Not a Replacement for Lateral Load Anchors

Our team at Washington State University has been studying the effects of different types of lateral loads on decks (see "Measuring Lateral Loads on Decks" at deckmagazine.com/structure/measuring-lateral-loads-on-decks_o.aspx). Some people have misinterpreted our research, suggesting it indicates that the tension-tie detail in the IRC is unnecessary. But while our testing shows that a deck ledger that is properly fastened to the house framing is quite strong, we also found that the deck joist-to-hanger connection is a potentially weak link. In fact, nailed joist hangers alone simply aren't adequate for carrying tension forces resulting from lateral loads.

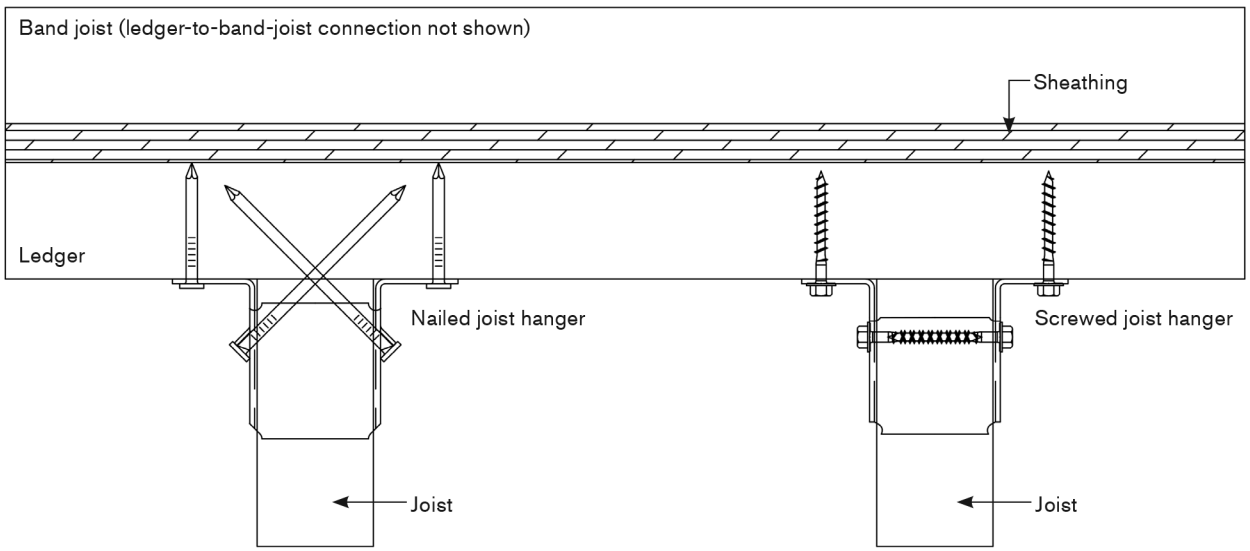
When decks are laterally loaded, the entire load path from the deck flooring to the house must be considered. Wind, seismic events, and even traction loads on the decking from occupants create lateral loads that are transferred to the joists, causing them to pull or push laterally against the deck ledger. In our initial testing, we were surprised by the relatively low loads that were needed to pull joists away from the ledger when typical deck-joist hangers were used.

The problem was two-fold: Smooth nails easily pull out of (or withdraw from) the deck ledger, and some joist hangers use a toenail-type of attachment to the joist that does not "grab" enough of the joist, resulting in tear-out. And when a deck ledger goes through moisture cycling in service, the withdrawal capacity of a smooth nail is reduced even further, to 25% of the tabulated value in the *National Design Specification for Wood Construction* (NDS Table 10.3.3).

For these reasons, we reinforced the joist-to-ledger weak link by using hanger-manufacturer-approved screws in place of nails, and by selecting a hanger model that accommodated perpendicular joist fastening (see illustration, below). It's important to note that the hangers used in our study were non-typical for deck construction, because they didn't have the level of corrosion protection required by the code for use with preservative-treated wood. The only deck-joist hangers (with appropriate galvanizing) available to us used the toenail-type attachment that we had found to be inadequate.

