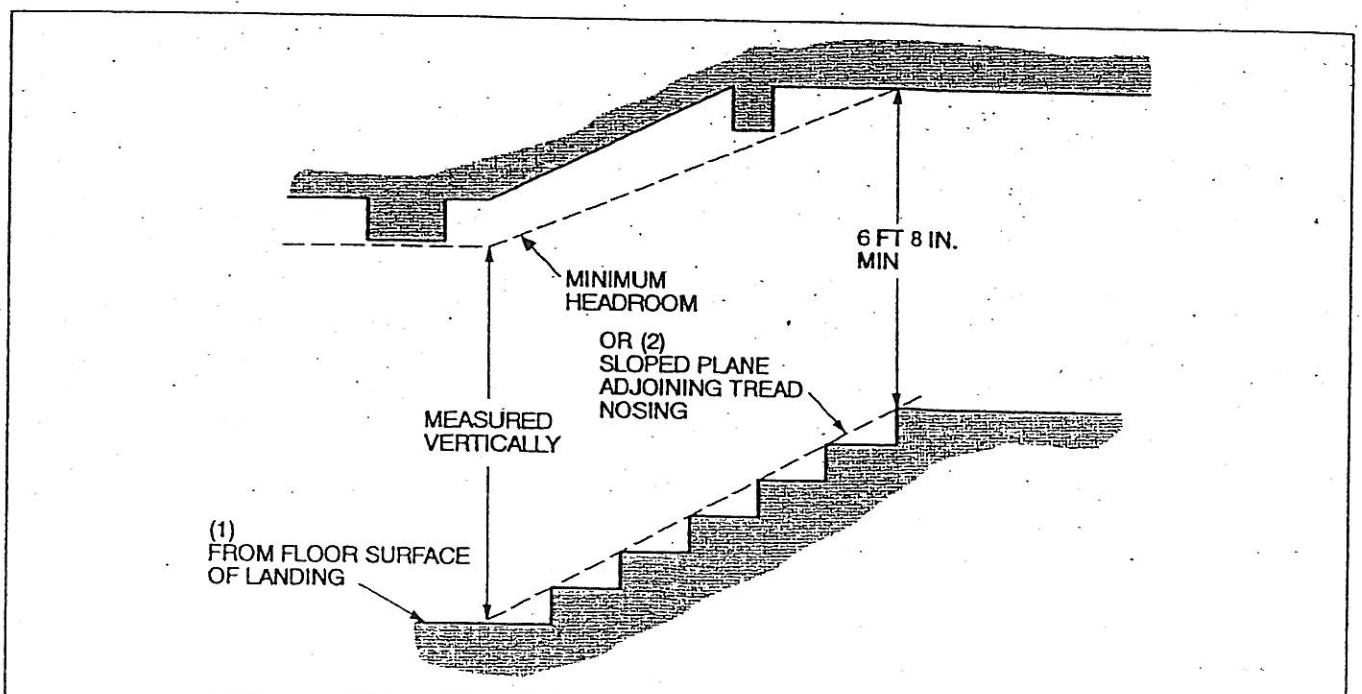
Exceptions:

1. The width of spiral stairways shall be in accordance with Section R311.5.8.
2. The width of existing stairways serving existing unfinished attics or existing unfinished basements being converted to habitable space shall not be less than 32 inches in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4 inches on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 28 inches where a handrail is installed on one side and 24 inches where handrails are provided on both sides.

(Amd) R311.5.2 Headroom. The minimum headroom in all parts of the stairway shall not be less than 6 feet, 8 inches measured vertically from the sloped plane adjoining the tread nosing or from the floor surface of the landing or platform.

Exception:

The minimum headroom in all parts of existing or replacement stairways serving existing unfinished attics or existing unfinished basements being converted to habitable space shall be 6 feet 6 inches, measured as above.



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

Figure R311.5.2
MINIMUM HEADROOM

2/2/06

R311.5.3 Stair treads and risers.

(Amd) R311.5.3.1 Riser Height. The maximum riser height shall be 8-1/4 inches. The minimum riser shall be 4 inches. Riser height shall be measured vertically between leading edges of adjacent treads.

Exception: The maximum riser height of existing or replacement stairs serving existing unfinished attics or existing unfinished basements being converted to habitable space shall be 9 inches, measured as above.

The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8 inch.

(Amd) R311.5.3.2 Tread Depth. The minimum tread depth shall be 9 inches. 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.

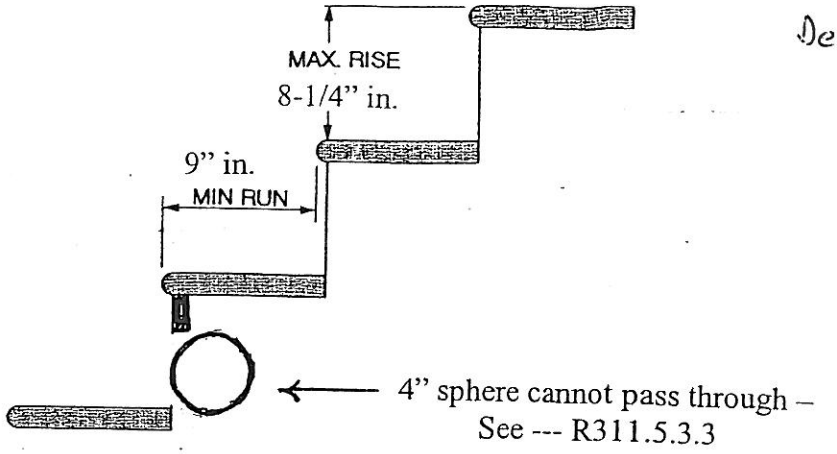
Exception: The minimum tread depth of existing or replacement stairs serving existing unfinished attics or existing unfinished basements being converted to habitable space shall be 8 inches, measured as above.

The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8 inch. Winder and circular stairway treads shall have a minimum tread depth of 9 inches measured as above at a point 12 inches from the sides where the treads are narrower. Winder treads shall have a minimum tread depth of 6 inches at any point. The greatest winder tread depth at the 12-inch walk line within any flight of stairs shall not exceed the smallest by more than 3/8 inch. The greatest circular tread depth at any walking line within any circular flight of stairs, measured at a consistent distance from a side of the stairway, shall not exceed the smallest by more than 3/8 inch.

R311.5.3.3 Profile. The radius of curvature at the leading edge of the tread shall be no greater than 9/16 inch (14.3 mm). A nosing not less than ¾ inch (19 mm) but not more than 1-1/4 inch (32 mm) shall be provided on stairways with solid risers. The greatest nosing projection shall not exceed the smallest nosing projection by more than 3/8 inch (9.5 mm) between two stories, including the nosing at the level of floors and landings. Beveling of nosing shall not exceed ½ inch (12.7 mm). Risers shall be vertical or sloped from the underside of the leading edge of the tread above at an angle not more than 30 (0.51 rad) degrees from the vertical. Open risers are permitted, provided that the opening between treads does not permit the passage of a 4-inch diameter (102 mm) sphere.

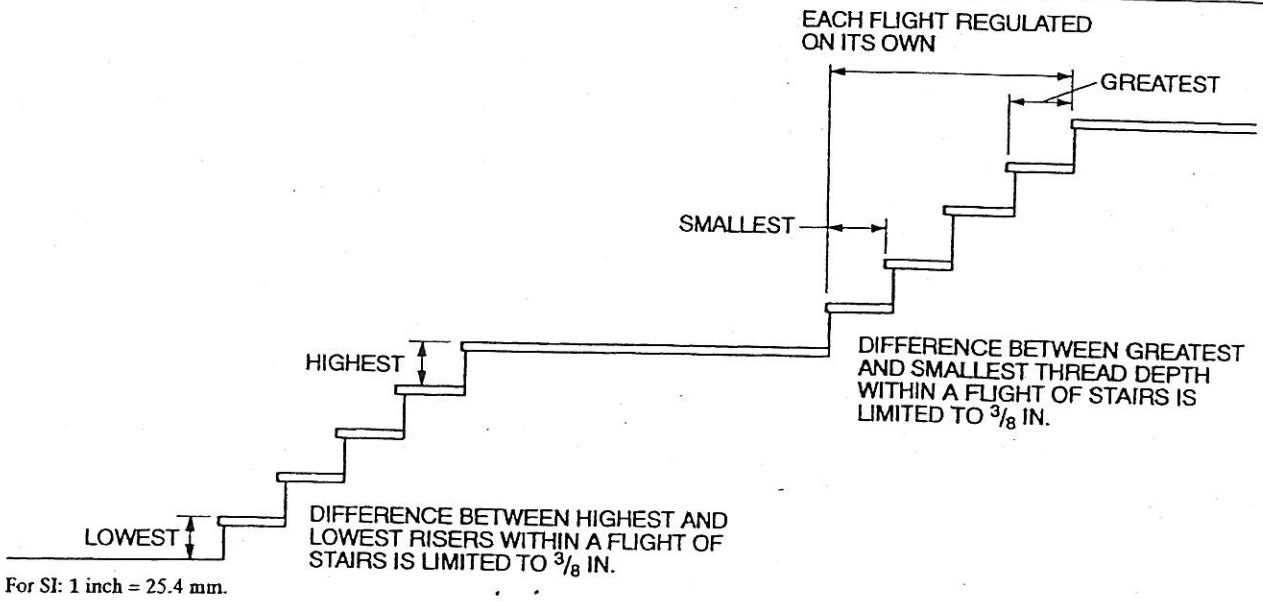
Exceptions:

1. A nosing is not required where the tread depth is a minimum of 11 inches (279 mm).
2. The opening between adjacent treads is not limited on stairs with a total rise of 30 inches (762 mm) or less.



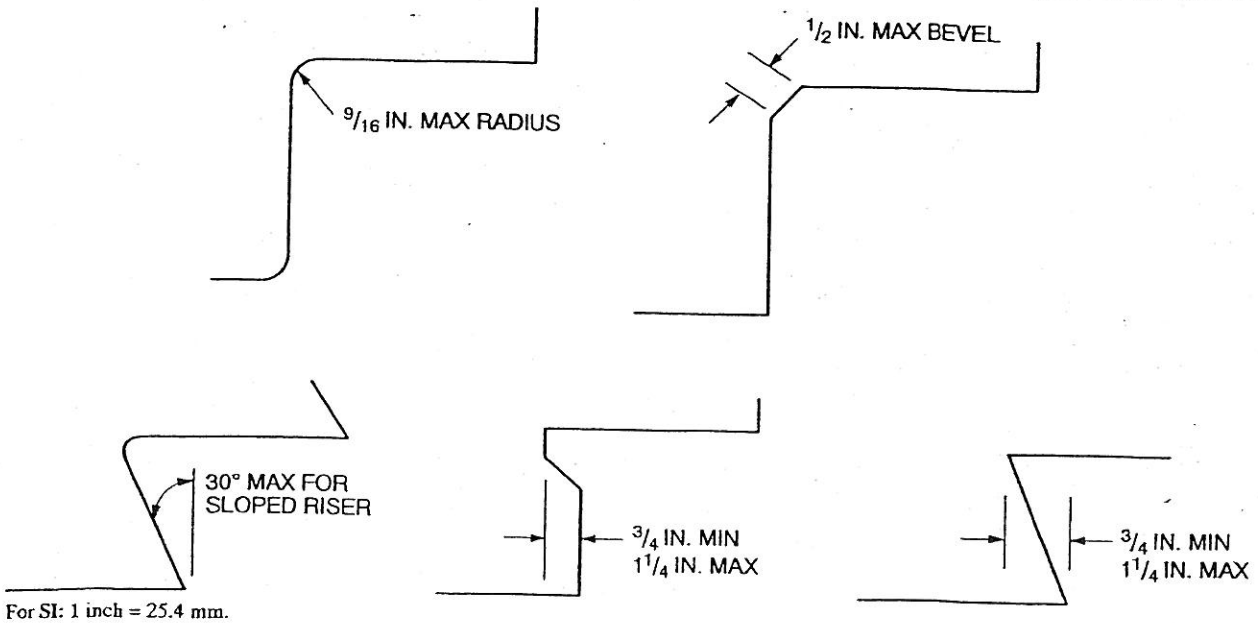
For SI: 1 inch = 25.4 mm.

Figure R311.5.3.1(1)
CONVENTIONAL STAIRWAY



For SI: 1 inch = 25.4 mm.

Figure R311.5.3.1(2)
STAIR TOLERANCES



For SI: 1 inch = 25.4 mm.

Figure R311.5.3.3
TREAD PROFILE

R311.5.6 Handrails. Handrails shall be provided on at least one side of each continuous run of treads or flight with four or more risers.

R311.5.6.1 Height. Handrail height, measured vertically from the sloped plan adjoining the tread nosing, or finish surface of ramp slope, shall be not less that 34 inches (864 mm) and not more than 38 inches (965 mm).

(Amd) R311.5.6.2 Continuity. Handrails for stairways shall be continuous for the full length of each 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 to a wall or shall terminate in newel posts or safety terminations. Handrails adjacent to a wall shall have a space of not less than 1 ½ inch between the wall and the handrails.

Exceptions:

1. Handrails shall be permitted to be interrupted by a newel post at a level landing.
2. The use of a volute, turnout, starting easing or starting newell shall be permitted over the lowest tread.

R311.5.6.3 Handrail grip size. All required handrails shall be of one of the following types or provide equivalent graspability.

