

Using the *Prescriptive Residential Deck Construction Guide*

by Glenn Mathewson

When it comes to structural provisions for decks, the International Residential Code falls rather short. According to the IRC, much of what we see in deck construction is an “alternative.” Alternative designs and methods are those that are not prescribed in the code — they fall outside of the cookie-cutter construction recipe. It is within the authority of the building official to approve alternative materials, designs, and methods, as long as they are at least equivalent to what’s provided in the code and are based on accepted engineering practice.

The local jurisdiction may also approve alternative provisions that are published by government agencies and reputable organizations. One such organization, the American Forest & Paper Association (AF&PA), has

recently published the *Prescriptive Residential Deck Construction Guide*, which is available as a free download from its Web site, www.afandpa.org (PDB, January/February 2008, page 22).

The AF&PA is also the publisher of the *National Design Specification* (the cornerstone for wood-frame engineering) and the *Wood Frame Construction Manual*, a standard that is specifically referenced by the IRC. Considering the AF&PA’s involvement in code standards, it would be reasonable to submit deck plans for local approval incorporating its provisions.

The *Prescriptive Residential Deck Construction Guide* is not a building code in itself, however. It’s intended to provide one alternative method to satisfy the code, but not represent the code specifically. In many ways it goes beyond code and in other ways

it may be questionable. In general, it’s very conservative. Following are some highlights of the differences between the AF&PA deck guide and the IRC.

Joists and Beams

The IRC contains span tables that are often used for sizing deck joists, but these tables include only a few wood species, and they don’t account for wet-service conditions or incised materials, both of which may slightly reduce the materials’ structural capacity.

The *Deck Construction Guide* provides a simple joist span table that accounts for all these reduction factors and includes values for redwood and western cedars — species absent from the IRC’s span tables (**Figure 1**). Span tables are also provided for multi-ply beams, from doubled 2x6s to tripled

Maximum Joist Spans¹

Species	Size	Joist Spacing (o.c.)		
		12"	16"	24"
Southern Pine	2x8	10'-6"	10'-6"	10'-2"
	2x10	15'-2"	15'-2"	13'-1"
	2x12	18'-0"	18'-0"	15'-5"
Douglas Fir-Larch, Hem-Fir, SPF ²	2x8	9'-3"	9'-3"	9'-1"
	2x10	13'-4"	13'-4"	11'-1"
	2x12	17'-10"	15'-9"	12'-10"
Redwood, Western Cedars	2x8	8'-4"	8'-4"	8'-4"
	2x10	12'-0"	12'-0"	11'-3"
	2x12	16'-1"	16'-0"	13'-0"

1. Assumes 40 psf live load, 10 psf dead load, L/180 cantilever deflection with 230 lb point load, No. 2 grade, and wet service conditions. See span calculator at www.awc.org for simple span conditions without cantilevers.

2. Incising factor used for refractory species including Douglas fir-larch, hem-fir, and spruce-pine-fir.

Figure 1. The joist span table in the *Prescriptive Residential Deck Construction Guide* includes common species not given in the IRC.

