DCA 6 Update

New provisions in the 2012 IRC lead to important changes in this popular deck design guide

by Glenn Mathewson

Originally published in 2007, the American Wood Council's (AWC) *Prescriptive Residential Wood Deck Construction Guide*—commonly referred to as DCA 6—is a recognized resource for both deck builders and code administrators. It was updated to conform to the 2009 IRC, and this summer, it was updated again to reflect requirements in the 2012 IRC and to more comprehensively address a deck's load path. In this article, I'll review the biggest changes in the 2012 DCA 6, following the load path from the ground up. (A free PDF of DCA 6 can be downloaded at awc.org/codes/dcaindex.php.)

Foundations

Deck foundations range from shallow and broad footings to deep and narrow piers, depending on frost depth, soil type, and local practices, so any attempt to standardize them is complicated. The IRC and DCA 6 size footings based on bearing area (the area of the bottom of the foundation that's in contact with the earth). Applying their provisions using the lowest standardized soil bearing capacity (1,500 psf) yields large bearing areas that work well for shallow and broad footings, but not for deep and narrow ones. Regions of the country that have been getting by with 8- to 12-inch-diameter piers, 30 inches or more in depth, may be surprised by the new DCA 6's 18-inch minimum diameter—up from 15 inches. Smaller-diameter footings are still allowed in soils with a bearing capacity that is known to be higher, such as sand or gravel.

The 2012 DCA 6 also includes the weight of the concrete foundation itself in calculations. New illustrations show various common footing methods, but the sizes are still based on the bearing area of a shallow footer (**Figure 1**). For instance, if an 18-inch-diameter pier is poured deeper than the minimum 7 inches provided

Table 4. Post Height for 6x6[5] and Footing Sizes for all Posts.

Beam Span, L_B	Joist Span L_J	Post Heights[1]					Footing Sizes[2]		
		Southern Pine	Douglas Fir-Larch[3]	Hem-Fir[3], Western Cedars	Redwood	Ponderosa Pine, Red Pine, SPF[3]	Round Footing Diameter	Square Footing	Footing Thickness[4]
6'	≤10'	14'	14'	14'	14'	14'	18"	16"x16"	7"
	≤14'	14'	14'	14'	14'	14'	21"	18"x18"	8"
	≤18'	14'	14'	12'	14'	11'	24"	21"x21"	10"
8'	≤10'	14'	14'	14'	14'	14'	20"	18"x18"	8"
	≤14'	14'	14'	14'	14'	11'	24"	21"x21"	10"
	≤18'	14'	13'	11'	12'	8'	27"	24"x24"	11"
10'	≤10'	14'	14'	14'	14'	12'	23"	20"x20"	9"
	≤14'	14'	13'	11'	13'	8'	27"	24"x24"	11"
	≤18'	12'	11'	8'	11'	2'	31"	27"x27"	13"
12'	≤10'	14'	14'	12'	14'	10'	25"	22"x22"	10"
	≤14'	13'	12'	9'	11'	5'	30"	26"x26"	13"
	≤18'	11'	9'	6'	9'	2'	34"	30"x30"	15"
14'	≤10'	14'	13'	11'	13'	8'	27"	24"x24"	11"
	≤14'	11'	10'	7'	10'	2'	32"	29"x29"	14"
	≤18'	9'	8'	2'	8'	NP	37"	33"x33"	16"
16'	≤10'	13'	12'	10'	12'	6'	29"	26"x26"	12"
	≤14'	10'	9'	5'	9'	2'	35"	31"x31"	15"
	≤18'	7'	5'	2'	7'	NP	40"	35"x35"	18"
18'	≤10'	12'	11'	8'	11'	2'	31"	27"x27"	13"
	≤14'	9'	8'	2'	8'	NP	37"	33"x33"	16"
	≤18'	5'	2'	2'	6'	NP	42"	37"x37"	19"