1. Type I. Handrails with a circular cross section shall have an outside diameter of at least 1-1/4 inches (32 mm) and not greater than 2 inches (51 mm). If the handrail not circular, it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than 6-1/4 inches (160 mm) with a maximum cross section of dimension of 2-1/4 inches (57 mm).
2. Type II. Handrails with a perimeter greater than 6-1/4 inches (160 mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of ¾ inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at least 5/16 inch (8 mm) within 7/8 inch (22 mm) below the widest portion of the profile. This required depth shall continue for at least 3/8 inch (10 mm) to a level that is not less than 1-3/4 inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be 1-1/4 inches (32 mm) to a maximum of 2-3/4 inches (70 mm). Edges shall have a minimum radius of 0.01 inches (0.25 mm).

R311.5.7 Illumination. All stairs shall be provided with illumination in accordance with Section R303.6.

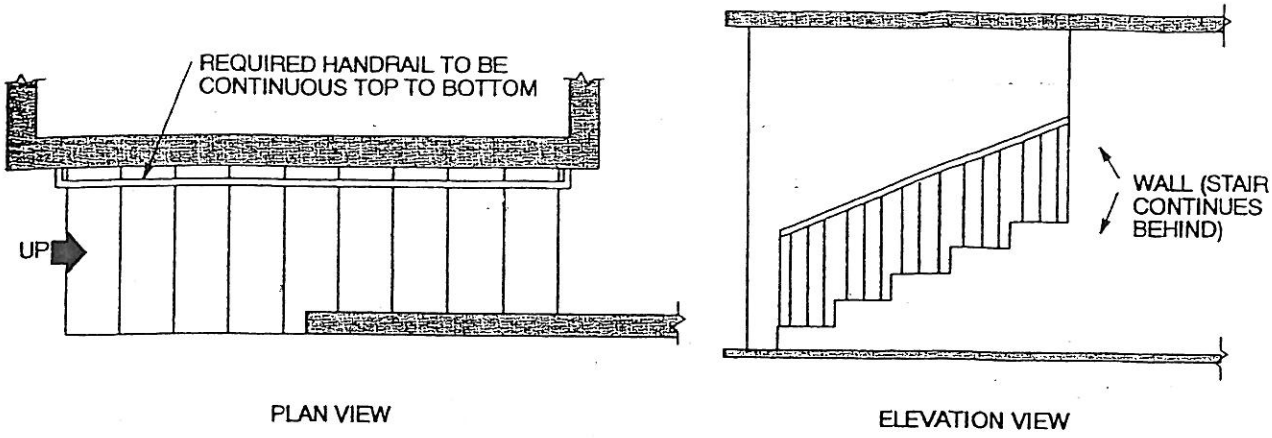
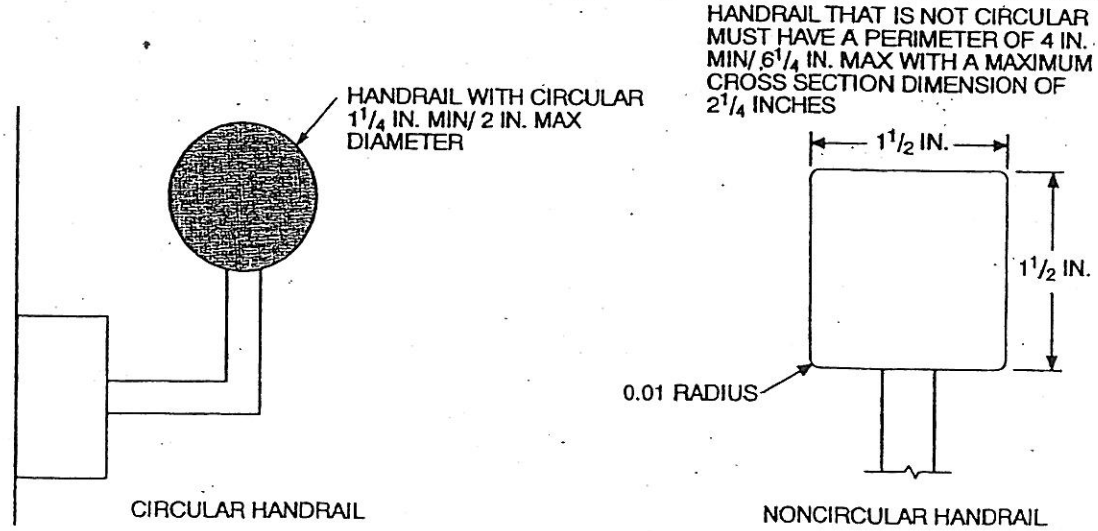


Figure R311.5.6.2
HANDRAILS



For SI: 1 inch = 25.4 mm.

Figure R311.5.6.3(1)
TYPE I HANDRAIL

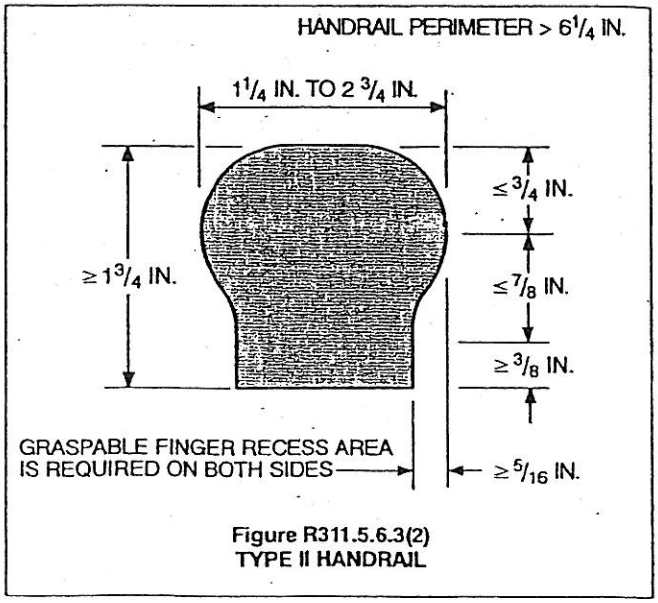


Figure R311.5.6.3(2)
TYPE II HANDRAIL

SECTION R312
GUARDS

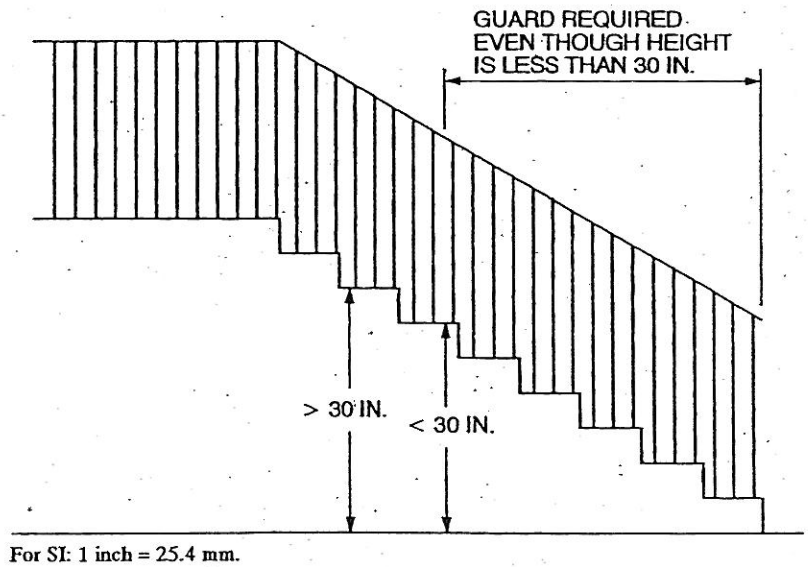
R312.1 Guards Required. Porches, balconies or raised floor surfaces located more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 36 inches (914 mm) in height. Open sides of stairs with a total rise of more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 34 inches (864 mm) in height measured vertically from the nosing of the treads.

Porches and decks, which are enclosed with insect screening, shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

R312.2 Guard opening limitations. Required guards on open sides of stairways, raised floor areas, balconies and porches shall have intermediate rails or ornamental closures which do not allow passage of a sphere 4 inches (102 mm) or more in diameter.

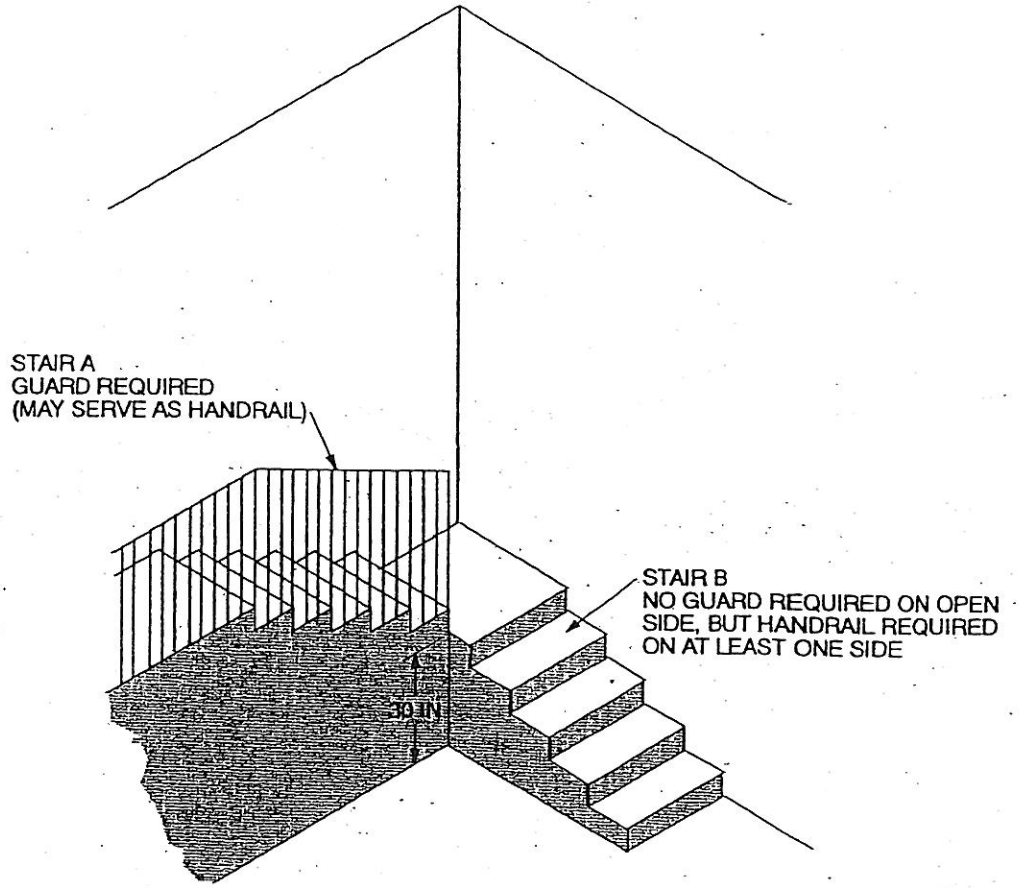
Exceptions:

1. The triangular openings formed by the riser, tread and bottom rail of a guard at the open side of a stairway are permitted to be of such a size that a sphere 6 inches (152 mm) cannot pass through.
2. Openings for required guards on the sides of stair treads shall not allow a sphere 4-3/8 inches (107 mm) to pass through.



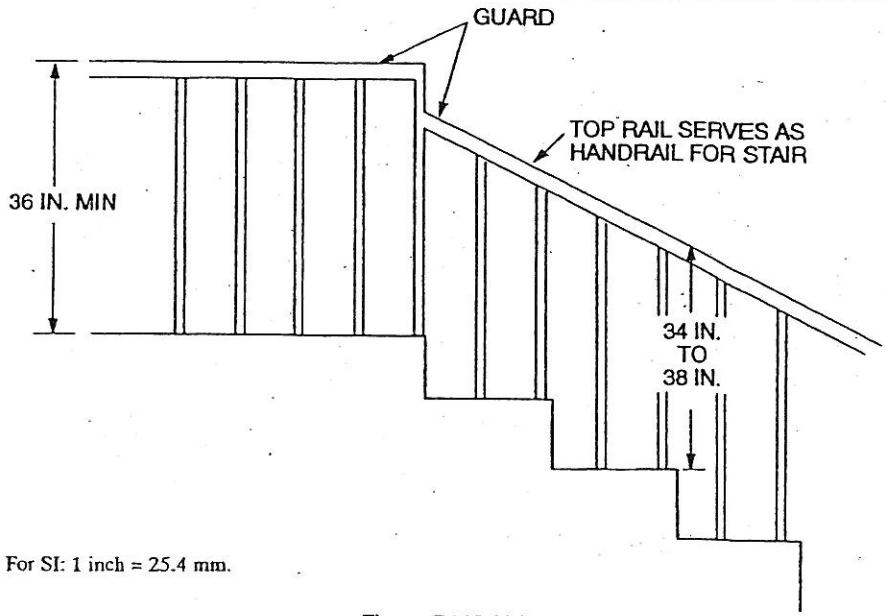
For SI: 1 inch = 25.4 mm.

