Post-Connection Demos at DeckExpo

by Andy Engel

Hands-on clinics on guardrail attachment at this year's DeckExpo showcased research first published in *JLC* — and raised a number of questions from show attendees. Some were left thinking that these new techniques were overkill, particularly since the load testing, as done in the *JLC* article and demonstrated by one of the exhibitors, DeckLok, was applied to a single post that wasn't installed as part of a balustrade. Another worry was that the techniques would enter the code as prescriptive measures, driving up costs for legitimate contractors, and making it harder to compete with fly-by-nighters and well-meaning but undereducated do-it-yourselfers. This issue's *Question & Answer* features these questions and others about guardrail attachment that I heard on the show floor — along with my responses.

Why Build for a 500-Pound Sideload?

Q At DeckExpo, there were several demonstrations showing how to attach a 4x4 guardrail post to withstand a 500-pound sideload, which was claimed to be the code requirement. But the 2006 IRC only calls out a 200-pound load from any direction. What gives?

A If you have ever taken a physics class, you may remember that force = mass x acceleration. Get a 200-pound person moving, and he can develop dynamic loads well in excess of his weight. As someone whose weight exceeds 200 pounds, and who has

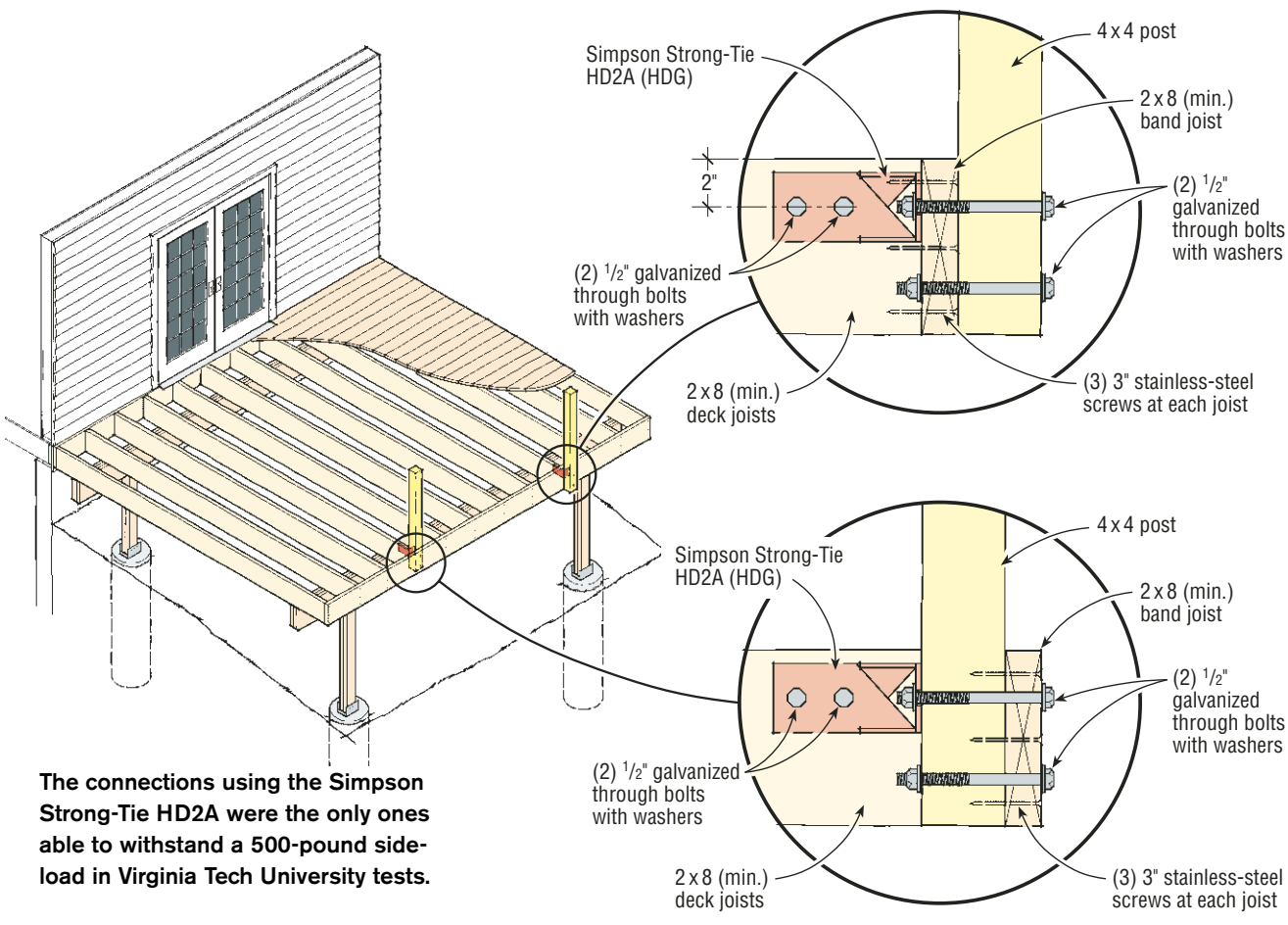
occasionally become, shall we say, clumsy while at a party on someone's deck, that 500-pound load requirement starts to seem meaningful.

