Exterior Decks

Decks live in a tough environment

Thursday **pm** - 3/14/2024

Residential Decks Design & Construction 2021 IRC

Exterior Decks

Wood-framed decks shall be in accordance with this section.

Decks shall be designed for the *live load* required in Section R301.5 or the ground snow load indicated in Table R301.2, whichever is greater.

For decks using materials and conditions not prescribed in this section, refer to Section R301.

R507.1 Decks

2

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Background:
Building Contractor - 1984 to present
Building Inspector Technician - 1997 - 2 years
Field Inspector – 1997 - 2020
Residential Plans Examiner – 1997 – to present
Code Development Committee – started 2001
Instructor – 1998 - present
Code Consultant – 2005 to present
Program Manager – Short Stint

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QUESTIONS ???

Have a question?

4

"Disclaimer"

- The opinions expressed in this presentation are the opinions of the presenter Russell Thornburg and do not represent the official opinion ***of*** the *International Code Council (ICC)* ***or*** *that* of the administrative authority of ***any*** jurisdiction. As always, the Building Official of the Jurisdiction, County or State has ***the*** final authority.
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"Disclaimer"

- **The text in this presentation does not necessarily represent actual code language. The presented text may summarize, highlight or generalize the code section. Additional provisions or exceptions may be included in the actual code section. References to the code sections are given for the purpose of verifying the complete provisions of the code section.**
- **Participants of the code are responsible for reading, studying, (reading & studying) interpreting (attending code panels & discussions), and enforcing the code as directed by the administrators of their code.**

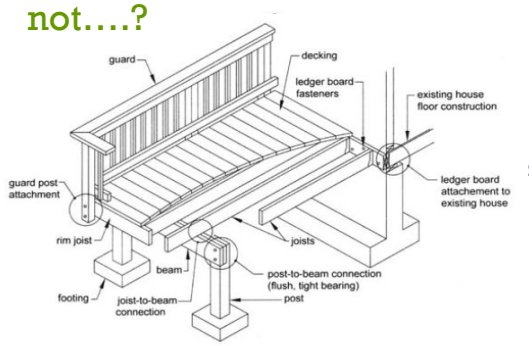
6

In Reference to all: Materials / Products / Illustrations / Pictures and comments of this Presentation

"Do not Assume:"

- ...that any picture in this presentation is in compliance of code, manufacturer's listing etc...
- ...that any product has been fully researched to the intent of the code
- ...that any product that can be sold / purchased meets any code requirements
- ...that any one product has been tested and meets the intent of any past/current adopted codes
- ...that any product has been properly installed unless you have done a complete thorough research of that product through the manufacturer's installation instruction, approved acceptable tested listing, and have reviewed its current evaluation report requirements by approved testing agency.

Which part of the deck is not….?



8

What's so wonderful about decks?

Expand a Home's Living Space

9

What's the Problem?

Improperly Built Decks Can be Dangerous

"Decks cause more injuries and loss of life than any other part of the home structure. Except for hurricanes and tornadoes, more injuries may be connected to deck failures than to all other wood building components and loading cases combined"

Collapse

Source: Washington State Magazine, "Making Decks Safer", Don Bender- Director, Wood Materials & Engineering Laboratory @ Washington State University

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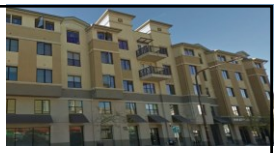

Investigation findings

So why did the balcony on a relatively new building collapse? The balcony was a cantilevered design attached to the building on only one side by support beams. At the time the collapse occurred, the stress on the balcony was greater than normal because 13 people were standing on it, but the design of the balcony should have been adequate to hold the weight. This is the straw that broke the camel's back, but in this case the camel's back had been weakened.

Investigators determined that the balcony failed because the strength of the beams was weakened because of extensive dry rot damage. Dry rot is decay caused by fungus that can grow when wood is exposed to water, especially in areas with inadequate ventilation.

Additionally, the party goers were unaware that the balcony was unsafe. There were some reports that tenants noticed mushrooms growing on the balcony in the weeks prior to the accident, but the structural issues with the balcony were not obvious, at least to the untrained eye, prior its collapse.

The investigation into this incident determined that the balcony was likely built to codes that were in place when the building was constructed. Despite meeting the codes, the beams in the balcony were exposed to weather because of inadequate water proofing and dry rot occurred as a result of the water contacting the beams and inadequate ventilation.

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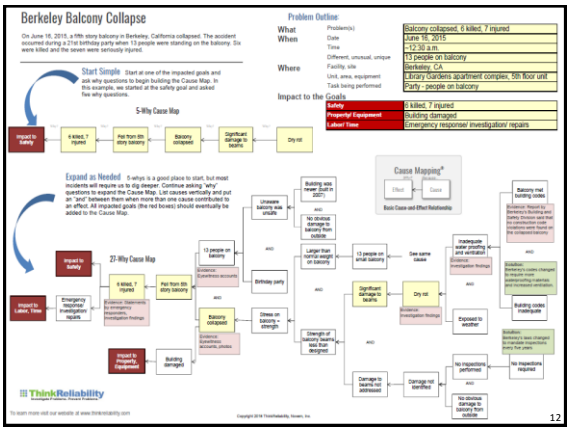

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U.S. & WORLD

THE DAY'S TOP NATIONAL AND INTERNATIONAL NEWS

Berkeley OKs Sweeping New Construction Standards After Balcony Collapse

By Terry McSweeney, Rhea Mahbubani and Bay City News

Published Jul 18, 2015 at 11:31 AM

Cause: Wood Rot & Lack of Inspections

The Berkeley City Council approved stricter standards for balcony construction and inspection Tuesday in a legislative effort to prevent accidents like the collapse of an apartment balcony last month that killed six people and injured seven others. Terry McSweeney reports.

8 Hurt in Maryland Deck Collapse

Howard County Fire and Rescue Services

Eight people were injured when the deck that they were on collapsed during a family party at a Maryland home last weekend. According to newspaper reports, about 20 people were on the 20-ft. x 40-ft. elevated deck Saturday afternoon when it detached from the upper floor of a house in Ellicott City, a town near Baltimore, Maryland. While none of the injuries are considered to be life-threatening, at least three medical evacuation helicopters and dozens of firefighters and paramedics responded to initial 911 calls reporting the incident. The cause of the collapse is under investigation.

15

Boston Fire Department

Four people were taken to the hospital when a second-story South Boston deck collapsed last weekend, reports the Boston Globe. The incident occurred during a Saturday evening party on the approximately 10-ft. x 10-ft. deck, which witnesses say was attended by 10 to 15 people. A first responder described the injuries as "non-life threatening," and the city's Inspectional Services department was on the scene and investigating the collapse. Photographs taken at the scene by the Boston Fire Department appear to show the deck ledger completely detached from the home.

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Township Considers Short-Term Rental Ordinance After Deck Collapse

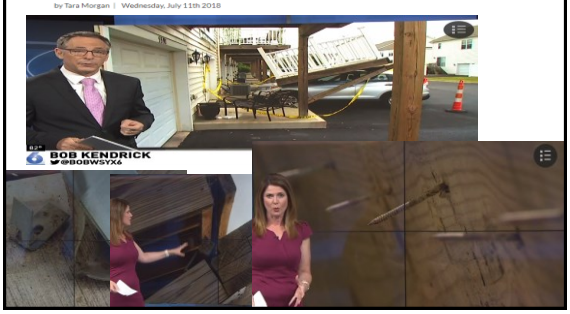
A deck collapse in the Poconos last year has prompted local officials to introduce an ordinance that would impose new regulations and deck inspection requirements on the town's short term rental properties. The collapse occurred in 2017, when twelve teenagers were hurt during a weekend party at a vacation rental in a gated community called Saw Creek. The property - known locally as one of the area's 'party houses' - was listed on the popular online lodging marketplace AirBnbN as having a capacity for up to 24 guests. At the time of the accident, the property was in compliance with all local ordinances and homeowners' association rules, though the home's 600-sq. ft. deck was apparently built without a permit, according to a news report in the Pocono Record. To address that problem, the local Board of Supervisors wants to require inspections of short-term rental properties by a third-party building and codes inspector, though the scope of the inspection remains unclear. Short term rental owners would be required to first obtain a permit from the township before renting properties for less than 30 days. The permit fee would cost $150, part of which would pay for the property inspection fee.

17

Damaged deck removed more than a year after a collapse that severely injured two

Columbus, Ohio

by Tara Morgan | Wednesday, July 11th 2018



Deck Collapse – Everett, WA - 3 injured

19

Deck/Balcony/Porch Failures in the News

Based on a study by Morse Technologies, Inc., from January 2000 through December 2006, there were 179 reported deck and railing failures. 1,122 people were injured and 33 people died.

Most deck and railing failures are NOT reported

NADRA - has reported over 6500 deck/balcony failures since 2003

20

Code Administration

- Additions, alterations or repairs to any structure ***shall*** conform to the requirements for a new structure **without** requiring the existing structure to comply with all of the requirements of this code, **unless** otherwise stated.
- Additions, alterations or repairs ***shall not*** cause an existing structure to less compliant with the provisions of this code. . . .

R102.7.1 Additions, alterations or repairs.

21

Code Administration

- Permits shall not be required for the following. Exemption from permit requirements of this code **shall not** be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction.
  - **10.** Decks not exceeding 200 sq. ft. in area, that are not more than 30" above grade at any point, are not attached to a dwelling and do not serve the exit door required by Section R311.4

R105.2 Work exempt from permit

22

Code Administration

- The building official is hereby authorized ***and*** directed to enforce the provisions of this code.
- The building official ***shall*** have the authority to render interpretations of this code ***and*** to adopt policies ***and*** procedures in order to clarify the application of its provisions.