Figure R312.1(1)
STAIRWAY GUARD



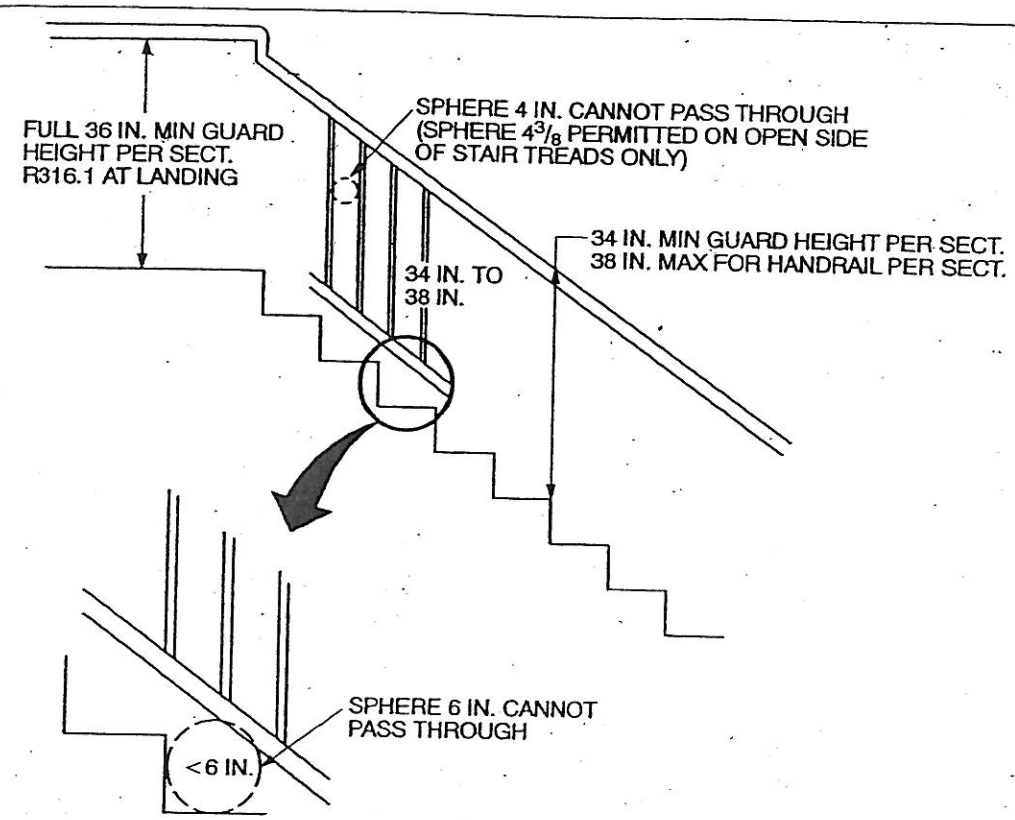
For SI: 1 inch = 25.4 mm.

Figure R312.1(2)
STAIRWAY GUARD



For SI: 1 inch = 25.4 mm.

Figure R312.1(3)
STAIRWAY GUARD



For SI: 1 inch = 25.4 mm.

Figure R312.2
GUARD REQUIREMENTS

R502.2.1 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. For decks with cantilevered framing members, connections to exterior walls or other framing members, shall be designed and constructed to resist uplift resulting from the full live load specified in Table 301.4 acting on the cantilevered portion of the deck.

TABLE R502.3.3(2)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING EXTERIOR BALCONY[a, b, e, f]

Member Size	Spacing	Maximum Cantilever Span (Uplift Force at Backspan Support in Lbs.)[c, d]		
		Ground Snow Load		
		≤30 psf	50 psf	70 psf
2 × 8	12″	42″ (139)	39″ (156)	34″ (165)
2 × 8	16″	36″ (151)	34″ (171)	29″ (180)
2 × 10	12″	61″ (164)	57″ (189)	49″ (201)
2 × 10	16″	53″ (180)	49″ (208)	42″ (220)
2 × 10	24″	43″ (212)	40″ (241)	34″ (255)
2 × 12	16″	72″ (228)	67″ (260)	57″ (268)
2 × 12	24″	58″ (279)	54″ (319)	47″ (330)

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

a. Spans are based on No. 2 Grade lumber of Douglas fir-larch, hem-fir, southern pine, and spruce-pine-fir for repetitive (3 or more) members.

b. Ratio of backspan to cantilever span shall be at least 2:1.

c. Connections capable of resisting the indicated uplift force shall be provided at the backspan support.

d. Uplift force is for a backspan to cantilever span ratio of 2:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to 2 divided by the actual backspan ratio provided (2/backspan ratio).

e. A full-depth rim joist shall be provided at the cantilevered end of the joists. Solid blocking shall be provided at the cantilevered support.

f. Linear interpolation shall be permitted for ground snow loads other than shown.

R303.6 Stairway Illumination. All interior and exterior stairways shall be provided with a means to illuminate the stairs including the landings and treads. Interior stairways shall be provided with an artificial light source located in the immediate vicinity of each landing of the stairway. For interior stairs the artificial light sources shall be capable of illuminating treads and landings to levels not less than 1 foot-candles (11 lux) measured at the center of treads and landings. Exterior stairways shall be provided with an artificial light source located in the immediate vicinity of the top landing of the stairway. Exterior stairways providing access to a basement from the outside grade level shall be provided with an artificial light source located in the immediate vicinity of the bottom landing of the stairway.

Exception: An artificial light source is not required at the top and bottom landing, provided an artificial light source is located directly over each stairway section.

R303.6.1 Light activation. The control for activation of the required interior stairway lighting shall be accessible at the top and bottom of each stairway without traversing any steps. The illumination of exterior stairways shall be controlled from inside the dwelling unit.

Exception: Lights that are continuously illuminated or automatically controlled.

LEDGER ATTACHMENT

R502.2.1 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. For decks with cantilevered framing members, connections to exterior walls or other framing members, shall be designed and constructed to resist uplift resulting from the full live load specified in Table 301.4 acting on the cantilevered portion of the deck.

SIDING AND FLASHING: Siding or the exterior finish system must be removed prior to the installation of the ledger board. Flashing is required at any ledger board connection to a wall of wood framed construction and shall be composed of copper (attached using copper nails), stainless steel, UV resistant plastic or galvanized steel coated with 1.85 oz/sf of zinc (G185 coating), etc.

MANUFACTURED WOOD JOIST: The term "MWJ" denotes manufactured wood "I" joists; see FIGURE 4. Examples of manufactured wood joists are TJI, GPI, and LPI.

Many new homes constructed with MWJ's include a 1-1/4" manufactured solid rim joist; see FIGURE 5. However, older homes constructed with MWJ's may only include a plywood band board. In these cases a freestanding deck or further information (manufacturer's installation specs.) will be required.

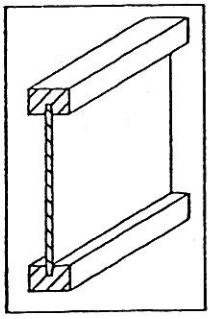


FIGURE 4: MWJ PROFILE

Thru-Bolts
Thru-bolts shall have a minimum diameter of $^1/_2$". Lead (pilot) holes for thru-bolts shall be $^{17}/_{32}$" to $^9/_{16}$" in diameter. Thru-bolts must be equipped with washers at the bolt head as well as the nut.

Expansion Anchors
Use expansion anchors when attaching a ledger board to a concrete or solid masonry wall as shown in FIGURE 6. Bolt diameters of the anchors shall be a minimum of $^1/_2$"; in some cases, this may require an anchor size of $^5/_8$". Minimum embedment length shall be 2-$^1/_2$". Expansion anchors must have washers.

Epoxy Anchors
When attaching to hollow masonry, fill the cells with grout and use expansion anchors, or use one of the epoxy anchors listed in TABLE 5 and install as shown in FIGURE 7. Epoxy anchors shall have a minimum diameter of $^1/_2$" and minimum embedment length of 3-$^1/_2$". Installation shall be in strict conformance to the manufacturers' instructions. Epoxy anchors must have washers.

EPOXY ANCHORS

Manufacturer	Product
ITW Ramset/Red Head	Epcon Acrylic 7
Hilti	HY-20

Lag Screws
Lag screws shall have a minimum diameter of $^1/_2$" and shall be hot-dipped galvanized or stainless steel. Lag screws may be used only when the field conditions match those shown in FIGURE 5. **You must verify the existing conditions in the field prior to applying for a building permit and installing lag screws. Compliance with all the requirements herein is critical to ensure the structural stability of your deck.** See FIGURE 12 for lag screw length and shank requirements. All lag screws shall be installed with washers.

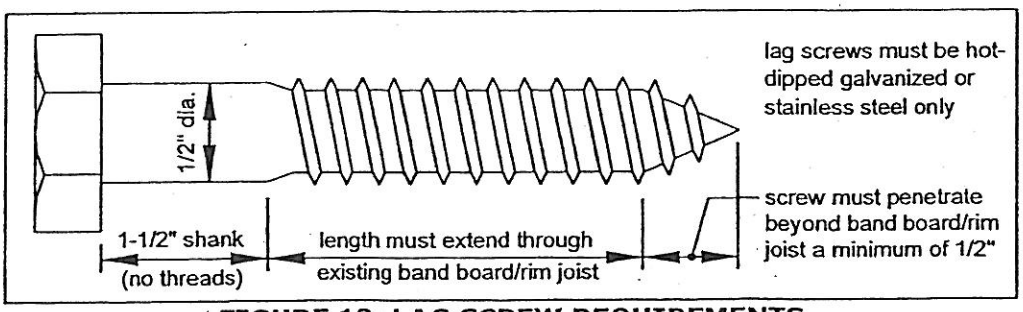


FIGURE 12: LAG SCREW REQUIREMENTS

Lag screw installation requirements: each lag screw shall have lead (pilot) holes drilled as follows: 1) drill a $^1/_2$" diameter hole in the ledger board, 2) drill a $^5/_{16}$" diameter hole into the solid connection material of the existing house. DO NOT DRILL A $^1/_2$" DIAMETER HOLE INTO THE SOLID CONNECTION MATERIAL.

The threaded portion of the lag screw shall be inserted into the lead hole by turning. DO NOT DRIVE WITH A HAMMER. Use soap or a wood-compatible lubricant as required to facilitate tightening. Each lag screw shall be thoroughly tightened.

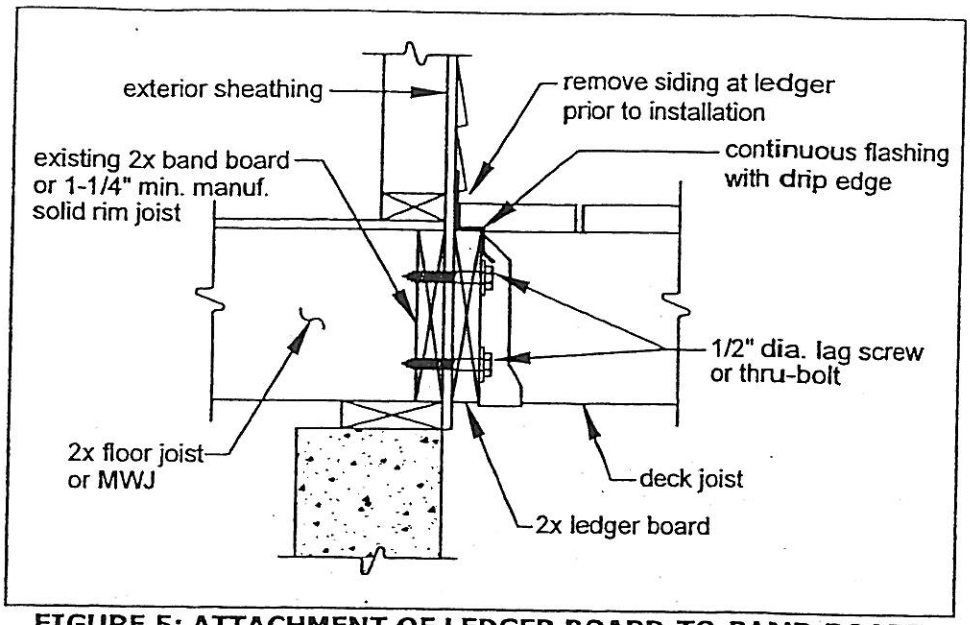


FIGURE 5: ATTACHMENT OF LEDGER BOARD-TO-BAND BOARD

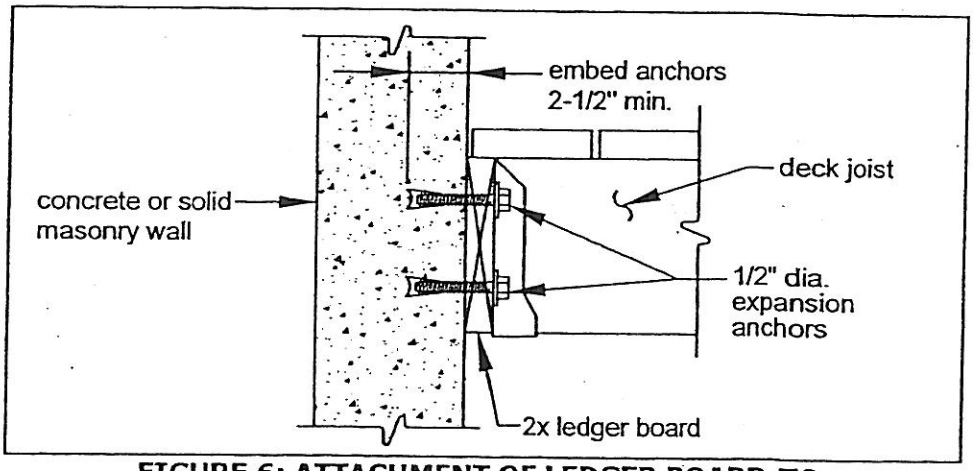


FIGURE 6: ATTACHMENT OF LEDGER BOARD-TO-FOUNDATION WALL (CONCRETE OR SOLID MASONRY)