1. Assumes 40 psf live load, 10 psf dead load, $L_B/4$ and $L_J/4$ overhangs, No 2. Stress grade and wet service conditions.
2. Assumes 1,500 psf soil bearing capacity and 150 pcf concrete. Value may be multiplied by 0.9 for corner posts.
3. Incising assumed for Douglas fir-larch, hem-fir, and spruce-pine-fir.
4. Assumes 2,500 psi compressive strength of concrete. Coordinate footing thickness with post base and anchor requirements.
5. 8x8 nominal posts may be substituted anywhere in Table 4 to a maximum height of 14'.

Figure 12. Typical Footing Options.

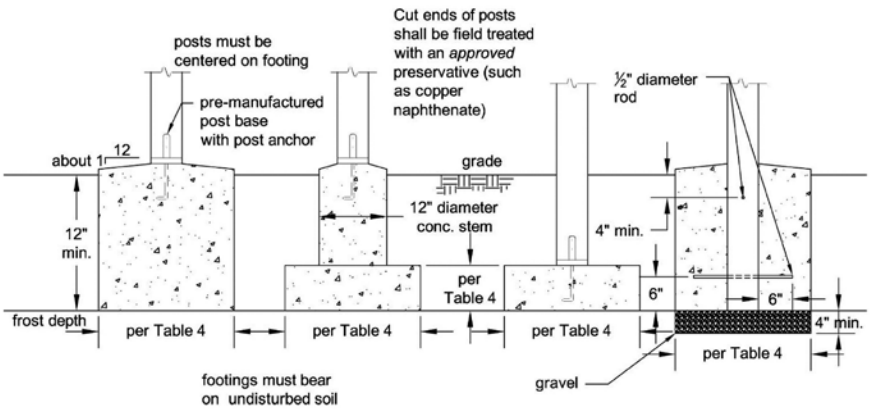

Figure 1. Foundation styles are now sized according to bearing area and an assumed lateral load from knee bracing, a methodology that results in larger footings below grade compared with those designed under previous versions of DCA 6.

in the table, then the weight of the additional concrete should be accounted for in adjustment factors provided in the commentary, yielding an even larger pier diameter. To offset this condition and reduce the amount of exposed concrete at the top, a pier/footing foundation with a narrower pier bearing on a larger footing can be installed.

A new footnote allows for a reduction in footing size for a corner post, which is assumed to be carrying half the weight of a mid-span post. The reduction is 10%, though, not 50%, to account for lateral loads acting on the corner posts through knee braces.

Posts

Previously, DCA 6 had a blanket maximum post height of 14 feet. Now, maximum height—newly added to the foundation table—is based on joist and beam spans and the species of lumber. Also, research showing that lateral loads on the deck are translated to lateral forces on the posts through knee braces has resulted in a reduction of maximum post heights, now between 2 feet and 14 feet. To ease design constraints caused by this change, the document allows the use of 8x8 posts up to a 14-foot height for all conditions in the table. As in the past edition, the commentary provides some methodology for using 4x4 posts, such as on small stair landings.

Preservative Treatment

In previous DCA 6 editions, various wood species were listed in Table 1, along with the minimum required ground-contact treatment retention required for common preservatives. Though useful to the technical reader, it has been replaced with a table that simply lists which species can be treated for ground contact and which can't.

Glued Laminated Beams

One of the most helpful parts of DCA 6 is its table of deck beam spans based on joist span (so helpful that a similar table has been added to the 2015 IRC). The new version improves on that by including a table for glued laminated timbers, or glulams (**Figure 2**), which not only accommodates different architecture, but also allows for up to an 18-foot span—up from 15 feet for a three-ply 2x12 in the previous document. (Though glulams can certainly span farther than 18 feet, the span is limited here by DCA 6's foundation design.)