R104.1 General

23

Code Administration

- Materials, equipment and devices approved by the *building official* ***shall be*** constructed ***and*** installed in accordance with such approval.
- R104.9.1 Used materials, equipment ***and*** devices ***shall not*** be reused unless approved by the building official.

R104.9 Approved & used materials equipment

24

Code Administration

- The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code. The Building Official shall have the authority to approve....

R104.11 Alternative materials, design and methods of construction and equipment 25

Code Administration

- It ***shall be*** the duty of every person who performs work for the installation or repair of building, structure, electrical, gas, mechanical or plumbing systems, for which this code is applicable, to comply with this code.

R105.8 Responsibility 26

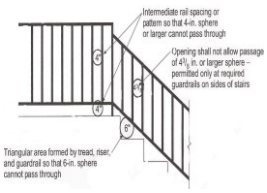
Code Administration

- Manufacturer's installation instructions, as required by this code, ***shall be*** available on the job site at the time of inspection.

18 manufacturer's listed on the enternet

R106.1.2 Manufacturer's installation instructions 27

Code Administration



- It ***shall be*** unlawful for **any** person, firm or corporation to erect, construct, alter, extend, repair, move, remove, demolish or occupy **any** building, structure or equipment regulated by this code, or cause same to be done, in conflict with or in violation of **any** of the provisions of this code.

R113.1 Unlawful acts 28

Code Administration

- Existing Structure
  - May require a Preliminary Inspection
    - All set backs must be re-examine
    - Code compliance (glazing, structure, mechanical system, etc)
    - How much to be replaced?

R105.9 Preliminary inspection 29

Existing Decks: What to Look for and What Can Be Done

Retrofitting an Existing Deck

- **It is estimated that of the 40 million existing decks, only half are code-compliant. Experts believe that it is likely that many of these decks are potentially unsafe.**

The Life Expectancy of Decks

- **Most experts agree that the average life of a deck is 10-15 yrs.* However, when decks are properly maintained on a routine basis, use the correct fasteners and connectors they could last more than 30 years.**
- **Since deck building started more than 35 years ago, there are many decks that are past their useful life.**

*Source: Wood Myths Facts and Fiction, Paul Fisette, 2005 Building Material and Wood Technology-UMass @ Amherst

A technical report in the Forest Products Journal/1998 indicated that the average PPT deck only lasts 9 years due to the fact that PPT wood soaks and loses moisture. And as a result, the wood twists, bends, cracks and virtually tears itself apart.

R102.7.1 Additions, alterations or repairs. - Additions, alterations or repairs to any structure *shall conform* to the requirements for a *new structure without requiring* the existing structure to comply with the requirements of this code, unless otherwise stated. Additions, alterations, repairs and relocations *shall not cause an existing structure to become unsafe or adversely* affect the performance of the building. Old languages

31

Railing Failure (MN) – Note Rot/Cracks on Right

32

Deck Collapse – Ship Bottom, NJ – 7/24/07 (7 injured)

Code Administration

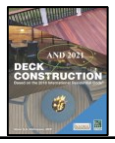
- Doors other than the required egress door shall be provided with landings or floors **not more** than 7 3/4" below the top of the threshold.

R311.3.2 Floor elevations for other exterior doors

34

Mechanical Vents

New Book



- Dryers that can't exhausted the heat, store the heat…and the lint. With fuel (lint), oxygen and heat, you have the recipe for fire. The US Consumer Product Safety Commission reported 15,600 dryer fires in 1998, with 20 deaths and 370 injuries, not a statistic a deck builder wants to contribute to.

By: Glenn G. A. Mathewson, Deck Construction, 2009 ICC.

M1502.3 Duct Termination

35

Code Administration

Fuel-Burning Equipment Air Intake & Exhaust

- Combustion air ducts shall comply with all of the following:
  2. Ducts shall terminate in an unobstructed space allowing free movement of combustion air to the appliances.
  8. Combustion air intake openings located on the exterior of a building shall have the lowest side of such openings located not less than 12" vertically from the adjoining finished ground level.

IFGC 304.11 Combustion air ducts.

36

Code Administration

1. Incorrect Fasteners – Nails

- **Undersized Nails;**
  - **Finish nails**
  - **4d/6d common nails**
  - **Siding nails**
- **Roofing nails**
- **Powder-actuated fasteners should not be used to install with connectors.**

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Fasteners and Connectors

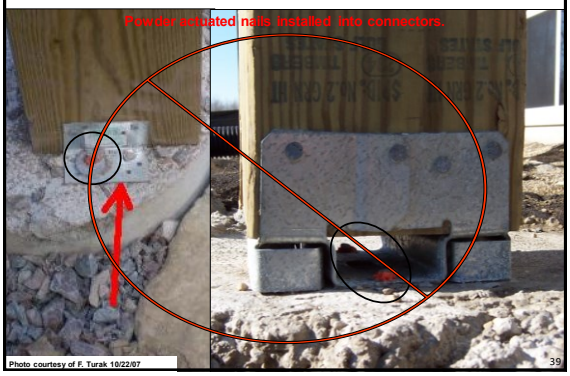
TABLE R507.2.3
FASTENER AND CONNECTOR SPECIFICATIONS FOR DECKS[a,b]

ITEM	MATERIAL	MINIMUM FINISH/COATING
Nails and timber rivets	In accordance with ASTM F1667	Hot-dipped galvanized per ASTM A153
Bolts[c] Lag screws[d] (including nuts and washers)	In accordance with ASTM A307 (bolts), ASTM A563 (nuts), ASTM F844 (washers)	Hot-dipped galvanized per ASTM A153, Class C (Class D for 3/8-inch diameter and less) or mechanically galvanized per ASTM B695, Class 55 or 410 stainless steel
Metal connectors	Per manufacturer's specification	ASTM A653 type G185 zinc coated galvanized steel or post hot-dipped galvanized per ASTM A123 providing a minimum average coating weight of 2.0 oz./ft² (total both sides)

a. Equivalent materials, coatings and finishes shall be permitted.
b. Fasteners and connectors exposed to salt water or located within 300 feet of a salt water shoreline shall be stainless steel.
c. Holes for bolts shall be drilled a minimum 1/16 inch and a maximum 1/8 inch larger than the bolt.
d. Lag screws 1/4 inch and larger shall be predrilled to avoid wood splitting per the National Design Specification (NDS) for Wood Construction.
e. Stainless-steel-driven fasteners shall be in accordance with ASTM F667.

38

Incorrect Fasteners – Nails (Powder Actuated Fasteners)



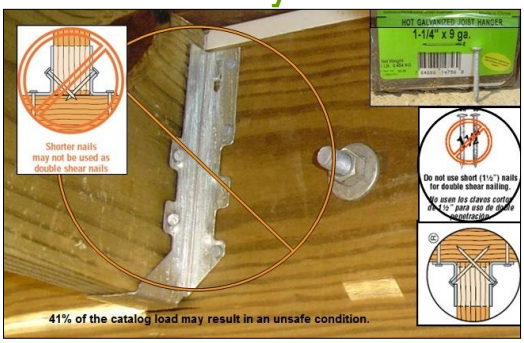
39

1. Incorrect Fasteners – Screws

- **Most wood screws are NOT acceptable due to low shear capacity and/or corrosion issues.**
- **Concrete & Masonry screws are NOT acceptable for exterior applications.**

40

What do you see?



Manufacturers requirements

41

Code Administration

R317.3.1 Fasteners for preservative-treated wood.

- Fasteners for preservative-treated wood ***shall*** be of hot dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Coating types and weights for connectors in contact with preservative-treated wood ***shall*** be in accordance with the connector manufacturer's recommendations. In the absence of manufacturer's recommendations, a minimum of ASTM A 653 type G185 zinc-coated galvanized steel, or equivalent, shall be used.

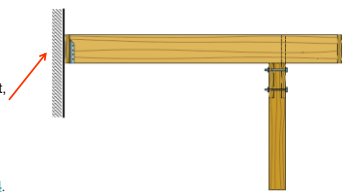
R317.3.1 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood

42

Minimum Permit Requirement

Building permits are required for the construction of all decks: **EXCEPT**

1) ≤ 200 Sq. ft.,
2) 30 inches above grade at any point,
3) Not attached the dwelling
4) Do not serve **the exit** door required by Section R311.4.



R105.2 IRC 2021 item 10

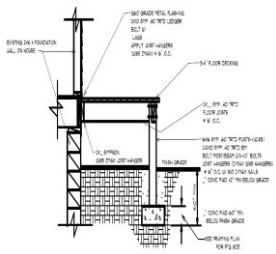
43

Examination of documents.

The plan is to be reviewed by JHA.

R106.3

The building official ***shall*** examine or cause to be examined construction documents for code compliance.



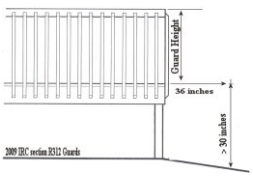
44

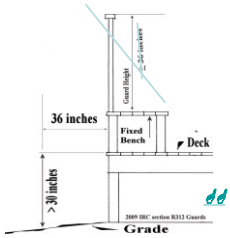
Guards

R312.1 Where required.
Porches, balconies, ramps or floor surfaces located > 30" above the floor or grade below shall have guards ≥ 36" in height. Spacing between spindles < 4"

45

Guards



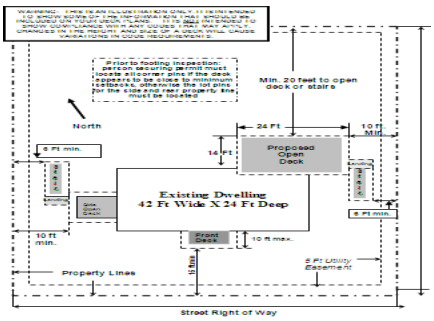


R312.1 Where required.