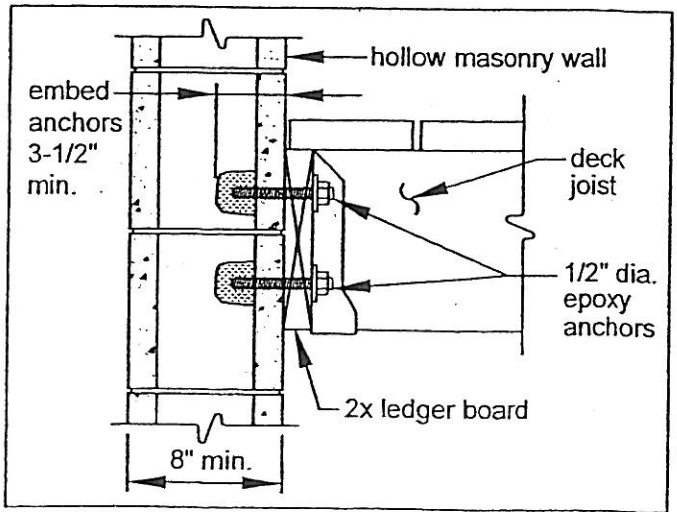
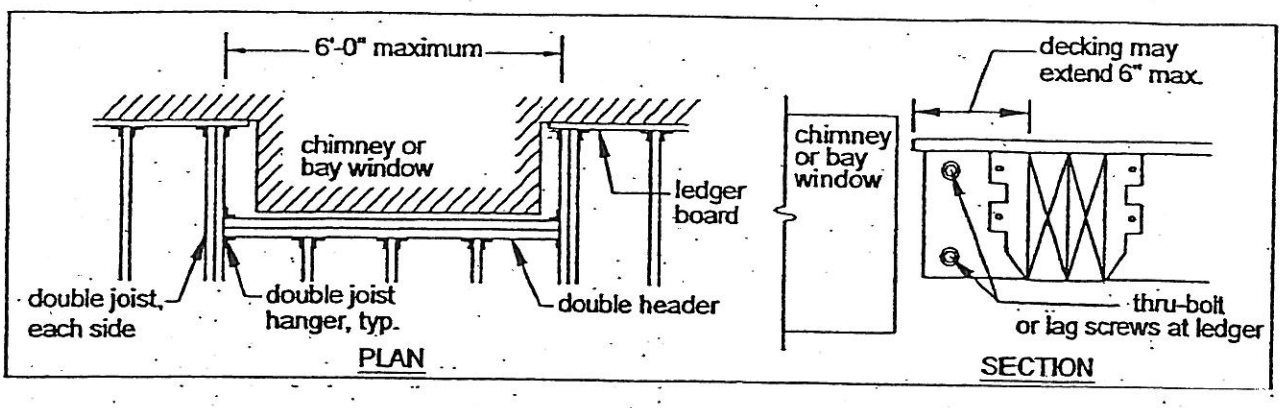


FIGURE 7: ATTACHMENT OF LEDGER BOARD-TO-FOUNDATION WALL (HOLLOW MASONRY)

FRAMING AT CHIMNEY OR BAY WINDOW



PROHIBITED LEDGER ATTACHMENTS

Attachments to the ends of pre-manufactured open web joists, to brick veneers, and to house overhangs/bay windows are strictly prohibited; see FIGURE 8 through FIGURE 10. In such cases the deck shall be free-standing.

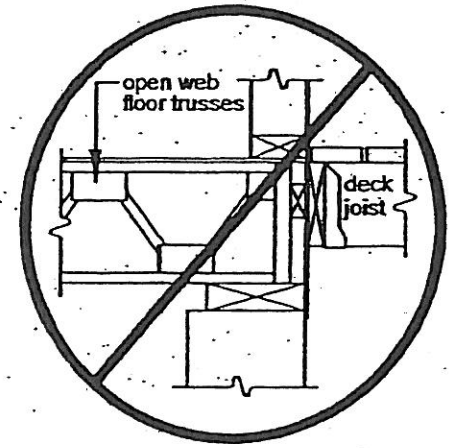


FIGURE 8: NO ATTACHMENT TO OPEN WEB TRUSSES

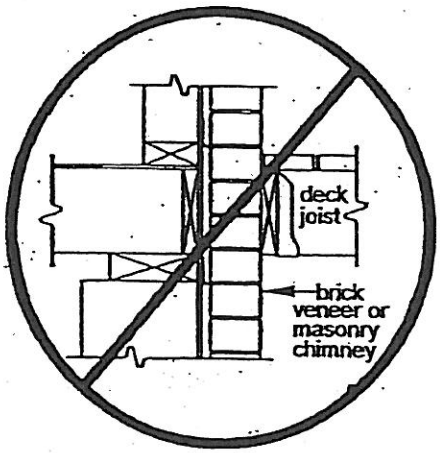


FIGURE 9: NO ATTACHMENT TO BRICK VENEER

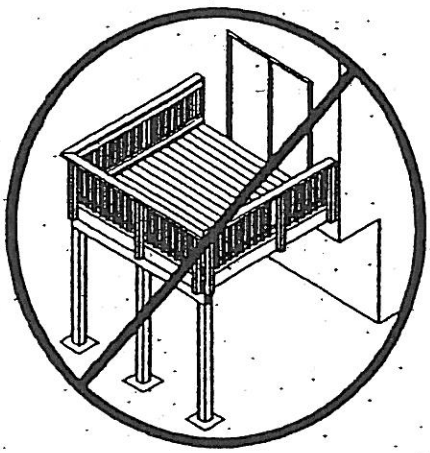


FIGURE 10: NO ATTACHMENT TO HOUSE OVERHANG

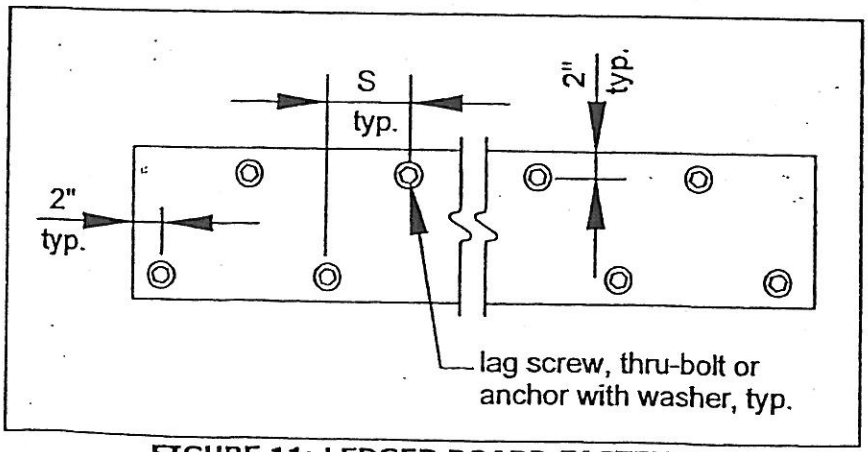


FIGURE 11: LEDGER BOARD FASTENER SPACING AND CLEARANCES

Table 4. Calculated o.c. spacings (inches) for PPT Hem-Fir or Southern Pine deck ledgers attached to SPF or a 1-inch thick LVL band joist.

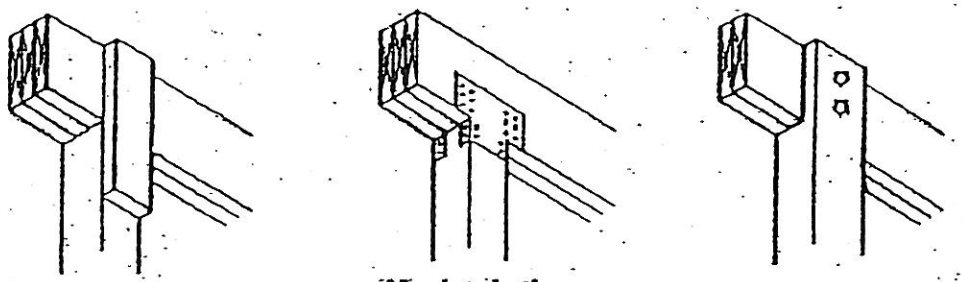
CONNECTION DETAIL*	RESIDENTIAL DECK JOIST SPAN						
	6 feet	8 feet	10 feet	12 feet	14 feet	16 feet	18 feet
1/2-inch lag screws with 15/32-inch sheathing	30	23	18	15	13	11	10
1/2-inch bolts with 15/32-inch sheathing	36**	36**	34	29	24	21	19
1/2-inch bolts with 15/32-inch sheathing and 1/2-inch stacked washers	36**	36**	29	24	21	18	16

* Average deflections between the ledger and band joist at design load were less than 0.23 inch.

**These spacings were limited by a consideration of the bending strength of a 2 x 8 (minimum) ledger between the bolts or lag

Posts to girder attachment should be braced to prevent girder from "rolling". (Figure 3). Any seams or splices in the girder must be over the posts. (Figure 4).

Post to girder Attachment Detail
(Figure 3)



2x6 Gusset attached to side of post and girder

Mechanical fasteners install as per manufactures

Post notched and bolted to girder

POST-TO-BEAM

The post-to-beam connection may be accomplished by notching the post as shown in **FIGURE 20**. All thru-bolts shall have washers at the bolt head and nut.