2x6 Joists

Sometimes a deck—one at ground level, for instance—is best served by the low profile of 2x6 framing. Though overlooked by previous editions, 2x6 joists are included in the new DCA 6. While this adds design flexibility, a minimum 2x8 must still be used for attachment of a guard post.

Table 3B. Glued Laminated Timber Beam Spans (L_B)[1] for Joists Framing from One Side Only.

Stress Class[2]	Width[3]	Depth[4]	Joist Spans (L) Less Than or Equal to: 6'	8'	10'	12'	14'	16'	18'
Balanced or Unbalanced 20F-1.5E And Higher Grade Cedar	3-1/2"	9-1/2"	12'-2"	10'-6"	9'-4"	8'-6"	7'-10"	7'-4"	6'-11"
		11-7/8"	15'-2"	13'-1"	11'-8"	10'-8"	9'-10"	9'-2"	8'-8"
		14"	17'-10"	15'-5"	13'-9"	12'-7"	11'-7"	10'-10"	10'-2"
	5-1/4"	11-7/8"	18'-0"[5]	16'-8"	14'-10"	13'-7"	12'-6"	11'-8"	11'-0"
		14"	18'-0"[5]	18'-0"[5]	17'-6"	15'-11"	14'-9"	13'-9"	13'-0"
		16"	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]	16'-10"	15'-9"	14'-10"
Unbalanced 24F-1.8E Douglas Fir-Larch or Southern Pine	3-1/2"	9-1/2"	13'-11"	12'-1"	10'-9"	9'-10"	9'-1"	8'-6"	8'-0"
		11-7/8"	17'-5"	15'-1"	13'-5"	12'-3"	11'-4"	10'-7"	10'-0"
		14"	18'-0"[5]	17'-9"	15'-10"	14'-5"	13'-4"	12'-6"	11'- 9"
	5-1/4"	11-7/8"	18'-0"[5]	18'-0"[5]	17'-1"	15'-7"	14'-5"	13'-6"	12'-8"
		14"	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]	17'-0"	15'-10"	14'-11"
		16"	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]	17'-0"
Balanced 24F-1.8E Douglas Fir-Larch or Southern Pine	3-1/2"	9-1/2"	13'-11"	12'-7"	11'-8"	11'-0"	10'-5"	9'-11"	9'-7"
		11-7/8"	17'-5"	15'-10"	14'-8"	13'-9"	13'-1"	12'-6"	12'-0"
		14"	18'-0"[5]	18'-0"[5]	17'-4"	16'-3"	15'-5"	14'-9"	14'-2"
	5-1/4"	11-7/8"	18'-0"[5]	18'-0"[5]	17'-4"	16'-3"	15'-5"	14'-9"	14'-2"
		14"	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]	17'-6"	16'-9"
		16"	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]	18'-0"[5]

1. Assumes 40 psf live load, 10 psf dead load, L/360 simple span beam deflection limit, cantilever length/180 deflection limit. Glued laminated timber shall be naturally durable or preservative treated with an oil-borne treatment in accordance with AWPA U1. See MINIMUM REQUIREMENTS & LIMITATIONS.
2. Preservative treated structural composite lumber of equal or greater capacity can be substituted.
3. Beam widths of 3-1/8" or wider can be used for the tabulated 3-1/2" width, and beam widths of 5-1/8" or wider can be used for the tabulated 5-1/4" width.
4. Beam depth must be equal to or greater than joist depth if joist hangers are used (see Figure 6, Option 3).
5. Beam span prescriptively limited to 18'-0" for footing design.

Figure 2. Regardless of the manufacturer, glulams have consistent design values and can be sized according to this new table in DCA 6. Balanced members can be placed in any orientation, whereas unbalanced members have variations in the laminated pieces and must be placed with the correct side up.