Guards shall be provided for those portions of open-sided walking surfaces, including floors, stairs, *ramps* and landings that are located more than 30" measured vertically to the floor or *grade* below at any point within 36" horizontally to the edge of the open side. Insect screening shall not be considered as a *guard*.

46

Location of the Deck



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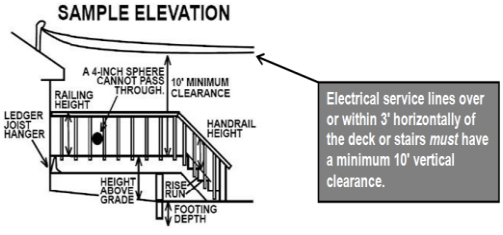
Assumed



Electrical service lines over or within 3' horizontally of the deck or stairs *must* have a minimum 10' vertical clearance.

48

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.

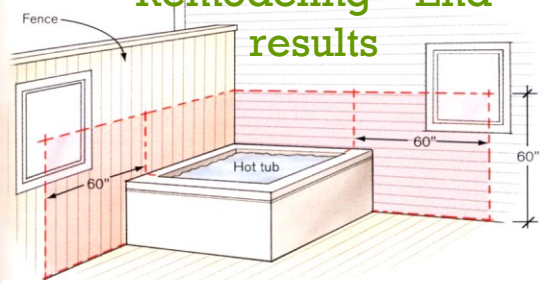
R311.7.2

49

Call before Digging

50

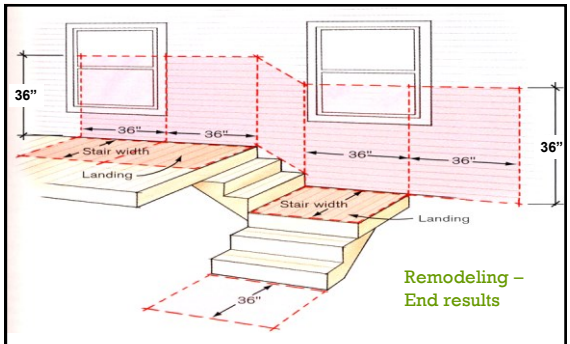
Remodeling – End results



R308.4.5 Glazing and wet surfaces. Glazing in walls, enclosures or fences containing or adjacent hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers and indoor or outdoor swimming pools where the bottom exposed edge of the glazing is < 60" measured vertically above any standing or walking surface shall be considered to be a hazardous location. This shall apply to single glazing and each pane in multiple glazing.

Exception: Glazing that is more than > 60" measured horizontally and from the water's edge of a bathtub, hot tub, spa, whirlpool or swimming pool or from the edge of a shower, sauna or steam room.

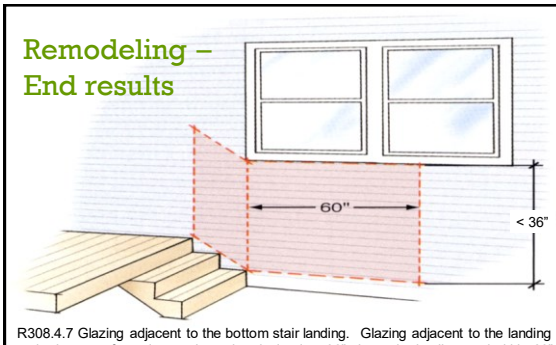
51



R308.4 Hazardous Locations item **6**. Glazing where the bottom exposed edge of the glazing is < 36" above the plane of the adjacent walking surface of stairways, landings *between* flights of stairs and ramps shall be considered a hazardous location. Except: 1 railing; 2 - **≥ 36"**

52

Remodeling – End results



R308.4.7 Glazing adjacent to the bottom stair landing. Glazing adjacent to the landing at the bottom of a stairway where the glazing is < 36" above the landing *and* within 60" horizontally arc <180⁰ from the bottom tread nosing shall be considered to be a hazardous location. **Exception:** Where the glazing is protected by a *guard* complying with Section R312 and the plane of the glass is > 18" from the *guard*.

53

Describe what you see

54

WOOD MATERIALS

- Standard for the Care of Preservative-treated Wood Products R317.1.1, R318.1.2 - ***U1—16*** USE CATEGORY SYSTEM: User Specification for Treated Wood Except Commodity Specification H R317.1, R402.1.2, R504.3, R703.6.3, R905.7.5, Table R905.8.5, R905.8.6....
- R504.3 Materials. Framing materials, including sleepers, joists, blocking and plywood subflooring, shall be pressure-preservative treated and dried after treatment in accordance with AWPA U1 (Commodity Specification A, Special Requirement 4.2), and shall Bear the label of an accredited agency.

55

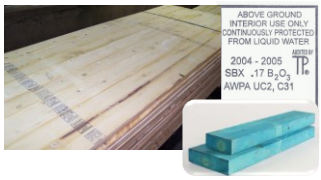
Naturally durable species

While such woods as redwood and cedar are widely considered to be naturally durable species, only the **"heartwood"** of redwood, cedars, black locust, and black walnut is actually *considered decay resistant* by the IRC. The sapwood, the outside part of a log, does not qualify.

- According to the USDA *Wood Handbook* (1999), "Untreated sapwood of substantially all species has low resistance to decay and usually has a short service life under decay-producing conditions."
- Only the *average heartwood* of species is rated in Table 3-10 of the *Wood Handbook*.

56

Waterborne, Borates



Borate Treated Sill Plate
- Interior Use Only
  - ✓Above Ground Contact
  - ✓Continuously Protected from Liquid Water
- Non-Corrosive
- Building Code Accepted
- Cost Competitive Replacement for CCA
- Generally Blue in color for identification

Exterior Borates
- Interior & Exterior Uses
- Non-Corrosive
- Building Code Accepted
- Clear in Color

57

Treated Materials

Borate treated lumber may be used for exterior use provided it is **NOT** in contact with ground.

58

What Information is on ALSC Quality Marked Product?

Company Name or Plant #
Exposure Category
Preservative
AWPA Usage Category
Year of Treatment (If Applicable)
Retention Level
Inspection Agency Logo
WWPI Checkmark (Optional)

R317.2 & R318.1.1 Quality mark.

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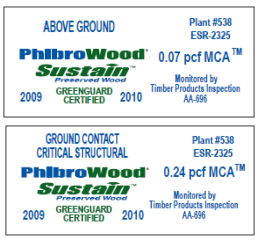
What Information is on IRC Quality Marked Product?

Company Name or Plant #
Exposure Category
Preservative
Retention Level
End Use
Monitored by
The designation "Dry," if applicable

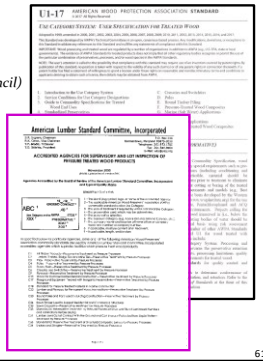


R317.2 & R318.1.1

60

Usage Systems, Standards

- *AWPA - Commodity Standards*
- *Usage Categories*
- *ICC - ESR#'s (International Code Council)*



- AWPA -Handout
- ALSC – Handout

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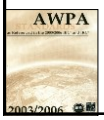
PTW

Common preservative treatments and retention levels (pcf) for sawn lumber in ground contact.[a]

Species	ACQ-B	ACQ-C	ACQ-D	CA-B	CuN-W
Southern Pine	0.40	0.40	0.40	0.21	0.11
Douglas Fir-Larch	0.40	0.40	NR	0.21	0.11
Hem-Fir	0.40	0.40	0.40	0.21	0.11
Ponderosa Pine	0.40	0.40	0.40	0.21	0.11
Red Pine	0.40	0.40	0.40	0.21	0.11
Spruce-Pine-Fir	NR	0.40	NR	NR	NR
Redwood	NR	NR	NR	NR	NR

[a] Preservatives and retentions listed in Table 1 are based on the American Wood Protection Association (AWPA) *Book of Standards*. NR = Treatments Not Recommended.



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Materials

- **R507.2 Materials.** Materials used for the construction of decks shall comply with this section.
- **R507.2.1 Wood materials.** Wood materials shall be **No. 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...field in accordance with AWPA M4.
- ***All*** preservative-treated wood products in contact with the ground shall be labeled for such usage.
- **R507.2.1.1 Engineered wood products.** Engineered wood products shall be in accordance with Section R502.

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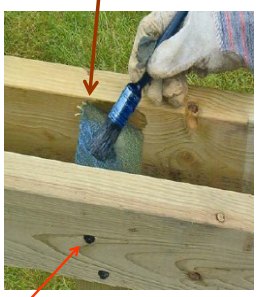
Decay



R317.4 Wood/Plastic Composites New definition

- Decks and exterior structures
- ASTM D 7032
- installed according to the manufacturer's instructions
- Section R317.4 referenced by other sections

What this??