Deck Beam Spans¹

		Joist Spans (ft) Less Than or Equal to:						
Species	Size	6	8	10	12	14	16	18
Southern Pine	2-2x6	7'-1"	6'-2"	5'-6"	5'-0"	4'-8"	4'-4"	4'-1"
	2-2x8	9'-2"	7'-11"	7'-1"	6'-6"	6'-0"	5'-7"	5'-3"
	2-2x10	11'-10"	10'-3"	9'-2"	8'-5"	7'-9"	7'-3"	6'-10"
	2-2x12	13'-11"	12'-0"	10'-9"	9'-10"	9'-1"	8'-6"	8'-0"
	3-2x6	8'-7"	7'-8"	6'-11"	6'-3"	5'-10"	5'-5"	5'-2"
	3-2x8	11'-4"	9'-11"	8'-11"	8'-1"	7'-6"	7'-0"	6'-7"
	3-2x10	14'-5"	12'-10"	11'-6"	10'-6"	9'-9"	9'-1"	8'-7"
	3-2x12	17'-5"	15'-1"	13'-6"	12'-4"	11'-5"	10'-8"	10'-1"
Douglas Fir-Larch ² , Hem-Fir, SPF ² , Redwood, Western Cedars	3x6 or 2-2x6	5'-8"	4'-11"	4'-4"	4'-0"	3'-8"	3'-5"	3'-0"
	3x8 or 2-2x8	7'-2"	6'-2"	5'-6"	5'-0"	4'-8"	4'-4"	4'-0"
	3x10 or 2-2x10	8'-9"	7'-7"	6'-9"	6'-2"	5'-8"	5'-4"	5'-0"
	3x12 or 2-2x12	10'-1"	8'-9"	7'-10"	7'-2"	6'-7"	6'-2"	5'-10"
	4x6	6'-8"	5'-9"	5'-2"	4'-9"	4'-4"	4'-1"	3'-10"
	4x8	8'-9"	7'-7"	6'-10"	6'-3"	5'-9"	5'-5"	5'-1"
	4x10	10'-9"	9'-4"	8'-4"	7'-7"	7'-1"	6'-7"	6'-3"
	4x12	12'-6"	10'-10"	9'-8"	8'-10"	8'-2"	7'-8"	7'-3"
	3-2x6	7'-4"	6'-8"	6'-2"	5'-9"	5'-4"	5'-0"	4'-8"
	3-2x8	9'-8"	8'-9"	7'-11"	7'-3"	6'-9"	6'-3"	5'-11"
	3-2x10	12'-4"	10'-10"	9'-8"	8'-10"	8'-2"	7'-8"	7'-3"
	3-2x12	14'-6"	12'-7"	11'-3"	10'-3"	9'-6"	8'-11"	8'-5"

1. Assumes 40 psf live load, 10 psf dead load, L/360 simple span beam deflection limit, L/180 cantilever deflection limit, No. 2 grade, and wet service conditions.

2. Incising factor used for refractory species including Douglas fir-larch, hem-fir, and spruce-pine-fir.

Figure 2. Spans for beams from a variety of species and configurations are provided by the *Prescriptive Residential Deck Construction Guide*.

Joist Span – Free Standing Deck

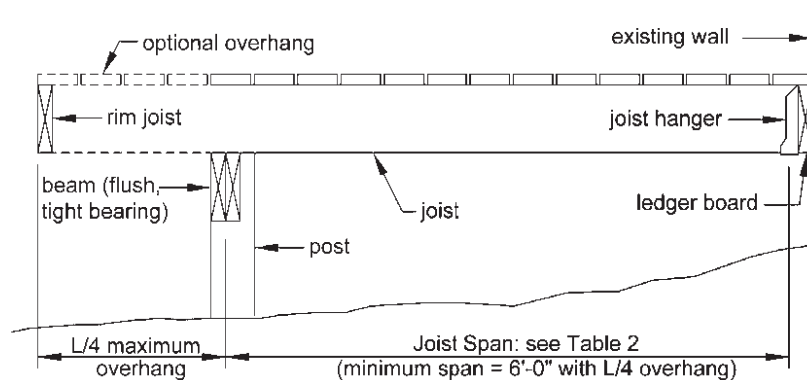


Figure 3. Maximum joist cantilevers are spelled out in the *Prescriptive Residential Deck Construction Guide* as one quarter of the entire span.

2x12s (**Figure 2**). These tables are incredibly useful, and I imagine most jurisdictions would approve the spans with little question.

Cantilevers

As mentioned previously, the IRC specifically allows design that's in accordance with the *Wood Frame Construction Manual* (R301.1.1). In that book, the cantilever allowance for joists is $L/4 - 1/4$ the total span – which is identical to the allowance in the *Deck Construction Guide* (**Figure 3**). Using this design provision shouldn't be a problem, as it's essentially in the IRC.