Our testing shows that using screws instead of nails creates a significantly stronger joist-to-ledger connection when joists are loaded in withdrawal; however, a number of variables remain to be investigated before broad conclusions can be made. For example, there are different types of joist hangers: those with a fastener pattern entirely perpendicular to the member face and those with toenail-type fastening. Size is also important. The 2x10 hangers we tested were fastened to the ledger with 10 fasteners and to the joist with six fasteners, while similar 2x6 or 2x8 hangers would have six fasteners into the ledger and four fasteners into the joist. Would hangers with fewer fasteners still adequately transfer withdrawal loads? And as hardware

Nailed vs. Screwed Joist Hangers



Joist hangers with toenailing (left) are commonly used in deck construction, but joist hangers with a perpendicular fastener pattern that have been screwed to the framing (right) produce a stronger joist-to-ledger connection.

manufacturers are quick to point out, hangers are rated for vertical—not lateral—loads. This raises the question of whether or not a hanger's vertical capacity is affected by being subjected to a lateral load.

We also have yet to analyze the effects of hidden deck-board fasteners, deck-board orientation, deck bracing, and aspect ratios on loads and load paths. With the "weak link" being the deck's joist-to-ledger connection, clearly some sort of hardware (or detail) is needed to carry lateral loads from the deck joists to the house diaphragm. The tension-tie detail in the IRC is one way to accomplish this load path. Our research is continuing in order to find other solutions that are more practical and economical.

Don Bender
Pullman, Wash.

More on Deck Failures

While Kim Katwijk states (in "Another Deck Failure," May/June 2014) that his research shows that fewer than 40 deck collapses occur per year in the United States, my own quick Google search came up with more than 25 million deck-collapse articles. Granted, each incident produces dozens and dozens of stories about it due to the nature of the Web, but experience tells me that I could probably find 40 deck-collapse incidents in the Buffalo, N.Y., area this year alone. In fact, many of them never even make the news.

Based on what I've seen in the field, the vast majority of decks would fail if they were actually loaded to their code-required design capacity. Remember, a 10x10 deck should be capable of carrying 4,000 pounds of people who are dancing and jumping around, and should stand up to at least 90-mph wind loads over and over again. I think the reason that we don't see exponentially more deck failures is that most decks usually experience only 10% to 20% of their design loads.

Unfortunately, I know of many general contractors—who also build decks—and even deck specialists who just do not understand the importance of the details and don't try to learn them. And, sadly, it seems that there are almost as many code officials who do not understand proper deck design and detailing either.

Michael Oliver
Code Enforcement Officer
Town of Tonawanda, N.Y.

Field-Treating PT Pine

Glenn Mathewson points out (in "Decay Resistance and the Code," May/June 2014) that field treatment of cuts and holes in pressure-treated pine with copper naphthenate is not specified in AWPA (American Wood Protection Association) Standard M4. Though that's true, both the Southern Pine Council and the AWPA note that field-treating pressure-treated southern pine is a recommended best practice. And my experience with several pressure-treated decks built between 2004 and 2009 that have shown signs of decay has convinced me that field treatment is a good idea.

In most cases, the rot occurs where cut ends are in contact with other wood, such as the butt joints of built-up beams, stair-stringer tread cuts, and joist ends at the ledger and rim joist. I've even found rot in ground-contact-treated 4x4 posts, where beams are resting on top of the posts.

The challenge in my area is finding copper naphthenate. Since cuts in treated wood are rarely field-treated on the East Coast, there's little demand for the solution, and most lumberyards don't stock it.

Mike Guertin
East Greenwich, R.I.

Good Roof, Bad Stairs

In Bobby Parks' article ("Planning Porch Roofs," May/June 2014), there is a set of stairs with a bottom riser that is roughly one-third the height of the other risers on the stairs. Stair stringers are something that anyone of any skill level in the trade should be able to calculate with their eyes closed.

Ross Rickard
Grover Beach, Calif.

According to the author, the stairs were originally built to code—which requires a difference of no more than 3/8 inch between the tallest and lowest risers in a set of stairs—and attached to a 3-foot by 4-foot concrete landing pad. Later, the homeowners hired a different contractor to build a concrete patio, and apparently this contractor poured the new patio over the existing pad, rather than breaking it out so that the new patio would be at the same elevation as the old pad. This not only buried the bottom step (and the bases of the columns supporting the porch) in new concrete, but resulted in the short riser shown in the photo. —The Editor ❖