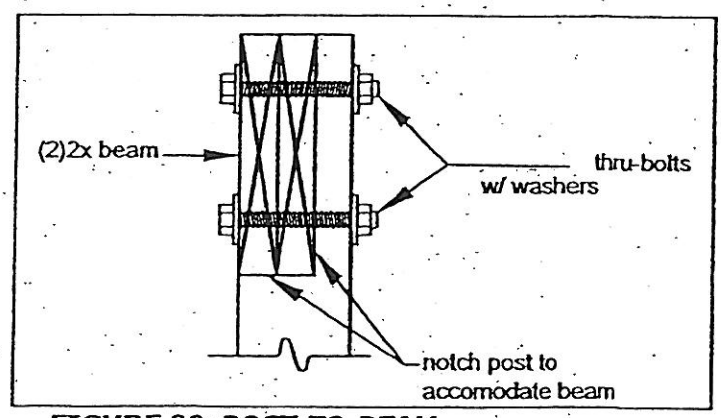


FIGURE 20: POST-TO-BEAM

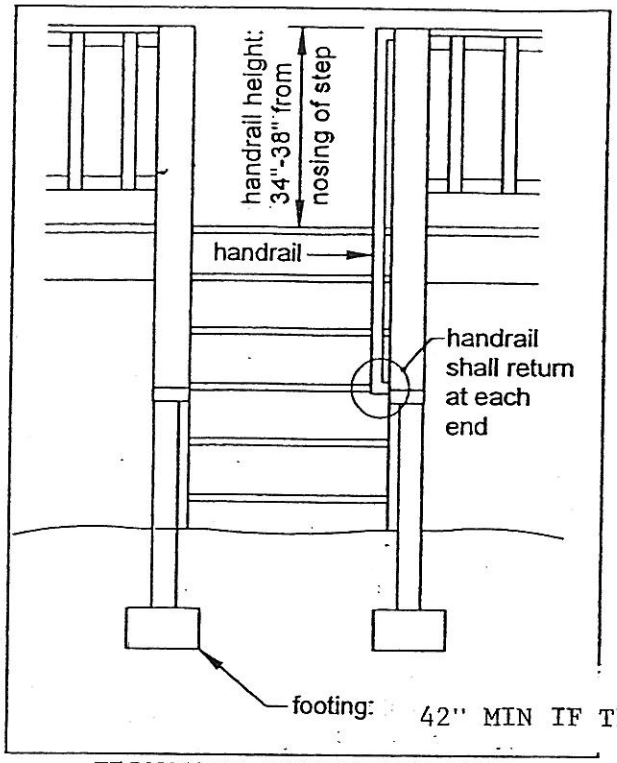


FIGURE 33: MISCELLANEOUS STAIR REQUIREMENTS

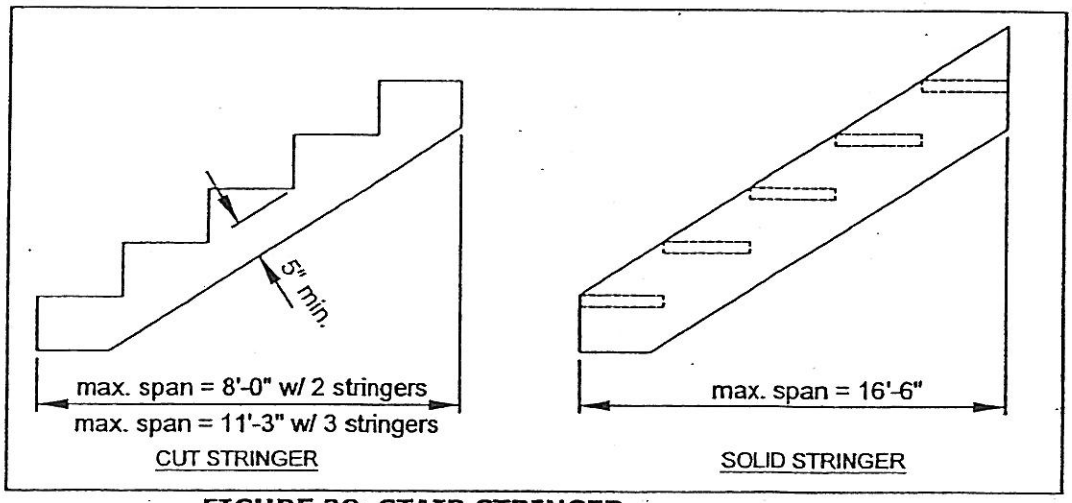


FIGURE 28: STAIR STRINGER

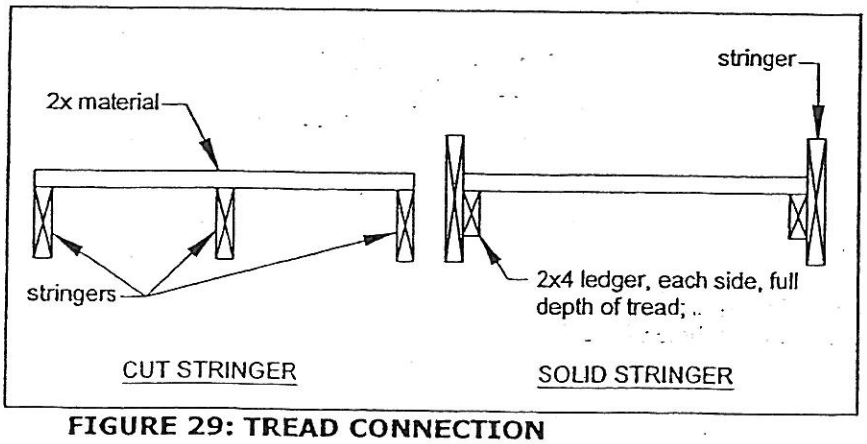


FIGURE 29: TREAD CONNECTION

SOUTHERN PINE SPAN TABLES

Maximum spans given in feet and inches
Inside to inside of bearings

TABLE 14 WET-SERVICE FLOOR JOISTS – 40 PSF LIVE LOAD, 10 PSF DEAD LOAD, 360 DEFLECTION

DECKS, MOISTURE CONTENT EXCEEDS 19%

Size (inches)	Spacing (inches on center)	Grade									
		Visually Graded				Machine Stress Rated (MSR)			Machine Evaluated Lumber (MEL)		
		SS	No.1	No.2	No.3	2400f - 2.0E	2250f - 1.9E	1950f - 1.7E	M23	M14	M29
2x6	12.0	10-9	10-7	10-4	9-4	11-2	11-0	10-7	10-9	10-7	10-7
	16.0	9-9	9-7	9-5	8-1	10-2	10-0	9-7	9-9	9-7	9-7
	19.2	9-2	9-0	8-9	7-4	9-6	9-4	9-0	9-2	9-0	9-0
	24.0	8-7	8-5	7-10	6-7	8-10	8-8	8-5	8-7	8-5	8-5
2x8	12.0	14-2	13-11	13-8	11-11	14-8	14-5	13-11	14-2	13-11	13-11
	16.0	12-11	12-8	12-5	10-3	13-4	13-2	12-8	12-11	12-8	12-8
	19.2	12-2	11-11	11-4	9-5	12-7	12-4	11-11	12-2	11-11	11-11
	24.0	11-3	11-1	10-2	8-5	11-8	11-6	11-1	11-3	11-1	11-1
2x10	12.0	18-1	17-9	17-5	14-0	18-9	18-5	17-9	18-1	17-9	17-9
	16.0	16-5	16-2	15-10	12-2	17-0	16-9	16-2	16-5	16-2	16-2
	19.2	15-6	15-1	14-8	11-1	16-0	15-9	15-2	15-6	15-2	15-2
	24.0	14-4	13-6	13-1	9-11	14-11	14-8	14-1	14-4	14-1	14-1
2x12	12.0	22-0	21-7	21-2	16-8	22-10	22-5	21-7	22-0	21-7	21-7
	16.0	20-0	19-8	18-10	14-6	20-9	20-4	19-8	20-0	19-8	19-8
	19.2	18-10	17-11	17-2	13-2	19-6	19-2	18-6	18-10	18-6	18-6
	24.0	17-6	16-1	15-5	11-10	18-1	17-10	17-2	17-6	17-2	17-2

These spans are intended for use in enclosed structures or where the moisture content in use does not exceed 19 percent for an extended period of time unless the table is labled Wet-Service. Applied loads are given in psf (pounds per square foot). Deflection is limited to the span in inches divided by 360, 240, or 180 and is based on live load only. The load duration factor, C_D, is 1.0 unless shown as 1.15 or 1.25. An asterisk (*) indicates the listed span has been limited to 26'0" based on availability; check sources of supply for lumber longer than 20'. Highlighted sizes/grades are NOT commonly produced.

The Southern Pine Council does not grade or test lumber, and accordingly, does not assign design values to Southern Pine lumber. The design values contained herein are based on the *2002 SPIB Standard Grading Rules for Southern Pine Lumber*, published by the Southern Pine Inspection Bureau, and modified as required by the *2001 National Design Specification® (NDS®) for Wood Construction* published by the American Forest & Paper Association (AF&PA).

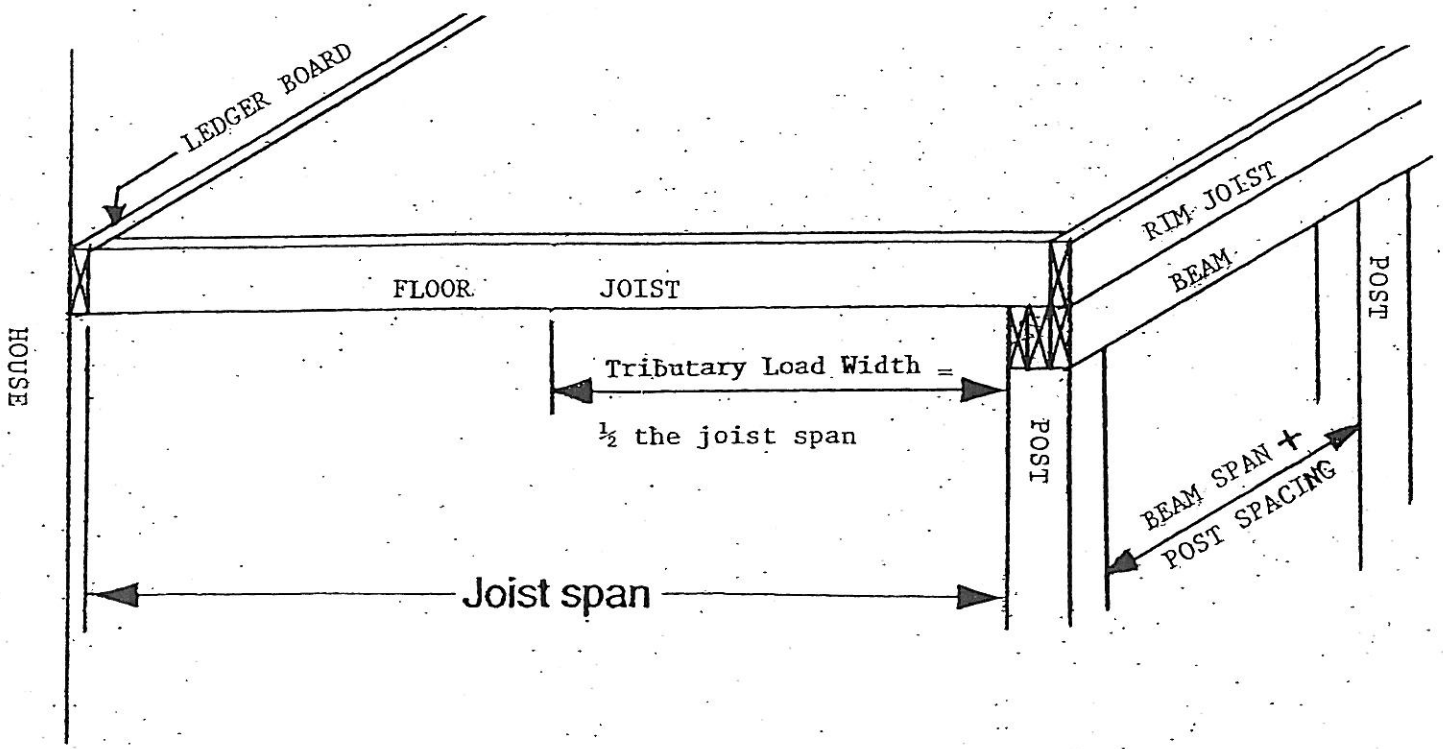
The primary purpose of this publication is to provide a convenient reference for joist and rafter spans for specific grades of Southern Pine lumber. The maximum spans provided herein were determined on the same basis as those in *Span Tables for Joists and Rafters*, published by AF&PA. Accordingly, the Southern Pine Council, its principals and/or members, do not warrant in any way that the design values on which the span tables for Southern Pine lumber contained herein are based are correct, and specifically disclaim any liability for injury or damage resulting from the use of such span tables.

The conditions under which lumber is used in construction may vary widely, as does the quality of the lumber and workmanship. Neither the Southern Pine Council, nor its principals and/or members, have any knowledge of the construction methods, quality of materials and workmanship used on any construction project; and accordingly, cannot and do not, warrant the performance of the lumber used in completed structures.

BEAM SIZE AND BEAM SPAN – (OR POST TO POST SPACING)

Maximum Beam Span – Residential Decks (40 spf live load-/10psf dead load)								
Southern Pine CCA #2	Tributary Load Width (Tributary width is the portion of the joist span supported by the beam)1							
	Tributary Width	Tributary Width	Tributary Width	Tributary Width	Tributary Width	Tributary Width	Tributary Width	Tributary Width
Beam Size	4'	5'	6'	7'	8'	9'	10'	11'
2x8	6'5"	5'2"	4'3"	3'8"	3'2"	2'10"	2'7"	2'4"
2-2x8	10'1"	9'1"	8'3"	7'4"	6'5"	5'8"	5'2"	4'8"
3-2x8	12'10"	11'10"	10'10"	10'	9'5"	8'6"	7'8"	7'
2x10	8'2"	6'6"	5'5"	4'8"	4'1"	3'8"	3'3"	3'
2-2x10	12'0"	10'9"	9'10"	9'2"	8'2"	7'3"	6'6"	5'11"
3-2x10	15'8"	14'1"	12'10"	11'11"	11'12"	10'7"	9'9"	8'11"
2x12	9"11"	7'11"	6'7"	5'8"	5'	4'5"	4'	3'7"
2-2x12	14'0"	12'7"	11'6"	10'8"	9'11"	8'10"	7'11"	7'3"

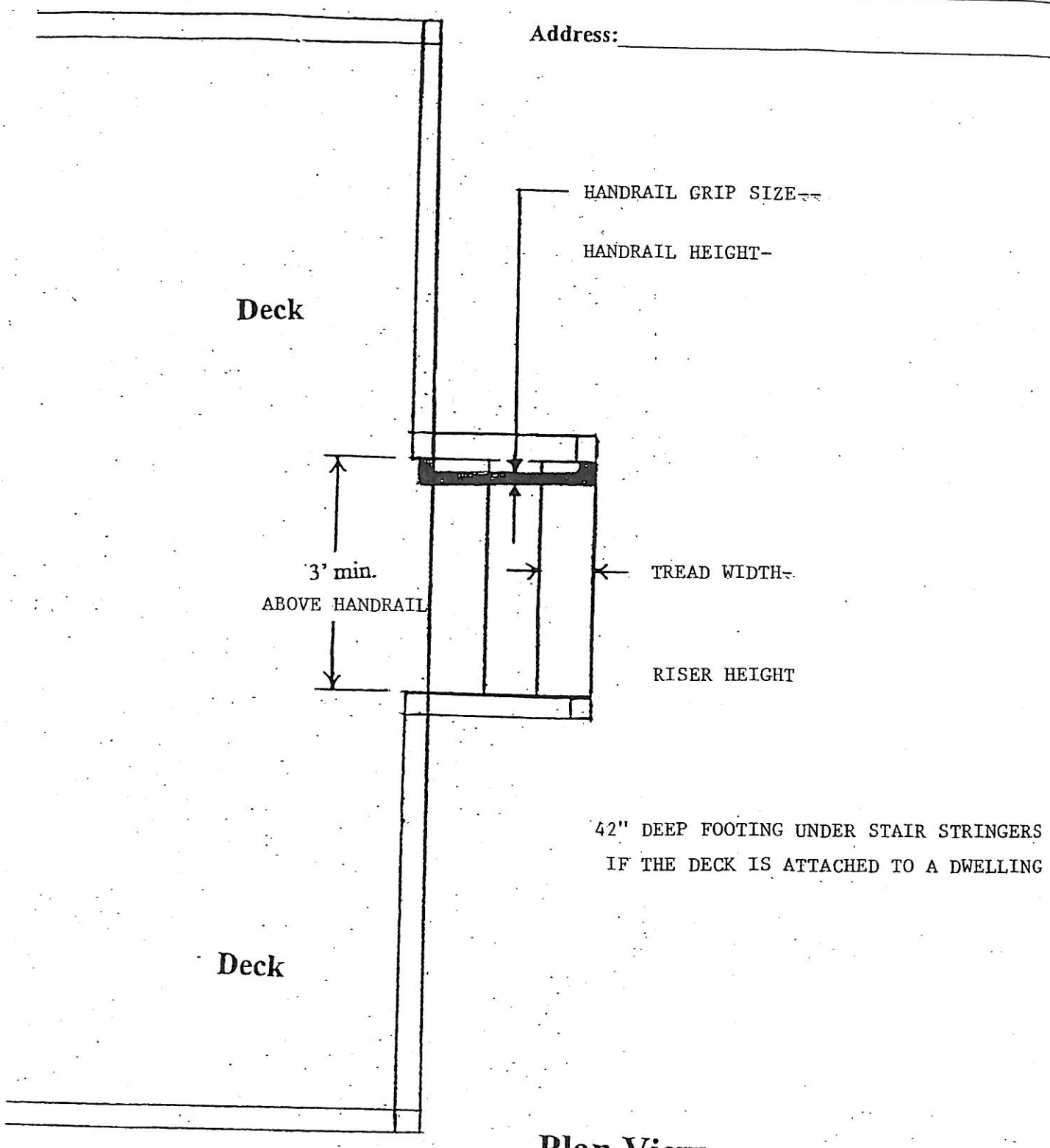
1. For simple spans the tributary width is ½ the joist length – for a center beam the tributary width is the sum of the ½ the span from each side of the beam.