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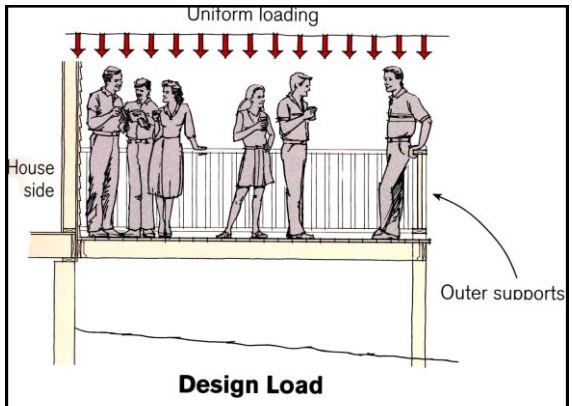

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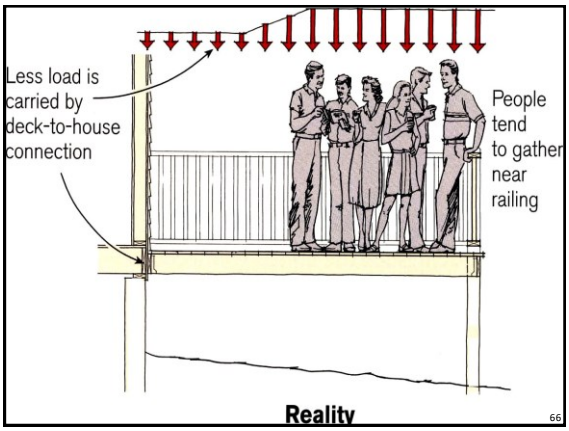

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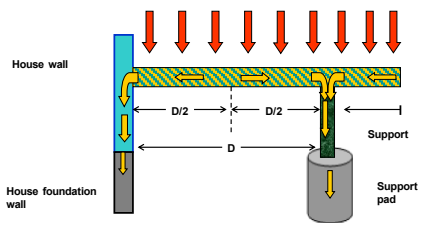
Understanding Load Paths



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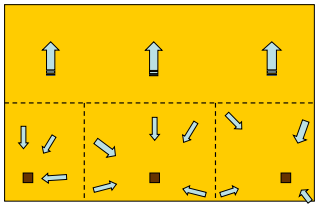
Understanding Load Paths

Tributary distance is: ½ distance from post to post, ½ distance from the house to end of the deck. (1/2 distance)



Loads are assumed to be uniform across the floor.

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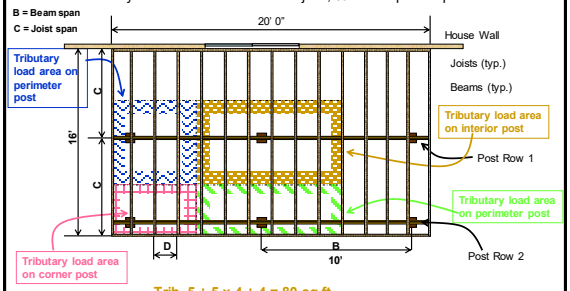
Tributary load area for posts

Tributary is: half the distance of the joist, &/or from post to post



Trib. 5 + 5 x 4 + 4 = 80 sq ft
or 10 x 8 = 80 sq ft.

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Footing Size

- Tributary area: ½ distance to post to post or beam and/or to house
- Live Load 40lb + 10lb dead load = 50lb total Load
- Total load divided by soil bearing load according to R401.4.1
- Square root = size sq. ft required

- 80 sq. ft. floor area x 50lbs of total load = 4000lbs point load
- 4000 lb / 1500 lb soil bearing = 2.6 cubit ft
- Square root of 2.6 = 1.63' square or Side x 1.12838 = diameter 1.63 x 1.12838 = 1.84' dia.

Tables R301.5 & 401.4.1

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Tributary load area for posts

- 80 sq ft x (40 x 10) = 4000lb
- 4000 / 1500 = 2.6 cubit ft
- 2.6 sq root = 1.6 square
- or 20 dia. Footing
- If footing is made up of filling the entire hole with concrete or a sauna tub the weight of the concrete (size and height) should also be included in deck load as a reaction to soil.

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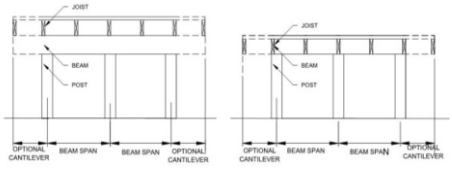
Deck Beams

Maximum allowable spans for wood deck beams, as shown in Figure R507.5, shall be in accordance with Tables R507.5(1) through R507.5(4).

Beam plies shall be fastened together with two rows of 10d (3" × 0.128") nails minimum at 16" o.c. along each edge.

Beams shall be permitted to **cantilever** *at each end up to* one-fourth of the actual beam span.

Deck beams of other materials shall be permitted where designed in accordance with accepted engineering practices.



R507.5 Deck Beams

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Beam Sizes

Table R507.5(1) - Maximum Deck Beam Span—40 PSF Live Load[c]

BEAM SPECIES[f]	BEAM SIZE[e]	EFFECTIVE DECK JOIST SPAN LENGTH[a, b, j] (feet)						
		6	8	10	12	14	16	18
		MAXIMUM DECK BEAM SPAN LENGTH (feet-inches)[a, b, j]						
Southern pine	1 – 2 × 6	4-7	4-0	3-7	3-3	3-0	2-10	2-8
	1 – 2 × 8	5-11	5-1	4-7	4-2	3-10	3-7	3-5
	1 – 2 × 10	7-0	6-0	5-5	4-11	4-7	4-3	4-0
	1 – 2 × 12	8-3	7-1	6-4	5-10	5-5	5-0	4-8
	2 – 2 × 6	9-11	8-6	7-7	6-11	6-5	6-0	5-8
	2 – 2 × 8	11-8	10-0	8-11	8-2	7-7	7-1	6-8
	2 – 2 × 10	13-9	11-9	10-6	9-6	8-10	8-3	7-10
	2 – 2 × 12	15-11	13-8	12-2	11-1	10-3	9-7	9-1
	3 – 2 × 6	13-6	11-6	10-3	9-4	8-7	8-1	7-8
	3 – 2 × 8	15-11	13-7	12-1	11-0	10-2	9-6	9-0
	3 – 2 × 10	18-8	16-0	14-3	13-0	12-0	11-2	10-6
	3 – 2 × 12	21-7	18-6	16-6	15-0	13-11	13-0	12-3
Douglas fir-larch[d] Hem-fir[d] Spruce-pine-fir	1 – 2 × 6	4-5	3-10	3-5	3-1	2-10	2-8	2-6
	1 – 2 × 8	5-8	4-11	4-4	3-11	3-7	3-4	3-2
	1 – 2 × 10	6-11	6-0	5-4	4-10	4-5	4-2	3-11
	1 – 2 × 12	8-2	7-1	6-4	5-9	5-4	5-0	4-8
	2 – 2 × 6	9-6	8-2	7-3	6-7	6-1	5-8	5-5
	2 – 2 × 8	11-3	9-8	8-7	7-10	7-3	6-9	6-5
	2 – 2 × 10	13-3	11-5	10-2	9-2	8-5	7-11	7-6
	2 – 2 × 12	15-4	13-3	11-9	10-8	9-10	9-2	8-8
	3 – 2 × 6	13-0	11-2	9-11	9-0	8-3	7-9	7-4
	3 – 2 × 8	15-4	13-2	11-8	10-7	9-9	9-2	8-8
	3 – 2 × 10	18-0	15-6	13-9	12-6	11-6	10-9	10-2
	3 – 2 × 12	20-9	17-10	15-10	14-5	13-4	12-5	11-9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation permitted. Extrapolation not permitted.
b. Beams supporting a single span of joists with or without cantilever.
c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load is not assumed to be concurrent with live load.
d. No. 2 grade, wet service factor included.
e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.
f. Beam cantilevers are limited to the adjacent beam's span divided by 4.
g. Includes incising factor.
h. Incising factor not included.
i. Deck joist span as shown in Figure R507.5
j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).

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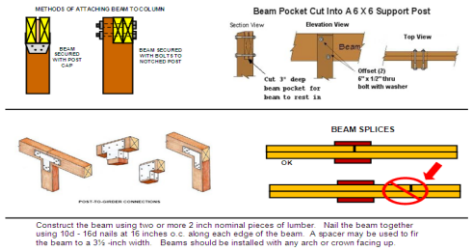
Beams

Attaching: Beam to Post Illustrations



Construct the beam using two or more 2 inch nominal pieces of lumber. Nail the beam together using 10d - 16d nails at 16 inches o.c. along each edge of the beam. A spacer may be used to fir the beam to a 3½ -inch width. Beams should be installed with any arch or crown facing up.

R507.5.1Deck beam bearing. The **ends of beams** shall have not less than 1½" of bearing on wood or metal and not less than 3" 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).

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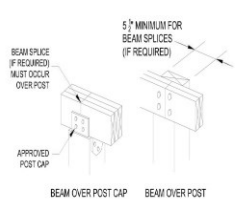
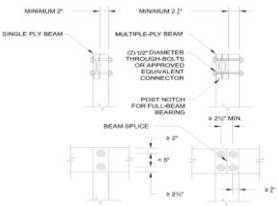
Deck Beam Bearing

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

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





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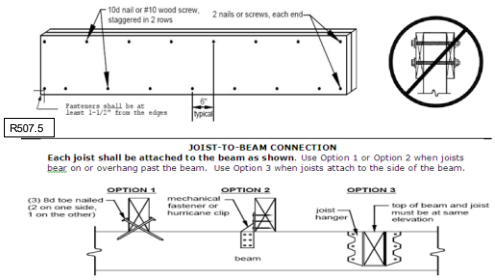
Beams



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WWP

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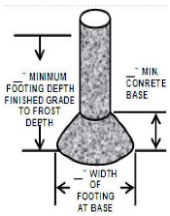
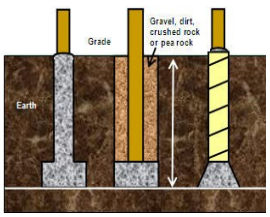
Footing Requirements





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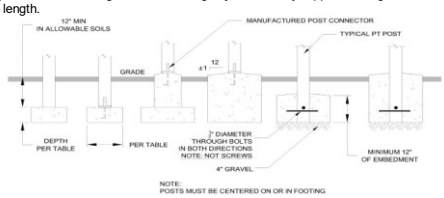
Partial Footing Chart

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 depth shall be in accordance with Section R403.1.4.

Exception: Free-standing decks consisting of joists directly supported on grade over their entire length.



R507.3.1 Minimum size. The minimum size of concrete footings shall be in accordance with Table R507.3.1, based on the tributary area and allowable soil-bearing pressure in accordance with Table R401.4.1.

