

STRUCTURE

Insight on engineering and codes

Sizing Posts

by Glenn Mathewson

Ledger bolting, joist hangers, joist and beam spans, and post-to-beam connections all get analyzed and scrutinized by the contractor and the inspector, but the support posts seem to be ignored. How often, in the context of the deck's height, are you questioned about what dimension the posts supporting the deck will be? In my experience, almost never.

Many contractors and deck-construction guides, such as the popular DCA 6-09 from the American Wood Council, have simply defaulted to using 6x6 posts in all applications, but many other builders and how-to guides rarely use anything other than a 4x4. How do you know which to use?

From what I have found by running numbers from the National Design Specification for Wood Construction (NDS) — on which the wood-construction portions of the International Residential Code (IRC) are based — and comparing those with data from other, older sources, it's clear that 6x6s are adequate for all but the most extreme decks, and 4x4s are often acceptable. Given that most decks are less than 12 feet tall or so, 6x6 posts can support the loads from nearly any typical deck framed with standard dimensional lumber, as

the maximum spans of the joists and beams limit the area and the load any single post must support. The only real question is when a 4x4 will not be strong enough.

As a post gets taller, the load it can support gets smaller. To better understand the dynamics of post cross-section and height, consider this analogy. With higher decks, I build the frame on temporary 2x4 posts so I can plumb down to find the exact pier locations. If I don't beef up those 2x4 braces before loading the decking on the frame, the posts will bow under the load. On a deck that's lower to the ground, the 2x4 braces will be shorter and won't bow as much, something most deck builders understand intuitively.

This is the same concern with 4x4 posts (or in the extreme, any post). With enough height and load, the 4x4 cannot resist bending. Wood species also plays a role in the limitations; just as joists can span farther if they are made of southern pine rather than cedar, the same is true for posts.

Posts in the IRC

So why is the IRC silent in regard to this common structural component? The answer is simple. As stated in section R301.1.2, the prescriptive structural provisions of the IRC are based only on platform and balloon framing, both of which rely on walls to transmit vertical loads to the foundation. The IRC says little about posts except to provide requirements for restraint at their tops and bottoms.

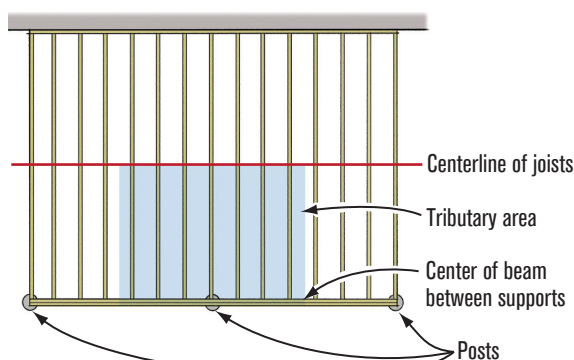
The difficulty in providing structural limitations for posts stems from the fact that you need to calculate the tributary load from the deck on each post. While many tables in the IRC provide structural limitations for members such as beams and joists, they are all based on span distances, not tributary area.

The tributary area is the portion of a deck that's supported by a single post. To calculate it for a particular post, imagine a plan view of the deck (see illustration, left). Draw a line through the mid-span of the joists. Then find the mid-span of the beam that the post supports, and extend lines from there back to the line at the joist mid-span. Find the area within the lines. To calculate the design load for the post, multiply the tributary area by the combined live and dead loads. Though this isn't difficult, it's beyond the methodology in the IRC.

Note that a center post in a long beam carries twice the load as one at the end of the beam. This could result in different

Calculating Tributary Area

The tributary area supported by a post is half the length of the beam on either side of the post multiplied by half the joist length to the next support, such as the ledger on the house or another beam, plus the entire distance the joists cantilever past the beam.



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minimum sizes for posts and foundations. For aesthetic reasons, most deck builders size them all based on the worst-case loading.

Determining Post Size

When the IRC leaves us hanging, we can often find an alternative rope to climb. In this case, though, I couldn't find a current source with a table that shows allowable tributary areas for various sizes and wood species of posts. However, I did find a table developed by the American Forest & Paper Association (AF&PA) and reprinted in a book titled *Wood Decks: Materials, Construction, and Finishing* that was published in 1996 by the Forest Products Society. The table provides maximum tributary areas that can be supported by a post based on species, length, and cross section.

The AF&PA is the same association that recently published the DCA 6, which makes me wonder why that document mentions only 6x6s (and not 4x4s) for posts. The 2005 NDS did include a revised formula for calculating a post's limitations, but nothing so drastic that 4x4s would suddenly become insufficient across the spectrum. According to the old AF&PA table, a 4-foot Douglas fir 4x4 post can support 256 square feet of deck. Using the 2005 NDS, I calculated that the same post can support 231 square feet, so it would seem there's no problem using 4x4s to support, say, an average-sized intermediate stair landing.

You could buy a copy of the NDS and learn how to calculate every post. However, most jurisdictions likely require an engineer to perform calculations like these. Some jurisdictions do allow the use of structural-design soft-

ware that's based on the 2005 NDS, such as StruCalc (strucalc.com). But I'd suggest that instead you establish some general boundaries for what posts you are comfortable using. As a building inspector, I've got "sniff test" values that I use to determine if something needs more consideration.

As I said before, the span limitations of the joists and beams limit the loading on a post. For a deck framed from 2x10s, I'd assume maximum spans of about 14 feet for joists and 10 feet for beams. This generally yields a maximum tributary area of about 70 square feet; I wouldn't blink at the use of 4x4 posts up to 8 feet in length. For taller decks with 2x10 framing, I might question 4x4 posts. Using the same methodology with 2x12 framing, I'd allow 4x4 posts at heights of about 4 feet for southern pine or Douglas fir before asking questions. Of course, that assumes the joist and beam sizes were based on maximum spans, not overbuilding. If 6x6 posts were used, I doubt I'd raise an eyebrow at any deck lower than 16 feet.

Beyond these heights, I'd likely request engineering, and steel posts would probably be the better choice. In fact, my concern probably wouldn't be that 6x6 posts would buckle, but rather that's a pretty tall deck to not have been engineered, period.

In conclusion, 4x4s are indeed a sufficient size post to use for many, many deck loading conditions. But if there is any doubt, the additional cost to use 6x6s instead is small compared with the total cost of a deck. ♦

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