So, while it's true that the IRC requires only that a guardrail withstand "a (200-pound) single concentrated load applied in any direction at any point along the top," accepted engineering practice applies a safety factor — as is explained in the following passage from "Strong Rail-Post Connections for Wooden Decks" in the February 2005 edition of *JLC*:

... when a structural assembly is tested in a lab, the load gets multiplied by an appropriate safety factor, which is intended to allow for the uncertainties of field installation and the fact that the connections may degrade in service from repeated loading and weathering (but not rot). We used a safety factor of 2.5, a number that has been in the model codes for decades for testing structural assemblies. So, for our testing, we needed to apply a 500-pound load to determine whether the post connection could be considered "code conforming."

That article, written by Virginia Tech University, Blacksburg, researchers Joseph Loferski and Frank Woeste, P.E., with Dustin Albright and Ricky Caudill, seems to be the basis for the DeckExpo demonstrations. In essence, no standard bolted or blocked post connection was able to withstand the 500-pound force applied to the top of a 4x4 southern pine post 36 inches above the level of the deck. The only attachment that the authors

Post Connections That Passed



The connections using the Simpson Strong-Tie HD2A were the only ones able to withstand a 500-pound side-load in Virginia Tech University tests.

found to work is shown in the illustration on page 36.

The Simpson HD2A connector (800/999-5099, www.strongtie.com) referenced in the drawing isn't the only connector that might fulfill this requirement. DeckLok brackets (866/617-3325, www.deck-lok.com) and USP TDX2 connectors (800/328-5934, www.uspconnectors.com) would also seem capable of providing the necessary beef, although they were not tested for the *JLC* article.

Adding such a bracket, including the requisite two additional bolts, would increase the material cost per post by $10 to $15. The additional labor is minimal, and the necessary up-charge is the sort of value-added item that a savvy deck builder can point to in his sales pitch to set himself apart from his competitors. Beyond that, what's the value of being able to sleep at night, knowing you've done your best to increase your customers' safety and reduce your liability?

Notching Posts

Q **The DeckExpo demonstrations also advised against notching posts, but I see that done all the time. What's wrong with notching posts?**

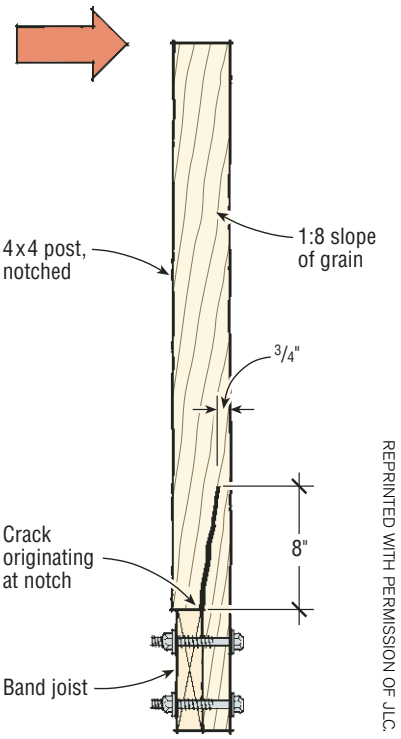
A This, too, was addressed in the *JLC* article referenced above:

Several of the 4x4 posts we tested were notched around the band joist — a common detail in the field. While you might expect the notch to be the weak point in the connection, in fact none of the test posts failed at the notch. Even so, notching should be avoided, because it does substantially reduce the strength of the post. Here's why:

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.

Cracks will typically start at the corner of a notch. As a crack develops, a steep "slope of grain" can critically reduce the section of the post, as the drawing shows.



Lab Testing of Single Posts

Q **Posts are always installed as part of a balustrade system, where the railing, particularly a cap railing that runs over the tops of the posts, ties posts together. Yet the tests I saw done at DeckExpo showed single posts being subjected to the 500-pound load. That's just not realistic.**

A On the surface, that's a fair criticism. However, there are several circumstances where posts installed in a balustrade do not benefit from such support. One would be an end post that's not further supported by being bolted to the house. Another would be a post upon which the cap rail is spliced, such as at a corner. And of course, not all balustrades have a cap rail.

No matter how it's attached, there is no practical way for a balustrade to be field tested. Even pushing on the rail doesn't prove much, as it's known in the safety industry that a 200-pound person can't easily exert a sideways-directed static load of even 100 pounds (dynamic loads are a different issue). And is it really a good idea to ask building inspectors to go around hip checking questionable rails?

So, lacking a way to verify the strength and code compliance of any field-installed railing system, simple prudence supports using a lab-tested approach to installing posts. And what's the cost? A typical deck might have eight or 10 posts — we're talking about less than $200. ❖