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Min. Footing Sizes

Table R507.3.1 Minimum Footing Size for Decks

LIVE OR GROUND SNOW LOAD[a] (psf)	TRIBUTARY AREA (ft²)	LOAD-BEARING VALUE OF SOILS[b, c, d] (psf) 1,500 Side of a square footing (inches)	1,500 Diameter of a round footing (inches)	1,500 Thickness (inches)[f]	2,000 Side of a square footing (inches)	2,000 Diameter of a round footing (inches)	2,000 Thickness (inches)[f]	≥ 3,000 Side of a square footing (inches)	≥ 3,000 Diameter of a round footing (inches)	≥ 3,000 Thickness (inches)[f]
40	20	12	14	6	12	14	6	12	14	6
	40	14	16	6	12	14	6	12	14	6
	60	17	19	6	15	17	6	13	15	6
	80	20	22	7	17	19	6	15	17	6
	100	22	25	8	19	21	6	15	17	6
	120	24	27	9	21	23	7	17	19	6
	140	26	29	10	22	25	8	18	21	6
	160	28	31	11	24	27	9	20	22	7
50	20	15	17	6	13	15	6	11	13	6
	40	19	21	8	16	18	6	13	15	6
	60	21	24	8	19	21	6	15	17	6
	80	24	27	9	21	23	7	17	19	6
	100	26	30	10	23	26	8	19	21	6
	120	28	32	11	25	28	9	20	23	7

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kPa.

a. Interpolation permitted, extrapolation not permitted.
b. Based on highest load case: Dead + Live or Dead + Snow.
c. Footing dimensions shall allow complete bearing of the post.
d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.
e. Area, in square feet, of deck surface supported by post and footings.
f. Minimum thickness shall only apply to plain concrete footings.

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Min. Footing Sizes

TABLE R507.3.1
MINIMUM FOOTING SIZE FOR DECKS

LIVE OR GROUND SNOW LOAD[a] (psf)	TRIBUTARY AREA (sq. ft.)	LOAD BEARING VALUE OF SOILS [b, c, d] (psf) 1500 Side of a square footing (inches)	1500 Diameter of a round footing (inches)	1500 Thickness (inches)	2000 Side of a square footing (inches)	2000 Diameter of a round footing (inches)	2000 Thickness (inches)	2500 Side of a square footing (inches)	2500 Diameter of a round footing (inches)
40	20	12	14	6	12	14	6	12	14
	40	14	16	6	12	14	6	12	14
	60	17	19	6	15	17	6	13	15
	80	20	22	7	17	19	6	15	17
	100	22	25	8	19	21	6	17	19
	120	24	27	9	21	23	7	19	21
	140	26	29	10	22	25	8	20	23
	160	28	31	11	24	27	9	21	24
50	20	12	14	6	12	14	6	12	14
	40	15	17	6	13	15	6	12	14
	60	19	21	6	16	18	6	14	16
	80	21	24	8	19	21	6	17	19
	100	24	27	9	21	23	7	19	21
	120	26	29	10	23	26	8	19	23
	140	28	31	11	25	28	9	21	25
	160	30	33	12	26	29	10	22	27

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kPa.

a. Interpolation permitted, extrapolation not permitted.
b. Based on highest load case: Dead + Live or Dead + Snow.
c. Assumes minimum square footing to be 12 inches x 12 inches x 6 inches for 6 x 6 post.
d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.
e. Area, in square feet, of deck surface supported by post and footings.

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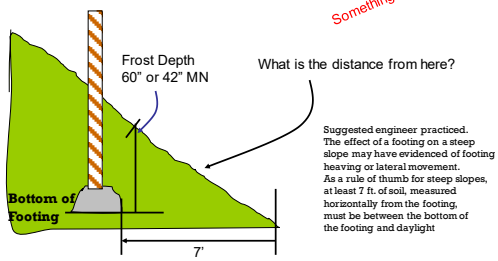
Footing Depth

Not code languages

Something to Ponder



Suggested engineer practiced. The effect of a footing on a steep slope may have evidenced of footing heaving or lateral movement. As a rule of thumb for steep slopes, at least 7 ft. of soil, measured horizontally from the footing, must be between the bottom of the footing and daylight

Manual for Inspection of Residential Wood Decks and Balconies 2003

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Posts to Footing & Connections

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Code Requirements: Cantilevered Applications

- … For decks with cantilevered framing members, connection to exterior walls or other framing members shall be designed and constructed to *resist uplift* resulting from the *full live load* specified in Table R301.5 acting on the cantilevered portion of the deck…

R507.8 Vertical & Lateral Supports

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Straps and Angles are NOT Hangers!

Fasteners & Connectors

CONCEALED FLANGE HANGER

CONVENTIONAL HANGER

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Joist Hangers to Meet 1½" Bearing for Decks

Photo courtesy of J Malley-NJ 10/05

Photo courtesy of K.Pezzano 8/24/06

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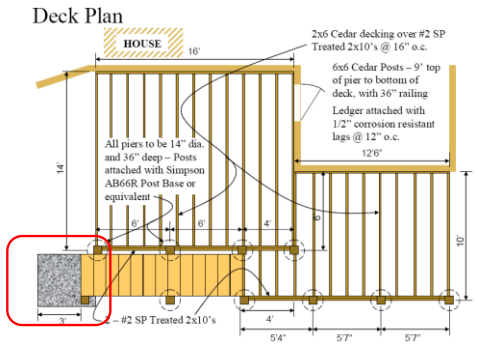
Top Elevation



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Required Joist Sizes

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.

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 *one-fourth of the joist span* or the maximum cantilever length specified in Table R507.6, whichever is less.

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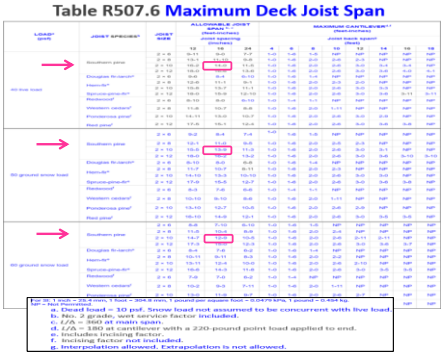
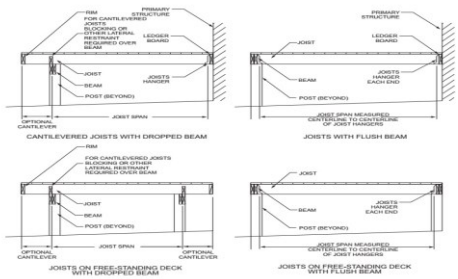
Required Joist Sizes

Table R507.6 Maximum Deck Joist Span



90

Deck Joist & Connections



R507.6 Deck joists. Maximum allowable spans for wood deck joists, shown in Figure R507.6, shall be in accordance with Table R507.6.

- ❑ The maximum joist spacing decking materials in Table R507.7.
- ❑ The maximum joist cantilever shall be limited to one-fourth of the joist span or the maximum cantilever length specified in Table R507.6, whichever is less.

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Deck Footing

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.

Exceptions:

1. Footings shall not be required for free-standing decks consisting of joists directly supported on grade over their entire length.
2. Footings shall not be required for free-standing decks that meet all of the following criteria:
   - 2.1. The joists bear directly on precast concrete pier blocks at grade without support by beams or posts.
   - 2.2. The area of the deck does not exceed 200 sq. ft.
   - 2.3. The walking surface is not more than 20" above grade at any point within 36" measured horizontally from the edge.

Flashing

- **Premature decline**
  - no Z-type flashing was installed over the edger-to-house connection, which led to extensive decay.

Flashing & Counter-Flashing

R507.2.4 Flashing. Flashing shall be corrosion-resistant metal of nominal thickness not less than 0.019 inch or approved nonmetallic material that is compatible with the substrate of the structure and the decking materials.

R703.4 item 5. Flashing
Approved corrosion-resistant flashing shall be installed -- where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.

Positively Anchored

. . . 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.

R507.8 Vertical and lateral supports

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).

Table R507.9.1.3(1) - Deck Ledger Connection to Band Joist

LOAD[c] (psf)	JOIST SPAN[a] (feet)	ON-CENTER SPACING OF FASTENERS[b] (inches): ½-inch diameter lag screw with ½-inch maximum sheathing[d, e]	½-inch diameter bolt with ½-inch maximum sheathing[d]	½-inch diameter bolt with 1-inch maximum sheathing[f]
40 live load	6	30	36	36
	8	23	36	36
	10	18	34	29
	12	15	29	24
	14	13	24	21
	16	11	21	18
	18	10	19	16
50 ground snow load	6	29	36	36
	8	22	36	35
	10	17	33	28
	12	14	27	23
	14	12	23	20
	16	11	20	17
	18	9	18	15
60 ground snow load	6	25	36	36
	8	18	35	30
	10	15	28	24
	12	13	23	20

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

a. Interpolation permitted. Extrapolation is not permitted.
b. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.
c. Dead Load = 10 psf. Snow load shall not be assumed to act concurrently with live load.
d. The tip of the lag screw shall fully extend beyond the inside face of the band joist.
e. Sheathing shall be wood structural panel or solid sawn lumber.
f. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to ½-inch thickness of stacked washers shall be permitted to substitute for up to ½-inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

Positively Anchored

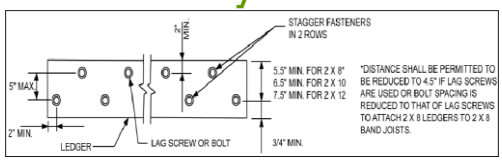
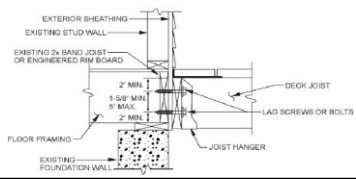


FIGURE R507.9.1.3(1) & (2)
PLACEMENT OF LAG SCREWS AND BOLTS IN BAND JOISTS



Positively Anchored

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

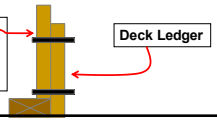
MINIMUM END AND EDGE DISTANCES AND SPACING BETWEEN ROWS				
	TOP EDGE	BOTTOM EDGE	ENDS	ROW SPACING
Ledger[a]	2 inches[d]	3/4 inch	2 inches[b]	1 5/8 inches[b]
Band Joist[c]	3/4 inch	2 inches	2 inches[b]	1 5/8 inches[b]

For SI: 1 inch = 25.4 mm.

a. 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)
b. Maximum 5 inches.
c. For engineered rim joists, the manufacturer's recommendations shall govern.
d. 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)

ANSI/APA PRR 410 or **ASTM D7672**

Band Joist - inside
Min 2" - SYP or HF or app. PP
1 1/4" R507.9.1.2
Alternate Ledger Details – R507.9.1.4



R502.1.7 Engineered wood rim board.