On the other hand, the allowable cantilever for beams (also $L/4$) provided in the *Deck Construction Guide* is not in the IRC (**Figure 4, page 3**). While beam cantilevers may be scrutinized by the building official, the acceptance of the guide's provisions would certainly add design flexibility.

Post Size

The *Deck Construction Guide* specifies a minimum 6x6 post and cites section R407 of the IRC. Strangely, this IRC section requires a minimum 4x4 post. The larger cross section required by the AF&PA may be a result of diagonal bracing provisions in the *Deck Construction Guide* that are not in the IRC. This bracing places forces perpendicular to the posts, which increases bending stresses on them.

Deck Beam Spans¹

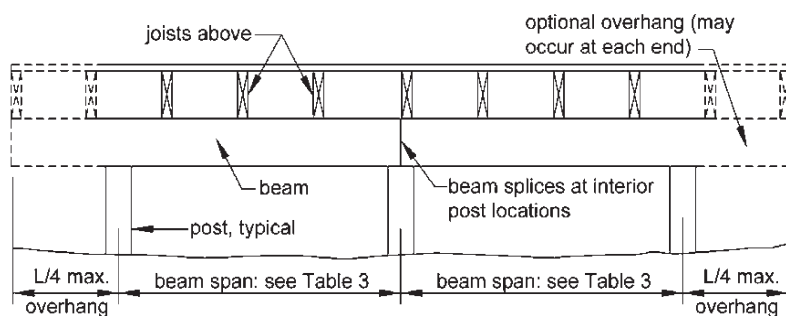


Figure 4. Beam cantilevers are provided by the *Prescriptive Residential Deck Construction Guide*, information not found in the IRC.

Deck Attachment for Lateral Loads

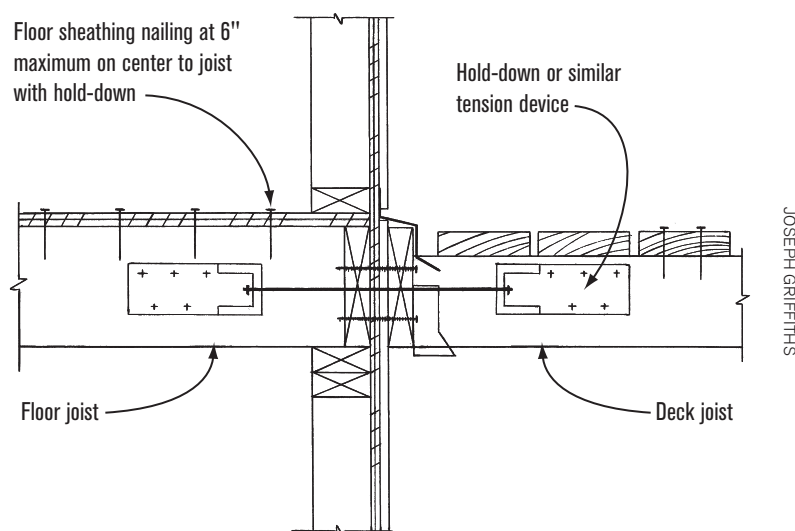


Figure 5. This illustration from the IRC suggests a more specific lateral attachment than does the *Prescriptive Residential Deck Construction Guide*.

The load path to the supporting soil requires all the components of the structural system to work together, so the system must be designed as a whole. By specifying braces for lateral support, the post size must be reconsidered. With these thoughts in mind, a jurisdiction might require the *Deck Construction Guide* to be used in its entirety, as a system design.

Lateral Bracing

Not all forces on a structure act vertically. Lateral forces, often imposed on decks by the movement of people, act in a horizontal direction. Live loads account for the weight of people, but not the horizontal forces generated by their movement. Decks are notoriously places of high occupant load and high occupant movement. Couple that with a lack of lateral bracing and the party on the deck may end early.

The concern is the deck pulling away from the house. The difficulty that may arise from trying to use *Deck Construction Guide* methods for lateral bracing of decks is that many building departments also consult the newer supplemental codes for guidance in approving alternatives. The IRC requires some sort of lateral bracing and the 2007 supplement to the IRC provides one possible method (**Figure 5**). I think it's conservative – and impractical for existing structures.