Print Name: _____

Signature: _____

Address: _____

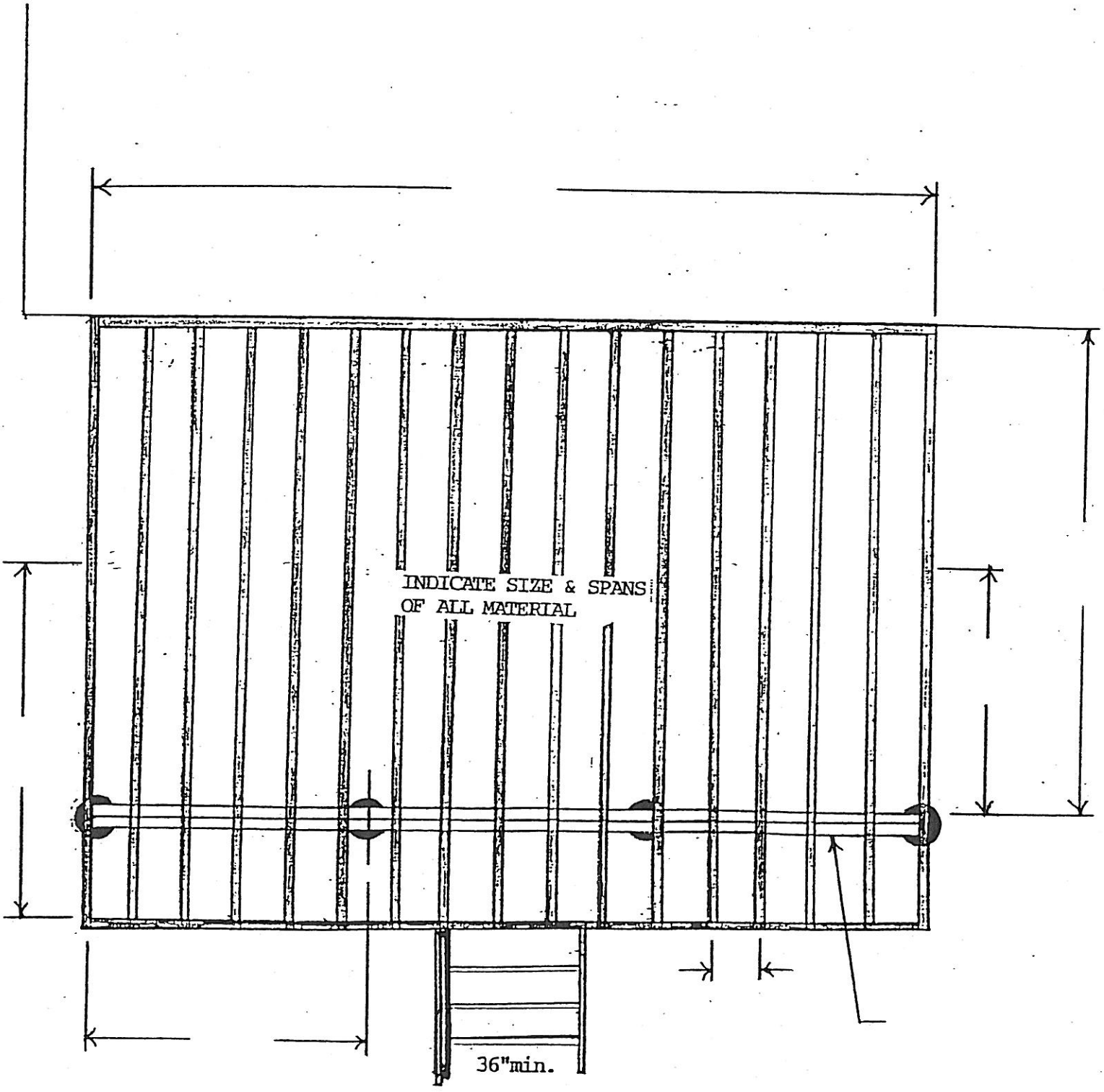


Plan View

Print Name:_____

Signature:_____

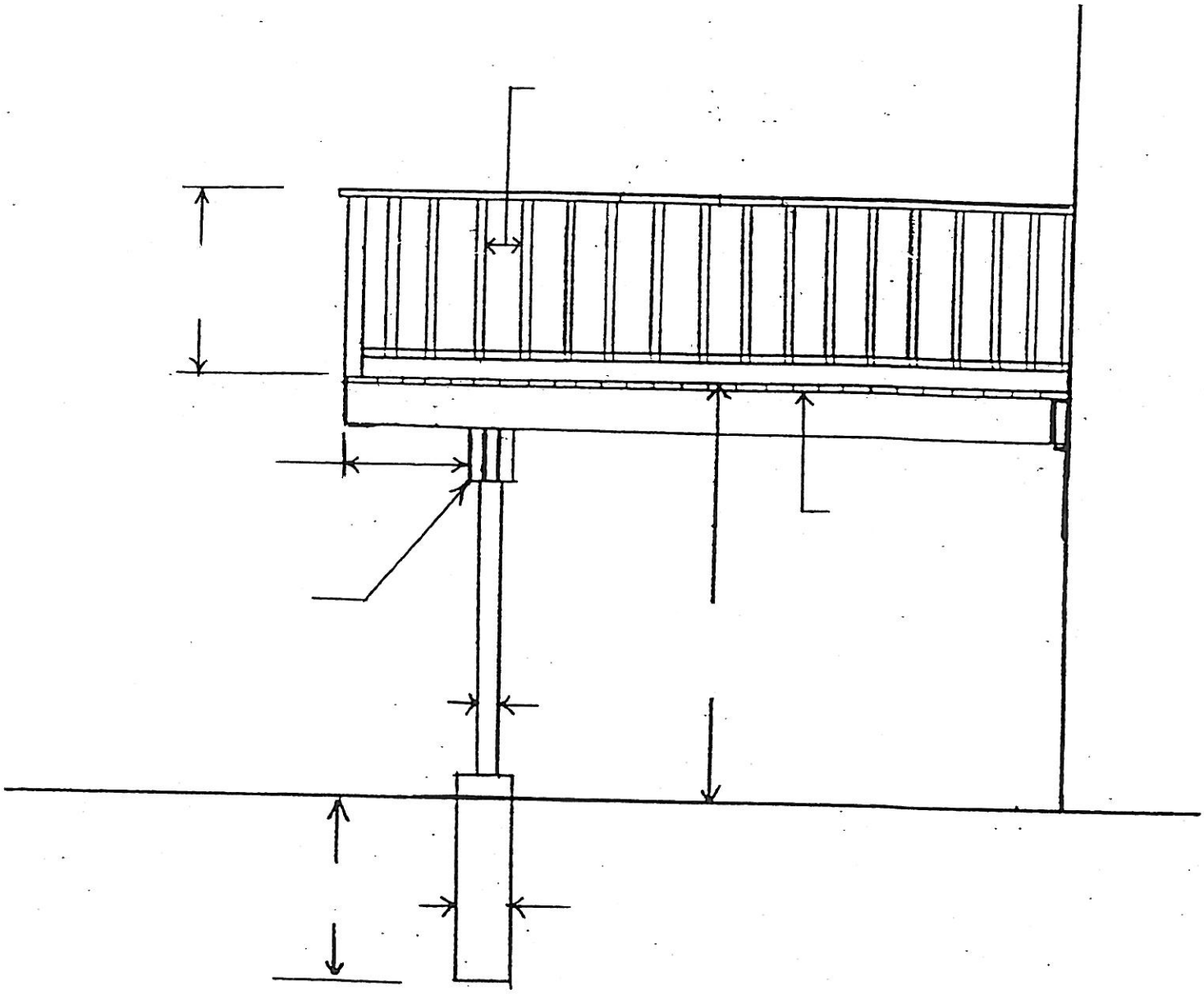
Address:_____



Print Name: _____

Signature: _____

Address: _____



ATTACHING Deck Ledgers

Preventing rot at the band joist is as important as using strong enough fasteners

Beginning in 2001, members of the staff at Virginia Tech's Engineering and Wood Science Departments launched a project to develop and publish an inspection manual for residential decks and balconies. To our surprise, we found that problems with deck attachment are quite common and that the issues are more complex than we had thought. In this article, we'll focus on the forces at work between the deck ledger and the band joist, and offer connection details that will safely carry the typical loads.

In addition to using the right fasteners in sufficient numbers, an important factor in designing ledger attachments is preventing moisture damage — rot — from weakening the ledger and band joist. Field observations of existing decks by Roger Robertson of the Chesterfield County, Va., Building Department revealed decay in untreated band joists where deck ledgers were attached. In some cases, the decay had spread into the interior floor joists.

Flashing between the ledger and the band joist is important for keeping water out of the interior framing. In his field studies, Robertson observed that

by Cheryl Anderson, Frank Woeste, and Joe Loferski

aluminum flashing in contact with CCA-treated lumber had corroded within five years of construction. Our details (see Detail 1) show a flashing layer, but if you use aluminum next to CCA pressure-treated lumber, we recommend that you use a product that has been coated to prevent corrosion.

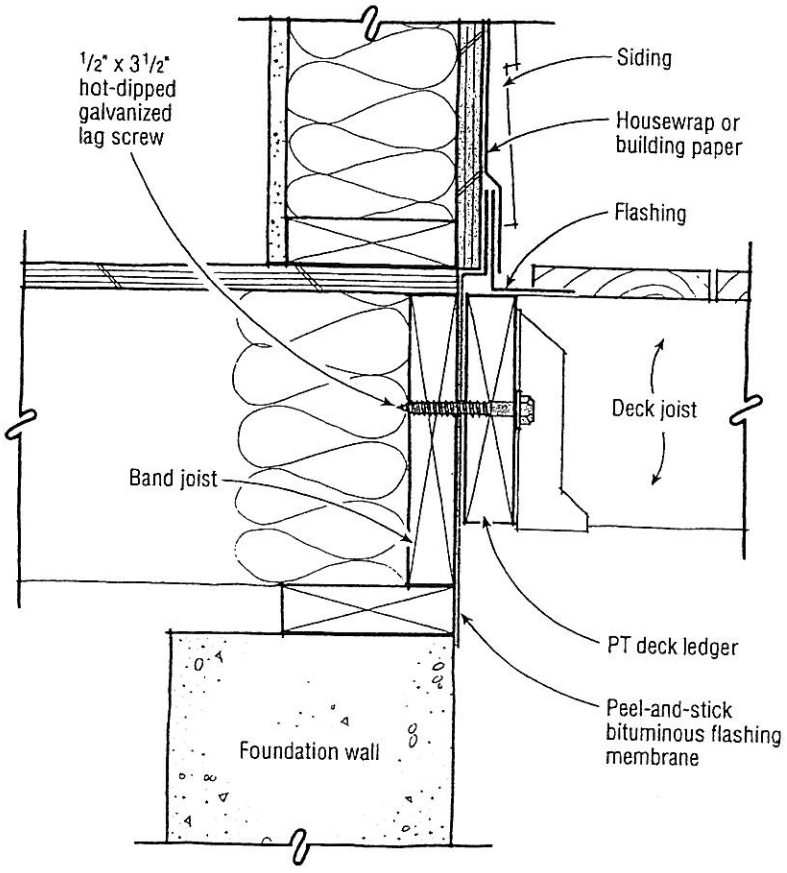
Attaching Ledger Directly to Band Joist

Builders often attach the deck ledger to the band joist after structural sheathing is already in place. But it's actually stronger if you attach the ledger right against the band. In Detail 1, the reaction force of the deck joist is transmitted directly to the band joist by lag screws acting in shear. The band joist and ledger board are in direct contact, with no sheathing in between.

Deck loads and lag screw shear values. The building code design loads for residential decks is 40-psf live load plus a dead load to account for the weight of the materials — usually about 10 psf.

When it comes to calculating how much weight a lag screw of a given size can support, the codes refer to the *National Design Specification for Wood Construction (NDS)*. Using the *NDS* formulas, we calculated that each 1/2-inch lag screw can carry 180 pounds, assuming the ledger is 2-by southern pine and the band joist is 2-by spruce-pine-fir. We assumed that the ledger has a moisture content no higher than 19%. (If the lumber is wetter, that would theoretically reduce its strength.)