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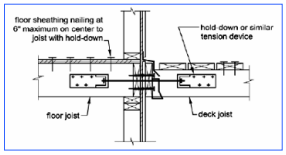
Lateral loads shall be transferred to the ground or to a structure capable of transmitting them to the ground.

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 lbs.

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 lbs.



R507.9.2 Lateral connection

Lateral loads may come from wind, seismic or the people moving on the deck. Think of the people doing the "electric slide".

Positively Anchored

Vertical and Lateral Supports at Ledger Details Joist

R507.9. and Table R507.9

- Prescriptive methods
  - Deck ledgers shall be a min. 2 x 8" nominal,
  - Pressure-preservative-treated Southern pine, incised pressure-preservative-treated hem-fir, **or** *approved*, naturally durable,
  - No. 2 grade **or** better lumber.
  - Deck ledgers **shall not** support concentrated loads from beams or girders.
  - Deck ledgers **shall not** be supported on stone or masonry veneer.

R507.9.1.1 Ledger details.

Positively Anchored

Vertical and Lateral Supports at Band Joist

R507.9. and Table R507.9

- Prescriptive methods
  - Band joists supporting a ledger shall be a min. 2" nominal
  - Solid-sawn, spruce-pine-fir or better lumber **or**
  - A min. 1" nominal engineered wood rim boards in accordance with Section R502.1.7.
  - Band joists **shall bear fully on the primary structure** capable of supporting all required loads.
  - **R502.1.7 Engineered wood rim board** shall conform to ANSI/APA PRR 410 **or** shall be evaluated in accordance with ASTM D7672.
  - Structural capacities shall be in accordance with ANSI/APA PRR 410 **or** established in accordance with ASTM D7672.
  - Rim boards conforming to ANSI/APA PRR 410 **shall be marked** in accordance with that standard.

R507.9.1.2 Band joist details

Positively Attached

Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. R507.8

Deck Ledgers shall not be supported on stone or masonry veneer. R507.9.1.1

R507.8 Vertical and Lateral Supports

.....Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self- supporting.

Deck Ledger Connection to Band Joist

- For decks supporting 50# total load
- **Connection** between a **deck ledger** of pressure-preservative-treated Southern Pine, Hem-Fir *or* approved decay-resistant species, ***and***
- 2" nominal lumber **band joist** bearing on a sill plate ***or***
- wall plate shall be ½" lag screws ***or*** bolts with washers according to Table R507.8.1.3(1).
- Lag screws, bolts and washers shall be hot-dipped galvanized or stainless steel.

R507.2

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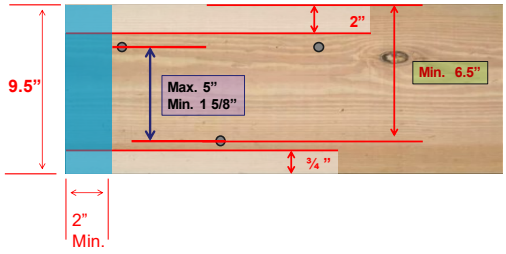
Deck ledger connection to band joist



R507.2

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Keep in Mind

Proper Lag Screw Installation for Ledger Attachment

- **2 (two) pre-bored holes are required (Do not hammer lag screw)**
  - 100% for the shank diameter in the shank portion of the screw (NDS '97 – 9.1.2.1a, NDS '01, '05 – 11.1.3.2a)
  - 40%-75% for the threaded portion (NDS '97 – 9.1.2.1b, NDS '01, '05 – 11.1.3.2b)
- **In other words, for a ½" lag screw:**
  - **Drill a 5/16" hole all the way through the ledger and rim joist or stud**
  - **Then, drill a ½" hole into the ledger, ONLY**

Lead holes not required for 3/8" or smaller lag screws loaded in withdrawal, provided the edge/end distance and spacing are sufficient to prevent splitting – NDS '97 – 9.1.2.2, NDS '01, '05 – 11.1.3.3

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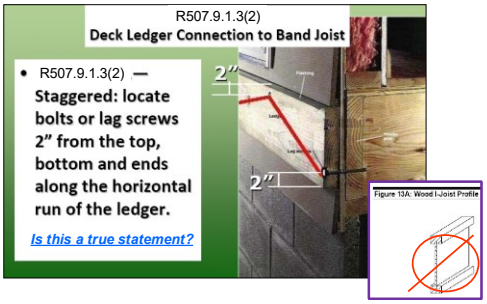

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Ledger Connection

Bolts installed 2"from the end and then staggered based on span of the joists according to the charts in R507.9.1.3 Ledger to Band Joist

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Ledger Board Connection

This ledger board connection of a deck to a cantilevered overhang.

This is a deadly situation.

- Even if the lag screws were to be positioned to penetrate the I-joist flanges, the connection would be dangerously weak.

American Wood Council DCA 6 – 2015 IRC

Deck joists (framed with PT framing lumber) have been hung from a ledger that is lagged into the rim board of a cantilevered I-joist system.

R502.2.2 IRC 06-09

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Modifying Ledger

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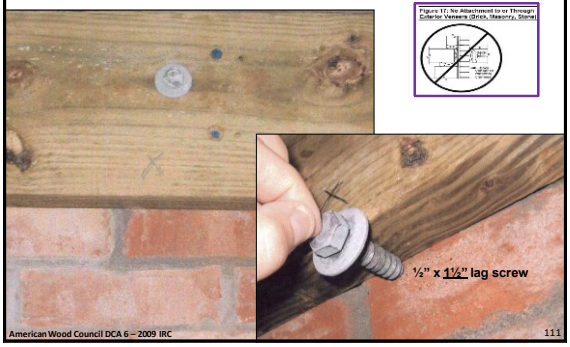
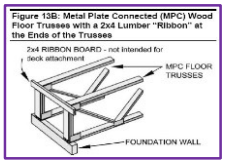
Verification



American Wood Council DCA 6 – 2009 IRC

111

Verification



American Wood Council DCA 6 – 2015 IRC

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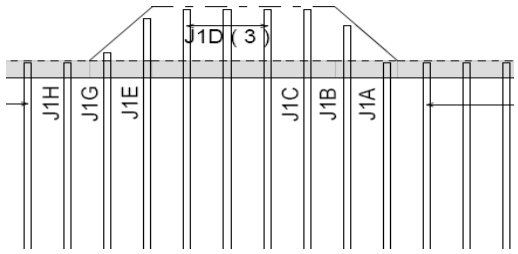
Floor Layout



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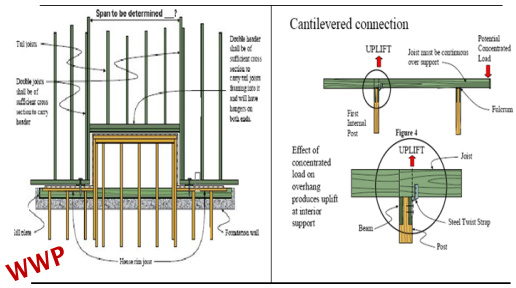
Cantilever Connection



WWP

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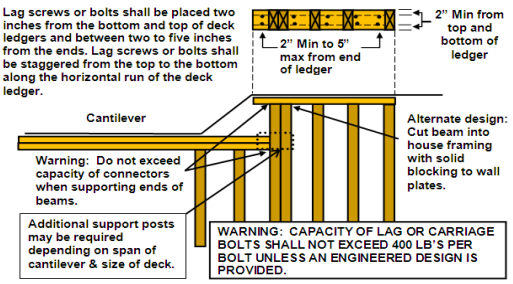
Cantilever



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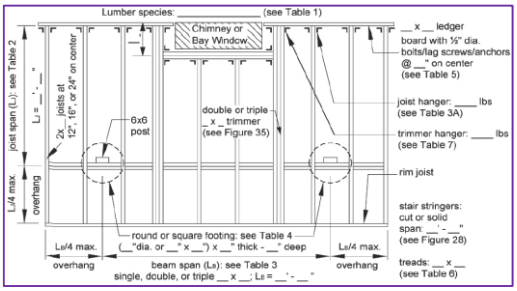
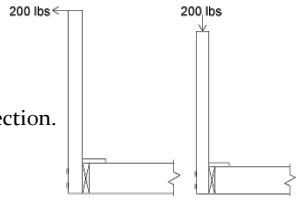
Typical Deck Framing Plan



Guards

- Point load.
  - 200 lbs.
  - Applied anywhere along top.
  - Applied in any direction.
- Infill.
  - 50 lbs.
  - Applied over 1 sf area.