While this particular connection is not required by the IRC, it does establish a minimum standard. By setting the bar for lateral restraint so high, the 2007 supplement to the IRC makes the *Deck Construction Guide* methods a questionable “equivalency.”

Ledger Details

The ledger fastening table in the *Deck Construction Guide* is nearly the same as that in the 2007 IRC supplement. However, the two differ significantly in one way. While the *Deck Construction*

Guide provides a detail for hanging a girder from a ledger (**Figure 6**), the 2007 IRC supplement states: "Girders supporting deck joists shall not be supported on deck ledgers or band joists." What this means is the standard practice of hanging a double beam from the ledger to carry other joists will no

longer be allowed. This fact may make a building official wary of approving an almost identical table that then allows beams to bear at the ledger.

Stairs

To my knowledge the *Deck Construction Guide* is the first "reputable" docu-

ment to provide structural details for typical deck stairs. While this is great, I also think that as written, it's both conservative and misleading. On the conservative side, notched stair stringers are limited to a horizontal span of 7 feet with southern pine, and 6 feet for other species. This may be a shock to deck professionals who are accustomed to longer spans. I assume that the use of a beam, posts, and footings set at midspan of the stairs would be an acceptable alternative that would allow longer flights with notched stringers.

What I find misleading about the section on stairs is that it allows stringers to be spaced at 36 inches and allows either a 2-by or 5/4 board to span this distance (**Figure 7**). Stringer spacing should be based on the maximum span of the tread material: Some synthetic decking materials can span only 8 inches when used as stair treads. I think the stair portion of the *Deck Construction Guide* should be used and approved with caution.

The *Deck Construction Guide* is not, nor is it intended to be, an all-inclusive code document. While it provides many useful specifications that aren't in the code, it also leaves some out. For example, opening limitations and minimum heights for stair guards are not mentioned, nor is the use of type II graspable handrails (those with a perimeter greater than 6¹/₄ inches). But the value in the *Deck Construction Guide* is that it fills some holes in the IRC and provides a good framework for generally acceptable deck design. ❖

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Framing Around a Chimney or Bay Window

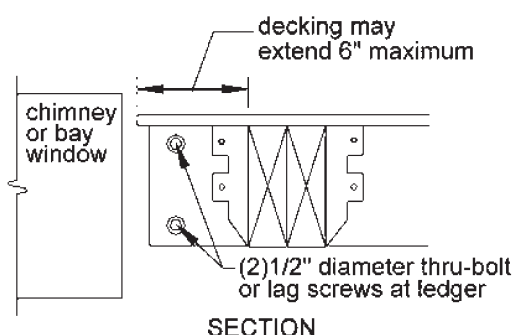
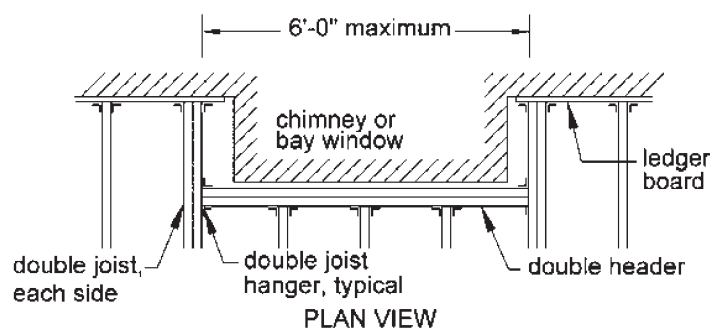


Figure 6. The *Prescriptive Residential Deck Construction Guide* details a method for hanging girders from ledgers; the 2007 IRC supplement forbids this detail. The decision lies with the local inspector.

Figure 7. The *Prescriptive Residential Deck Construction Guide* allows 3-foot spans between stringers; the IRC bases these spans on the strength of the tread material.