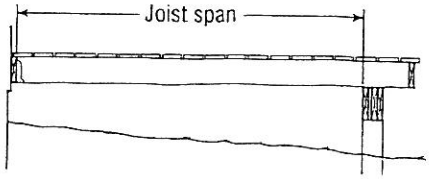
Detail 1: Attaching Ledger Directly to Band Joist



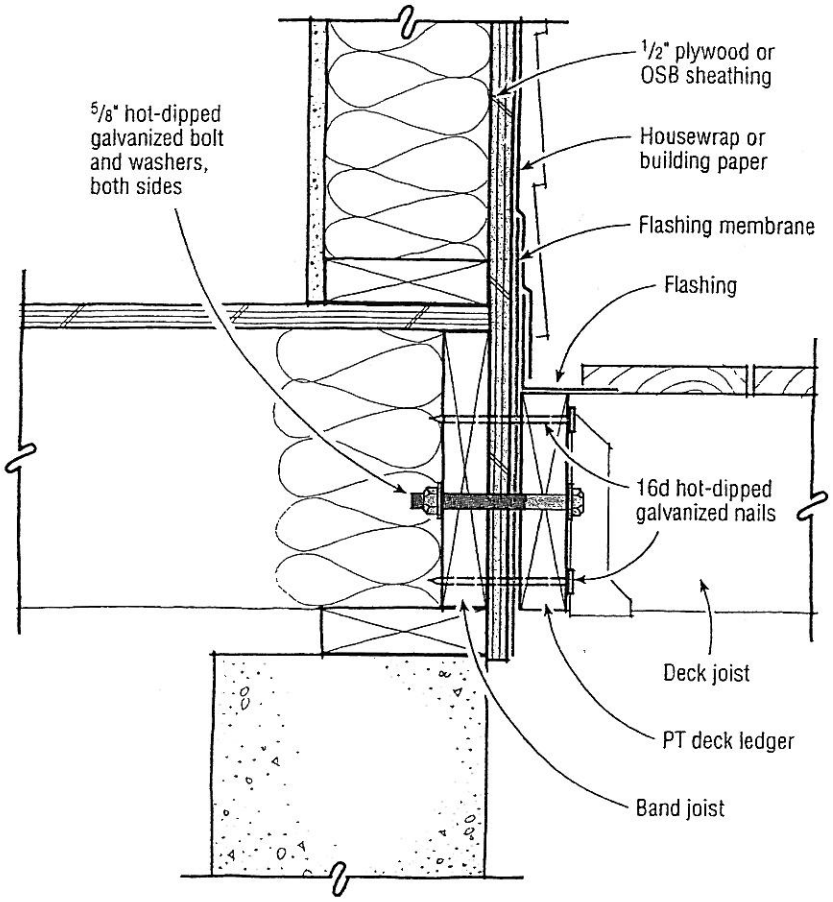
Detail 1 Fastener Schedule*

Joist span (ft.)	6	8	10	12	14	16	18
On-center fastener spacing (in.)	14.4	10.8	8.6	7.2	6.2	5.4	4.8

*Required spacing of 1/2x3 1/2-inch lag screw connecting southern pine ledger to spruce-pine-fir (SPF) band joist for residential deck joist spans. Assumes 40-psf live plus 10-psf dead load. Values are based on the root diameter of typical lag screws available at building supply stores. Attaching the ledger directly to the band joist with no sheathing in between provides the strongest mechanical connection with the fewest 1/2-inch lag screws.



Detail 2: Attaching Ledger to Band Joist Over Structural Sheathing



Detail 2 Fastener Schedule*

Fasteners	8-foot Max Joist Span	16-foot Max Joist Span
5/8-in. hot-dipped galvanized bolts and washers and 16d common hot-dipped galvanized nails	1 bolt @ 3'-6" o.c. and 2 nails @ 8" o.c.	1 bolt @ 1'8" o.c. and 3 nails @ 6" o.c.

Minimum edge distance for bolts is 2 1/2 inches. Nails must penetrate the supporting structure band a minimum of 1 1/2 inches.

*Reprinted by permission from the *North Carolina Residential Code*. The nail size in the table has been increased from 12d to 16d common (3 1/2 inches) to accommodate 1/2-inch structural sheathing, as shown in the drawing. Note that you must use 5/8-inch bolts as well as nails to make the connection.

Attaching Ledger on Top of Structural Sheathing

Because deck ledgers are often installed after the sheathing is nailed off (Detail 2), it's useful to have a fastener schedule that takes the 1/2-inch plywood or OSB into consideration. The *NDS* has no such design method, so we turned to the *North Carolina Residential Code*. Appendix M of that code includes a fastener schedule for deck ledgers that relies on 5/8-inch bolts and 16-penny common nails working together. The code specifies that no siding is permitted in the connection, but structural sheathing is okay where required if it's properly flashed. Note that the *NDS* requires bolt holes to be a minimum of 1/32 inch to a maximum of 1/16 inch larger than the bolt diameter. The purpose of this rule is to prevent the lumber from splitting if it shrinks in service.

Although the *International Residential Code* (*IRC*) specifies loads, maximum deck railing openings, and the need for lateral restraint, the *N.C. Code* is the only code we're aware of that gives design information for the ledger–band joist connection.

Attaching Ledger With Drainage Spacers

Sometimes spacers are installed between the deck ledger and the band joist to allow for drainage. While that can help prevent rot at the band joist, the spacers weaken the connection. *JLC* asked us to provide a bolting schedule for that condition, but unfortunately

we know of no design methodology that would allow us to assign any strength to the structural sheathing layer. That means that in coming up with the schedule for Detail 3, we had to assume that the ledger is separated from the band joist by a 1-inch gap. (This condition would be the same if the ledger were installed over 1-inch-thick foam insulation board, which also has no design strength.) The result is that each 1/2-inch bolt yields only about 80 pounds of shear strength, both because of the 1-inch gap and because of the "wet-use" service conditions of the ledger. It is likely that the bolt schedule in Detail 3 is overly conservative; certainly some of the spacings are ridiculously close when looked at from the carpenter's viewpoint.

For now, we have to rely on the *NDS* design methods to be safe. However, we have plans to test ledgers under actual loading conditions next year and will report our findings here as soon as we have them. Meanwhile, for those wishing to leave a space at the ledger, we strongly recommend Detail 4, page 87.

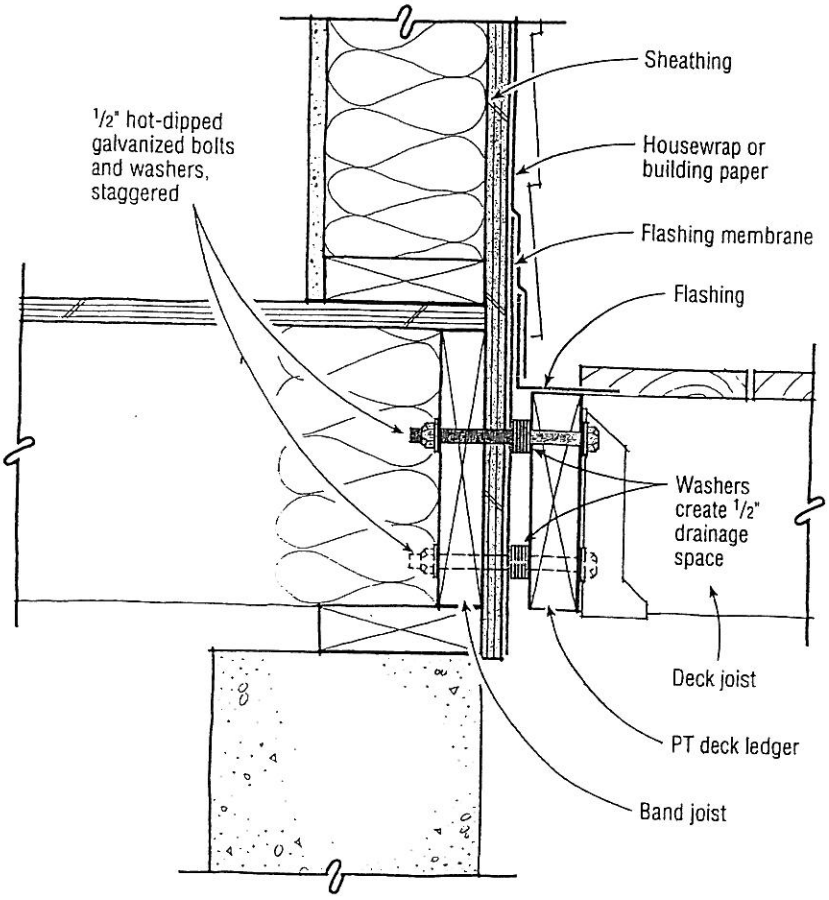
Supporting the Ledger With Posts

Attaching the ledger to the band joist may be common, but it makes it somewhat difficult for the builder — as well as the inspector — to be certain that the connection is safe and durable. In addition to the gravity loads, deck ledgers are subject to lateral, or sideways, loads, which are not addressed by the fastener schedules in the details above.

We recommend a different approach: supporting the ledger with pressure-treated posts, as shown in Detail 4. This approach has several advantages:

It eliminates the need to penetrate the house siding, sheathing, and band joist, thus eliminating the potential for decay.

Detail 3a: Attaching Ledger With Drainage Spacers

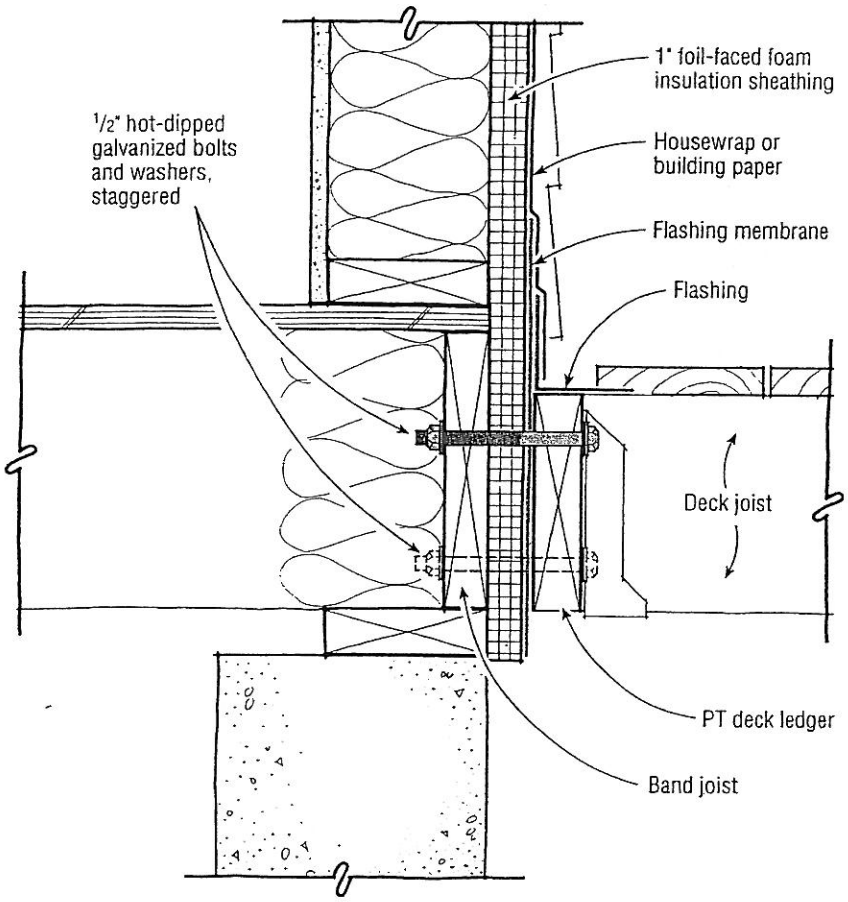


Detail 3 Fastener Schedule*

Joist span (ft.)	6	8	10	12	14	16	18
Bolt spacing (in.)	6.3	4.7	3.8	3.2	2.7	2.4	2.1

*Required spacing of 1/2-inch bolts (with washers on both sides) connecting SPF band joist (G = 0.42) to a PT ledger with the same or greater G value. Tabulated values are based on the assumption that the band and ledger are separated 1 inch due to 1/2-inch wall sheathing and a 1/2-inch spacer (washers). Assumes a residential deck load of 40-psf live plus 10-psf dead.

Detail 3b: Attaching Ledger Over Foam Sheathing



The authors used available *NDS* methods to create a fastener schedule that accounts for a drainage space behind a ledger attached over 1/2-inch sheathing (above left). Unfortunately, the sheathing provides no structural support to the bolt, resulting, from a design standpoint, in a 1-inch-wide gap between the ledger and the band. Thus, the same bolting schedule would apply to a ledger installed over 1-inch non-structural insulating sheathing (above).

- It relies on more efficient structural connections because the ledger rests directly on the end grain of the wood post. Connections that use lag screws, bolts, or nails loaded in shear require far more attention, in both design and construction, than a simple beam-to-post connection.
- It has structural redundancy, meaning that the possible failure of one element will not automatically produce or permit collapse of the entire structure. In this detail, the through-bolt prevents sideways movement of the deck, which might occur if the outside posts were not deeply embedded in the ground. In the unlikely event that the through-bolts should fail from corrosion or any other reason, the embedded 6x6 posts at the foundation wall would still prevent a lateral collapse of the entire deck.
- From an inspection point of view, it's easier to verify that a self-supporting deck is sound, because all the elements (except the footers) are exposed.

While the 6x6 posts we've seen in retail building supply centers are treated to the 0.40 lb/ft^3 retention, we recommend using posts treated to 0.60 for longer life. The ends of the posts placed in the ground should not be cut, as that exposes untreated heartwood. Southern pine heartwood, as well as the heartwood of other softwood species, does not accept the penetration of the CCA chemical treatment; thus, only the end surface contains the chemical. Another post option is PT parallam PSL, which, according to the TrusJoist website (www.tjm.com/), is treated at least to 0.60 lb/ft^3 retention. (The specific type of treatment should be considered by the deck designer in view of the fact that CCA is scheduled to be phased out for some residential applications

Why Don't More Ledgers Fail?

At first glance, the lag screw spacings shown in the details in this article appear to be overly conservative. Builders frequently attach deck ledgers only with nails, and when they use lag screws, it wouldn't be surprising to find that the screw spacings are far greater than those shown in Detail 1 (page 82), for example.

This was noted by Christopher DeBlois, P.E., in a past *Practical Engineering* article (3/96), who went on to say: "What I am sure of, though, is that almost all the decks that I do inspect don't have enough bolts connecting the deck band joist to the house."

So, the question is, why don't residential deck-to-house connections fail on a routine basis? There are a few possible reasons.