Where 4 X 4" wood posts support guard loads applied to the top of the guard, such posts shall not be notched at the connection to the supporting structure

Table R301.5, **R507.10.2 Wood posts at deck guards**

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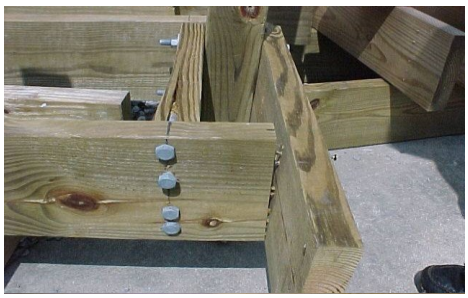
Guards Post

Under pressure 200lb



Guards Secured

Deadly rail

The photo to the right shows an example of a grossly deficient guardrail system that produced a fatality and another injured party. In this case, a young man died after falling through the guardrail with posts that were nailed only to joists on the end of the deck.

American Wood Council – DCA6

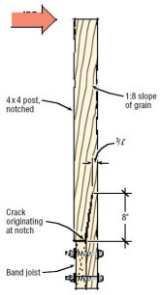
Note the notched 4x4 posts — a detail that is not permitted.

March/April 2008 ~ Coastal Contractor

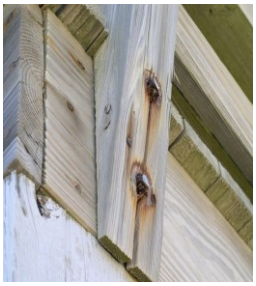
4 x 4 Post

Many years of observation have proved that moisture cycles will typically cause cracks to develop and propagate, parallel to the grain, From the corner of the notch. This may not be apparent when the post is first installed, but it happens gradually over time.

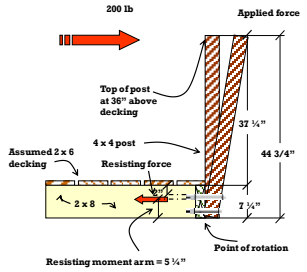
According to the grading rules for lumber, a piece of 4x4 No. 2 southern pine can have a "slope of grain" of up to 1:8 (or 1 inch in 8 inches). If a 4x4 with a slope of grain of 1:8 is notched 1.75 inches deep, a crack propagated along the grain will reduce the 1.75-inch thick section at the notch to only 3/4 inch at 8 inches above the corner of the notch — not something you'd want to bet your life on.



4 x 4 Post



Force of Typical Guard Rail Post



Moment = force x distance

Applied moment = resisting moment

Applied moment = 200 lb. x 44.75in.
= 8950 inch-pounds at base of post

Resisting moment = ? lb. x 5.25 in.

(5.25 in. the distance from bottom of joist to bolt centerline)

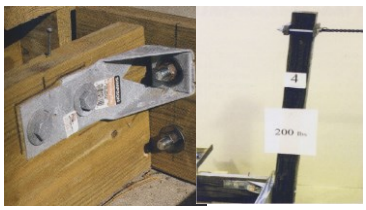
Resisting force = 8950 inch-pounds / 5.25.

= 1705 lbs

What fails? The steel itself might be up for the task, but the wood fibers under the washer would not be strong enough.

Blocking Splitting w/ 4 x 4 Post Attached

After testing the bolted and lagged connections, the authors tried reinforcing the post with blocking in a variety of configurations. Each configuration they tried failed when the blocking split along the grain.



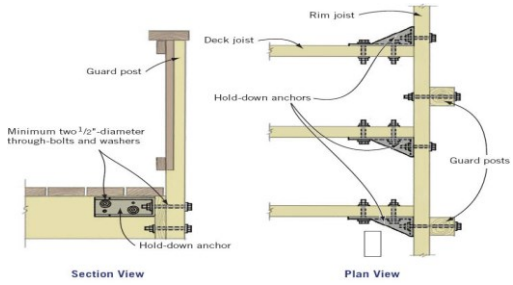
The authors tested the HD2A connection with the post installed both inside and outside the band joist; both configuration withstood the full test load. At 200 pounds, the sample post shown above deflected but the connection held. At 650 pounds with the posts till holding the test was ended so as not to damage the test machine.

Test Results: HD2A Anchors

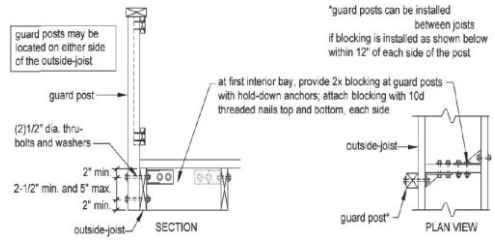
Post-to-Deck Connection Assembly	Average Test Load (lb.)	Range of Test Loads (lb.)	Average Deflection at 200 lb. (in.)	Average Test Load as Percentage of 500 lb.*
HD2A Anchor (4x4 post inside band)	645	593 to 687**	2	129%
HD2A Anchor (4x4 post outside band)	686	653 to 713**	1.9	137%

To be consider code conforming the performance must meet the requirements 100% and better.

Guardrail Connection



Guard Rail Post Attachment



American Wood Council DCA6, Figure 25 – 2015 IRC

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Connection Post & In-fill

WWP's

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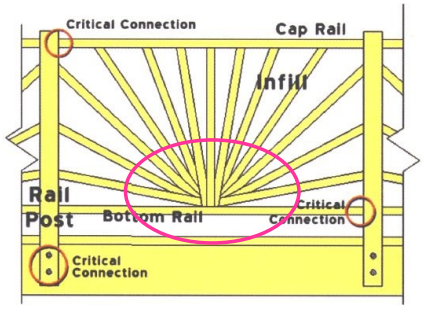
Critical Connection Guards



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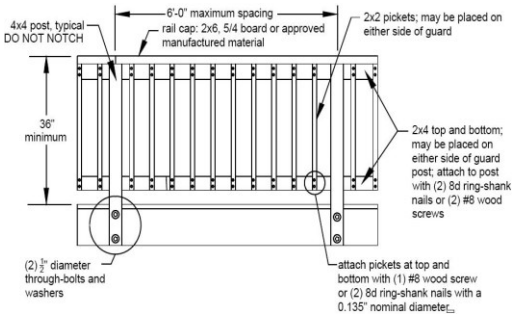
In-Fill Connection



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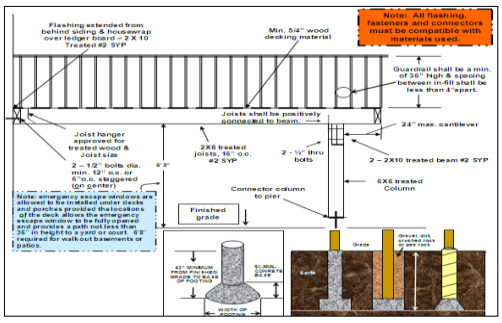
Submitted Elevation



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Post

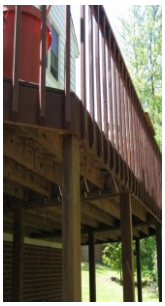
Table R507.4 - Deck Post Height

LOADS (psf)	POST SPECIES	POST SIZE	TRIBUTARY AREA (ft²)						
			20	40	60	80	100	120	140	160
			MAXIMUM DECK POST HEIGHT (feet-inches)							
40 live load	Southern pine	4 x 4	14-0	13-8	11-0	9-3	8-4	7-5	6-9	6-2
		4 x 6	14-0	14-0	13-11	12-0	10-8	9-8	8-10	8-2
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas fir*	4 x 4	14-0	13-8	10-10	9-3	8-0	7-2	6-2	5-3
		4 x 6	14-0	14-0	14-0	13-10	11-10	10-6	9-6	8-7
	Hem-fir*	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Spruce-pine-fir*	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood	4 x 4	14-0	13-2	10-3	8-1	6-8	NP	NP	NP
	Western cedars	4 x 6	14-0	14-0	13-6	11-4	9-8	8-4	6-9	6-2
	Ponderosa pine	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	13-7	8-7
	Red pine	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.
NP = Not Permitted.
a. Measured from the underside of the beam to the top of footing or pier.
b. 10 psf dead load. Snow load not assumed to be concurrent with live load.
c. No. 2 grade, wet service factor included.
d. Notched deck posts shall be sized to accommodate beam size in accordance with Section R507.5.2
e. Includes incising factor.
f. Incising factor not included.
g. Area, in square feet, of deck surface supported by post and footings.
h. Interpolation permitted. Extrapolation not permitted.

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" in surrounding soils or concrete piers. Other footing systems shall be permitted.

Exception: Where expansive, compressible, shifting or other questionable soils are present, surrounding soils shall not be relied on for lateral support.



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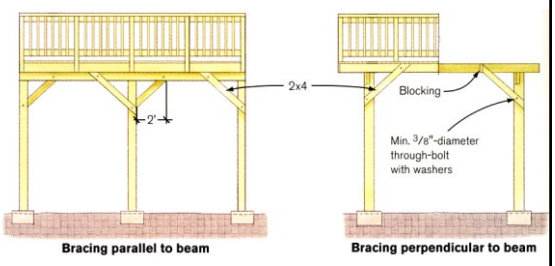
?? Sway Bracing ??



R507.4.1...lateral restraint shall be provided by manufactured connectors or a minimum post embedment of 12" in surrounding soils or concrete piers.

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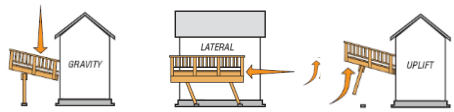
5 Steps to a Safer and Stronger Home – Decks

1. **Check Out the Deck**
   If, you are unsure about the safety of the deck, consult with a professional such as a structural engineer. (Wood)
2. **Carry the Weight – Gravity, Lateral, and Uplift**



3. **Create a Path – a "Continuous Load Path"**
4. **Combat Corrosion & Moisture issues – see "Corrosion Guidelines"**
5. **Maintain a Safe Deck**
   Regular maintenance and inspections are required.