Table 2. Maximum Joist Spans and Overhangs.[1]

Species	Size	Joist Spacing (o.c.) 12"	16"	24"	12"	16"	24"
		Allowable Span[2] (L_J)			Allowable Overhang[3] (L_O)		
Southern Pine	2x6[6]	9' - 11"	9' - 0"	7' - 7"	1' - 0"	1' - 1"	1' - 3"
	2x8	13' - 1"	11' - 10"	9' - 8"	1' - 10"	2' - 0"	2' - 4"
	2x10	16' - 2"	14' - 0"	11' - 5"	3' - 1"	3' - 5"	2' - 10"
	2x12	18' - 0"[7]	16' - 6"	13' - 6"	4' - 6"	4' - 2"	3' - 4"
Douglas Fir-Larch, Hem-Fir, Spruce-Pine-Fir[4]	2x6[6]	9' - 6"	8' - 4"	6' - 10"	0' - 11"	1' - 0"	1' - 2"
	2x8	12' - 6"	11' - 1"	9' - 1"	1' - 8"	1' - 10"	2' - 2"
	2x10	15' - 8"	13' - 7"	11' - 1"	2' - 10"	3' - 2"	2' - 9"
	2x12	18' - 0"[7]	15' - 9"	12' - 10"	4' - 4"	3' - 11"	3' - 3"
Redwood, Western Cedars, Ponderosa Pine[5], Red Pine[5]	2x6[6]	8' - 10"	8' - 0"	6' - 10"	0' - 9"	0' - 10"	0' - 11"
	2x8	11' - 8"	10' - 7"	8' - 8"	1' - 5"	1' - 7"	1' - 9"
	2x10	14' - 11"	13' - 0"	10' - 7"	2' - 5"	2' - 7"	2' - 8"
	2x12	17' - 5"	15' - 1"	12' - 4"	3' - 7"	3' - 9"	3' - 1"

1. Assumes 40 psf live load, 10 psf dead load, No. 2 stress grade, and wet service conditions.
2. Assumes L/360 deflection.
3. Maximum allowable overhang cannot exceed L/4 or ¾ of actual main span. Assumes, cantilever length/180 deflection with 220 lb point load (See Figure 1A and Figure 2).
4. Incising assumed for Douglas fir-larch, hem-fir, and spruce-pine-fir.
5. Design values based on northern species with no incising assumed.
6. Ledger shall be a minimum of 2x8 nominal. Where guards are required, outside joists and rim joists shall be a minimum of 2x8 nominal.
7. Joist length prescriptively limited to 18'-0" for footing design.

Figure 3. DCA 6 now limits overhang based on maximum joist span, which should provide for more design flexibility and longer spans than previously allowed.

Cantilevers (or Overhangs)

The new DCA 6 has revamped the manner in which the allowable joist span and overhang interact (**Figure 3**). As the overhang is increased, the maximum span is typically decreased to account for the extra loads. The AWC recognized that this phenomenon creates real headaches for a prescriptive design approach, and decided to present the limitations in a different way in the new edition.

In simple terms, previous editions limited span based on maximum overhang, whereas the new edition limits overhang based on maximum span. Previously, the joist span table was divided in two: joist spans with overhangs and joist spans without overhangs. Joists were allowed to overhang up to one-fourth a reduced

Figure 23. Lateral Load Device with Joists Perpendicular to Deck Joists.