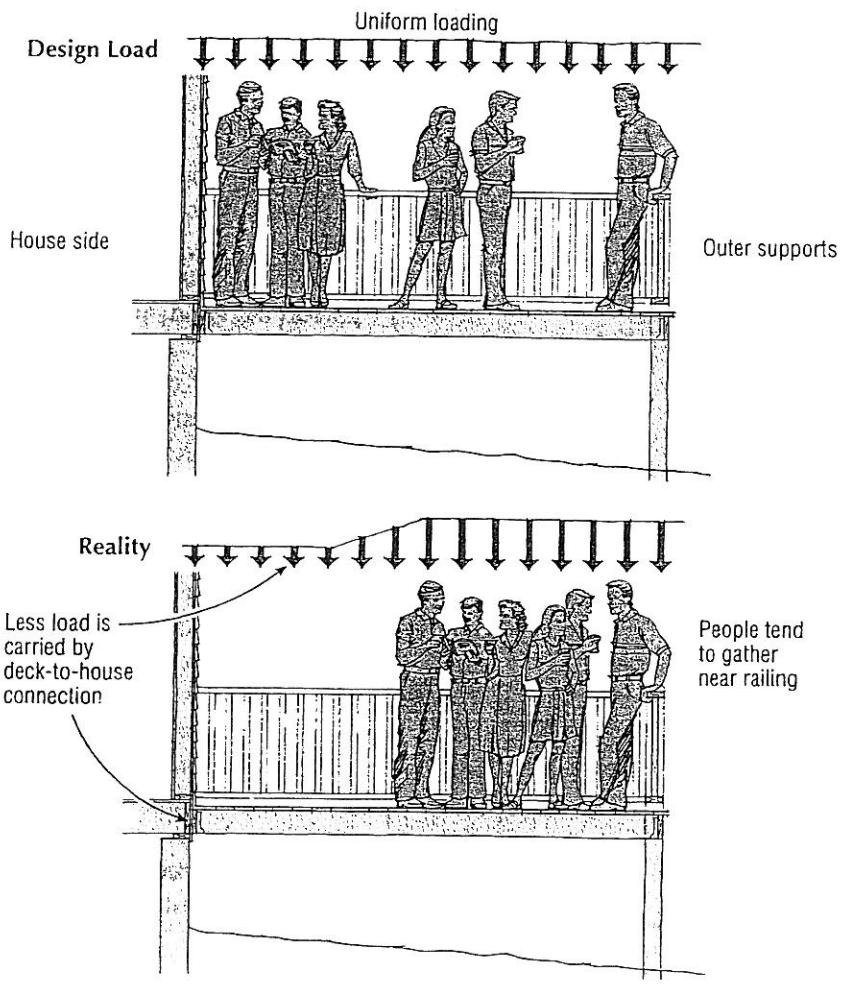
Decks Not Often Fully Loaded

Code design loads require residential decks to be able to support a 40-psf live load plus a 10-psf dead load. Assuming a 12x18-foot deck, 40 psf would be roughly equivalent to a gathering of 58 people, based on an average weight of 150 pounds per person. In reality, however, that many people are unlikely to gather at one time on a 12x18-foot deck during its entire service life.

Loads Not Uniform

The fastener schedules in this article assume that the deck will be uniformly loaded, so that approximately half of the load will need to be supported by the ledger. But large groups of people don't normally sit right next to the house. Instead, more people tend to gather near the outer edges of the deck, so that live loads are typically greater on the outer supports compared with the house side (see illustration at left).

Deck Loading



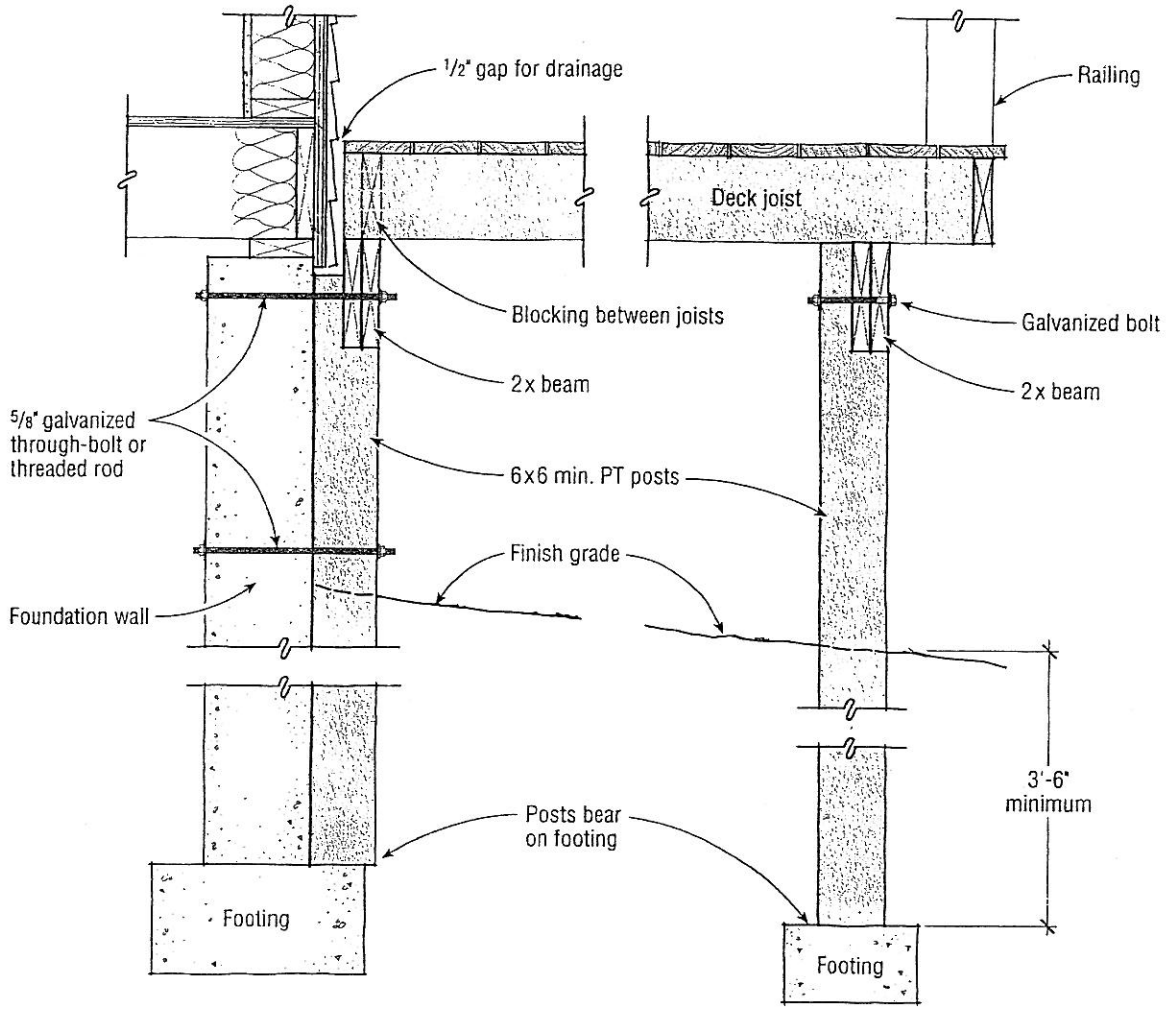
Decks are designed for uniform loading (top). In reality, people tend to gather near the railings rather than next to the house, taking some of the load off the ledger (above).

Connector Safety Factors

The allowable shear values for lag screws are based on code-approved engineering standards. Laboratory tests of lag screws indicate that the safety factor on the allowable design values can be as high as 5. Thus, a properly installed 1/2-inch lag screw in a band joist–ledger application will typically carry a lot more than 180 pounds of load before the connection ruptures. (Nevertheless, the safety factor should not be encroached upon: Its purpose is to account for any uncertainties of design, construction, and service conditions that may crop up. For example, a carpenter might drill too large a lead hole for the lag threads, which weakens the connection. Or a carpenter might align the lag screws in two or more rows in the wet ledger, which will increase the likelihood that the lumber will split as it dries.)

— C.A., F.W., & J.L.

Detail 4: Deck Fully Supported With Posts



The authors strongly recommend avoiding mechanical shear connections altogether and, instead, supporting residential decks with PT posts, as shown here. Use .60-retention pressure-treated lumber for greatest durability.

beginning in December 2003.)

The posts are located next to the house and notched to receive the ledger. The deck joists are then supported on the built-up beams, which further minimizes reliance on mechanical connections (joist hangers). The through-rods address lateral support, which, while not quantitatively addressed by the building codes, is extremely important.

Keep trash, vegetation, and construction debris out of the backfill around the post, as it would compromise the lateral resistance of the embedded post section. We also suggest that the post be backfilled around its base with an 80-pound bag of concrete mix, followed by 8 inches of well-compacted native soil or a sand and gravel mixture. The concrete above the footing pad will stabilize the bottom of the post in the unlikely event that the footing pad should rotate in service. The size of the post footing pad and the depth of the post embedment for a design should be determined by the deck designer and depends on local frost depth and soil strength, as well as local building codes.

Cheryl Anderson is a former graduate research assistant and ***Frank Woeste, P.E.,*** *is a professor emeritus in the Biological Systems Engineering Department at Virginia Tech in Blacksburg.* ***Joseph Loferski*** *is a professor in Virginia Tech's Wood Science and Forest Products Department. The authors'* Manual for the Inspection of Residential Wood Decks and Balconies *will be available in October 2003 from the Forest Products Society (608/231-1361).*

TECHNICAL BULLETIN

HD2AHDG
Guardrails: What the Codes Require

SIMPSON Strong-Tie®

When is a guardrail required?

"When porches, balconies, ramps or raised floor surfaces are located more than 30 inches above the floor or grade below..."

International Residential Code® - 2000, 2003 & 2006 (sections R316.1 – 2000, R312.1 –2003/2006)

"Guards shall be located along open-sided walking surfaces...that are located more than 30 inches above floor or grade below."

International Building Code® - 2000, 2004 & 2006 (sections 1003.2.12- 2000, 1012.1 - 2003, 1013.1-2006)

If the guardrail is not required because the deck or porch is not at least 30 inches above the finish grade, does a guardrail have to be code compliant?

Responsibility: "It shall be the duty of every person who performs work for the installation or repair of building, structure... to comply with this code."

International Residential Code® - 2000, 2003 & 2006 (section R105.8)

Conditions: "Structures or existing equipment that are or hereafter become unsafe...or otherwise dangerous to human life...shall be deemed an unsafe condition. Unsafe structures shall be taken down and removed or made safe, as the building official deems necessary."

International Building Code® - 2000, 2003 & 2006 (section 115.1)

What is the guardrail height requirement?

"...not less than 36 inches in height..."

International Residential Code® - 2000, 2003 & 2006 (sections R316.1 – 2000, R312.1 – 2003 & 2006)

"Guards shall form a protective barrier not less than 42 inches high."

Exceptions: "For occupancies in Group R-3, and within individual dwelling units...R-2... height measured not less than 34 inches and not more than 38 inches..."

International Building Code® - 2000, 2003 & 2006 (sections 1003.2.12.1 – 2000, 1012.2 – 2003, 1013.2 – 2006)

How much force must a handrail or guard be capable of resisting?

"Handrail assemblies and guards shall be able to resist a single concentrated load of 200 lbs., applied in any direction at any point along the top, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements."

International Residential Code® - 2000, 2003 & 2006 (Table R301.4 (d) – 2000, Table R301.5 (d) – 2003/2006)

International Building Code® -2000, 2003 & 2006 (section 1607.7.1.1)

What is the standard used to determine the performance of handrails and guards?

International Code Council Evaluation Service Test Acceptance Criteria 273.

How are handrails and guards tested?

The mounting of the handrails and supporting structure shall be capable of withstanding a load of at least 500 lbs.

When the load reaches 200 lbs., the deflection at the point of loading shall be recorded. The allowable deflection at 200 lbs. shall NOT exceed:

h (height in inches of the guard) ÷ 24 + l (length between posts) ÷ 96

For example:
Given a 36" rail height and 6' between the posts:

36" ÷ 24 = 1½" plus 72" ÷ 96 = ¾"
Total deflection must be ≤ 2¼ inches

Why have the code requirements changed?

Based on a study conducted at Virginia Tech. on the post-to-rail connection, ½" lag screws with washers and ½" machine bolts with washers failed to meet the load and deflection criteria as established by AC273.

Why the Simpson Strong-Tie® solution?

The connection details, as shown, have been tested and successfully performed to meet or exceed the criteria as established by the code and AC273.

Post-to-Deck Assembly	Average Deflection at 200 lbs.	Average Test Ultimate
HD2AHDG parallel-to-joist	1.5"	790 lbs.
HD2AHDG perpendicular-to-joist	1.5"	655 lbs.

This bulletin is effective until June 30, 2008, and reflects information available as of Sept. 1, 2006. This information is updated periodically and should not be relied upon after June 30, 2008; contact Simpson for current information and limited warranty or see www.strongtie.com.

Home Office
5956 W. Las Positas Blvd.
Pleasanton, CA 94588
FAX: 925/847-1603

Southwest U.S.A.
260 N. Palm Street
Brea, CA 92821
FAX: 714/871-9167

Southeast U.S.A.
2221 Country Lane
McKinney, TX 75069
FAX: 972/542-5379

Eastern Canada
5 Kenview Blvd.
Brampton, ON L6T 5G5
FAX: 905/458-7274

Warehouses:
Enfield, CT;
High Point, NC;
Jacksonville, FL;
Langley, BC

Northwest U.S.A.
5151 S. Airport Way
Stockton, CA 95206
FAX: 209/234-3868

Northeast U.S.A.
2600 International Street
Columbus, OH 43228
FAX: 614/876-0636

Quik Drive Factory
436 Calvert Drive
Gallatin, TN 37066
FAX: 615/451-9806

Western Canada
11476 Kingston St.
Maple Ridge, BC V2X 0Y5
FAX: 604/465-0297

Specials Factories:
Eagan, MN;
Kent, WA

800-999-5099
www.strongtie.com

Printed in the U.S.A.

T-HD2AGRDRL06 9/06 exp.6/08