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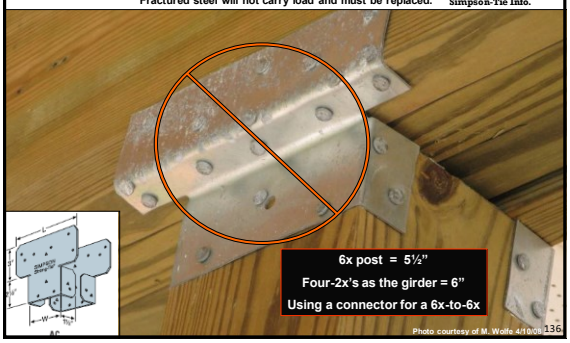
Girder-to-Post Connections – Girder over the Post
What's wrong with this installation?

Note i. Unless otherwise noted, bending steel in the field may cause fractures at the bend line. Fractured steel will not carry load and must be replaced. **Simpson-Tie Info.**



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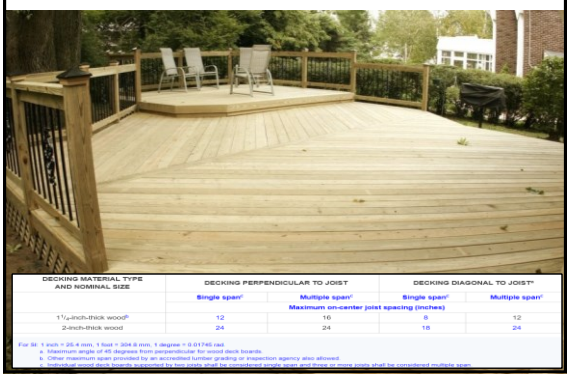
Deck Boards



DECKING MATERIAL TYPE AND NOMINAL SIZE	DECKING PERPENDICULAR TO JOIST		DECKING DIAGONAL TO JOIST[a]	
	Single span[c]	Multiple span[c]	Single span[c]	Multiple span[c]
	Maximum on-center joist spacing (inches)			
1"/4-inch-thick wood[b]	12	16	8	12
2-inch-thick wood	24	24	18	24

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.
b. Other maximum span provided by an accredited lumber grading or inspection agency also allowed.
c. Individual wood deck boards supported by two joists shall be considered single span and those or more joists shall be considered multiple span.

Composite Decking

R311.7.5.4, R311.7.8.6, R312.1.4, R317.4 & R507.2.2 Wood Plastic Composites.

Deck Boards

- Wood/plastic composites used in exterior deck boards, stair treads, handrails and guardrail systems shall bear a label indicating the required performance levels and demonstrating compliance with the provisions of ASTM D 7032.
- Wood/plastic composites shall be installed in accordance with the manufacturer's instructions.

4.2.2.2 Deck Boards Used as Stair Treads: Trex® 2-inch-by-6-inch (51 mm by 152 mm) and Trex® 5/4-inch-by-6-inch (32 mm by 152 mm) composite lumber, when used as a stair tread, is satisfactory to resist the code-prescribed concentrated load of 300 lbf (1.33 kN) when installed at a maximum center-to-center spacing of 12 inches (305 mm), and must have a minimum of three continuous spans over four supports. Trex Brasilia™ and Trex Contours™ composite lumber, when used as a stair tread, is satisfactory to resist the code-prescribed concentrated load of 300 lbf (1.33 kN) when installed at a maximum center-to-center spacing of 9 inches (229 mm), and must have a minimum of two continuous spans over three supports.

ESR 1190 section 4.2.2.2

ESR3168section 4.2.2

R317.4 Wood/plastic composites.

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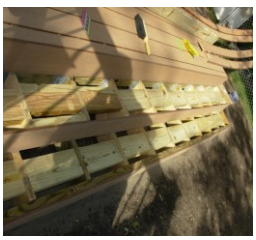
Composite Decking

R317.4 Plastic Composite Decking – R507.2.2..ff



http://www.10klakes.org/Uniformity/2016/PLASTICD.pdf

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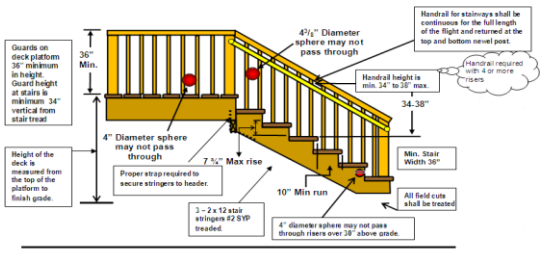
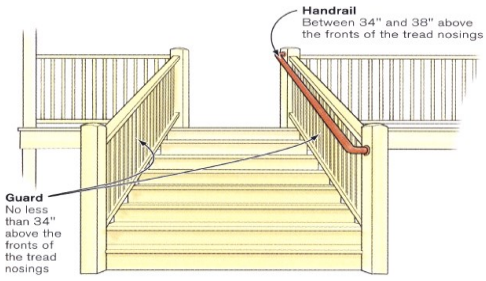
A Typical Stair Framing Detail



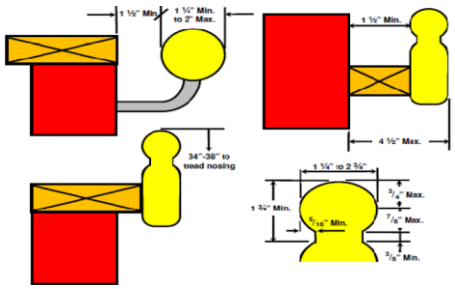
R303.8 Exterior stairway illumination. Exterior stairways shall be provided with an artificial light source located at the top landing of the stairway. Exterior stairways providing access to a basement from the outdoor grade level shall be provided with an artificial light source located at the bottom landing of the stairway

Handrail



R311.7.8.6 Handrails.

Handrail Dimensions



toward a wall, guard walking surface continuous to itself, or terminate to a post.

Continuous

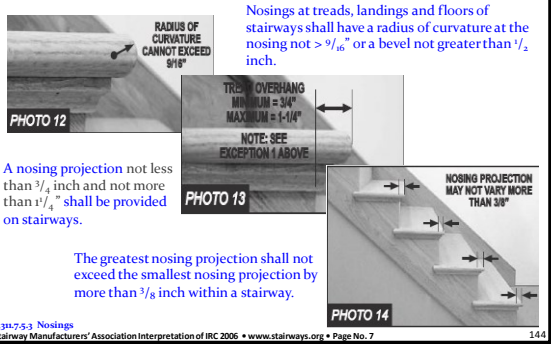
- **R311.7.8.3 Handrail clearance.** Handrails adjacent to a wall shall have a space of not < 1½" between the wall and the handrails.
- **R311.7.8.4 Continuity.** Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight.
- Handrail ends shall be returned toward a wall, guard walking surface continuous to itself, or terminate to a post.

Exceptions:

- Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
- A volute, turnout or starting easing shall be allowed to terminate over the lowest tread.

R311.7.8.4 Continuity.

Stair Tread Profile



Nosings at treads, landings and floors of stairways shall have a radius of curvature at the nosing not > 9/16" or a bevel not greater than 1/2 inch.

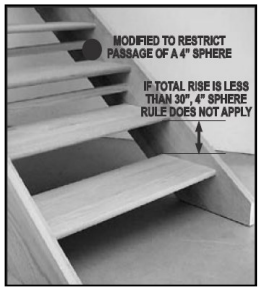
A nosing projection not less than 3/4 inch and not more than 1 1/4" shall be provided on stairways.

The greatest nosing projection shall not exceed the smallest nosing projection by more than 3/8 inch within a stairway.

R311.7.5.3 Nosings

Stairway Manufacturers' Association Interpretation of IRC 2006 • www.stairways.org • Page No. 7

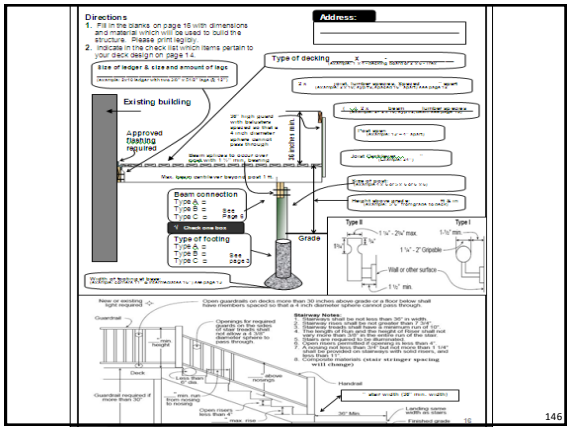
Risers Enclosed



Exceptions:

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

R311.7.5.1 Profile.



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Stairs & Illumination

- Exterior stairways shall be provided with an artificial light source located at the top landing of the stairway.

R303.8 Exterior stairway illumination

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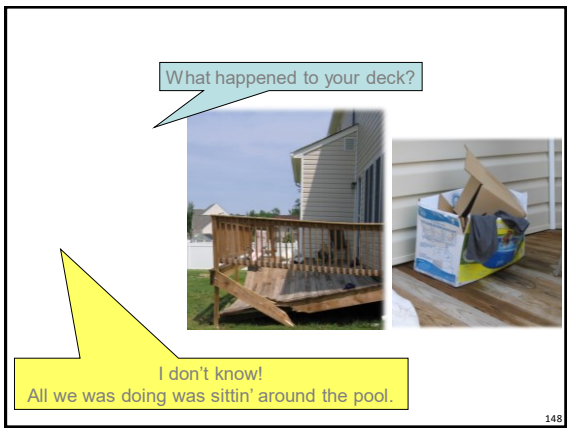

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Short Cuts

Learn from the mistakes of others.

You can never live long enough

To make them all yourself.

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Summary

- **Verify all code requirements.**
- **Call one another with your questions.**
- **…And remember: "Life is good."**

(Brent Snyder 2006)

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