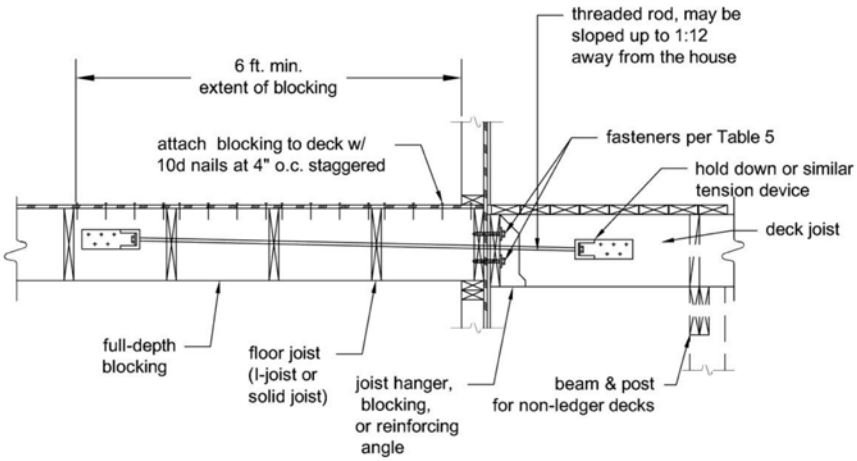

Figure 4. When floor joists are perpendicular to deck joists, the threaded rod connection between the tension devices must now extend at least 6 feet into the floor cavity, as shown in this illustration from the new DCA 6.

backspan. However, even a slight overhang, perhaps 6 inches, would trigger a significant reduction in allowable span.

The new presentation is meant to be more flexible and better apply to the actual loads of each design. Only one maximum span is provided, and the other half of the table provides the maximum overhang for each condition. Note that it's not always one-fourth the backspan; and though there's still a footnote limiting overhangs to one-fourth the backspan, it's secondary to the maximum allowable overhang for specific conditions.

Hollow Masonry

The 2009 DCA 6 included a figure specific to connecting a ledger to hollow masonry that required the cells at anchor locations to be filled with grout or concrete. Because the detail works only for new construction, the AWC eliminated the figure; however, the option remains as a note in the solid-masonry figure.

Hold-Down Tension Devices

The 2012 IRC clarified that decks must resist lateral loads, and that the detail in figure R507.2.3 is a permitted—though not required—option. Researchers at Washington State University continue to examine the role of hold-down tension devices and the lateral load path on decks as a whole; their findings could eventually lead to changes in the currently permitted method. In the meantime, the AWC uses the IRC's prescriptive approach, which requires at least two hold-down tension devices for all decks.

Expanding on the IRC detail, DCA 6 offers methods for installing hold-downs to various floor configurations. New figures provide options for connections to house floors that are built with engineered I-joists and solid joists in both parallel and perpendicular orientations (**Figure 4**). When floor joists are parallel to deck joists, connections must be made to a 3-foot-long 2x6 attached to the I-joist web with 16 clinched nails. When deck joists are perpendicular to interior I-joists, blocking must be installed 6 feet into the floor and connected to the sheathing 19 times. Similar to details produced by the Wood I-Joist Manufacturers Association for new construction, these connections won't be easy to install in existing construction where there is finished space below the interior floor. The IRC load target of 1,500 lb. in a concentrated location (nearly the curb weight of a new Smart car) is quite a load to design for, so the connection details are intended to distribute the load across the entire floor diaphragm as opposed to on a single joist.

Also new to the 2012 edition is an allowance for the threaded rod to slope up to 1:12 away from the house.

Aspect Ratio

Regardless of how many hold-down tension devices are installed on a deck, there's another lateral load issue that is not addressed in the IRC: Without braced walls and floor diaphragms, what keeps a deck from swaying?

The AWC analyzed lateral loads that act over a deck surface and included them in its design assumptions for knee braces and corner post height. Since center posts are not designed for the added lateral force applied by knee braces, bracing can be installed only at corner posts. But the ratio of a deck's length to its width, or its aspect ratio, also affects overall lateral loads—much like a longer wrench will place more force on a bolt. Therefore, DCA 6 sets a limit: The aspect ratio must be no more than 1 to 1; that is, a deck cannot extend perpendicularly from the ledger more than the length of the ledger. Commentary for the document, anticipated by the end of 2014, will allow for a 1:1.5 ratio when angled decking is installed. ❖

Glenn Mathewson is a building inspector in Westminster, Colo., and a private code educator and consultant. *Tables and illustrations are reproduced with permission of the American Wood Council, Leesburg, Va.*