

Connecting Girders to Deck Ledgers

by Paul Bennett

The difference between a beam and a girder is not always clear and is somewhat dependent on the type of construction. For instance, the terms are often interchanged in wood-frame construction, but have very different meanings in bridge construction. In wood construction, we often think of a girder as a member that receives several large point loads (such as a girder truss) as opposed to a beam that receives smaller loads (floor beam). However, for the purpose of this article we can assume the terms are interchangeable.

There's not a lot of guidance about girders in either the IRC or DCA 06, but they're often used in deck and porch framing. To provide better drainage, for example, many deck builders frame porch floors so that the T&G flooring can run perpendicular to the house. Typically, this means that joists are hung from double 2-by framing—or girders—rather than from the deck ledger and an opposing beam, so that they're parallel to the wall. Technically, though, the IRC doesn't permit girders supporting deck joists to be hung from deck ledgers or rim joists (see 2012 IRC, R507.2.2). At what point does a girder create enough of a point load that it becomes a problem and is disqualified by your code official from being attached to a deck ledger? *continued on page 17*

A doubled 2-by beam—or girder—attached to a deck ledger as shown here creates a point load that can cause the ledger to rotate outward and buckle. Even when the girder is hung directly from the rim joist, lateral-torsional buckling is possible if loads are high. Before considering this connection detail, consult with your inspector or an engineer.

Lateral-Torsional Buckling

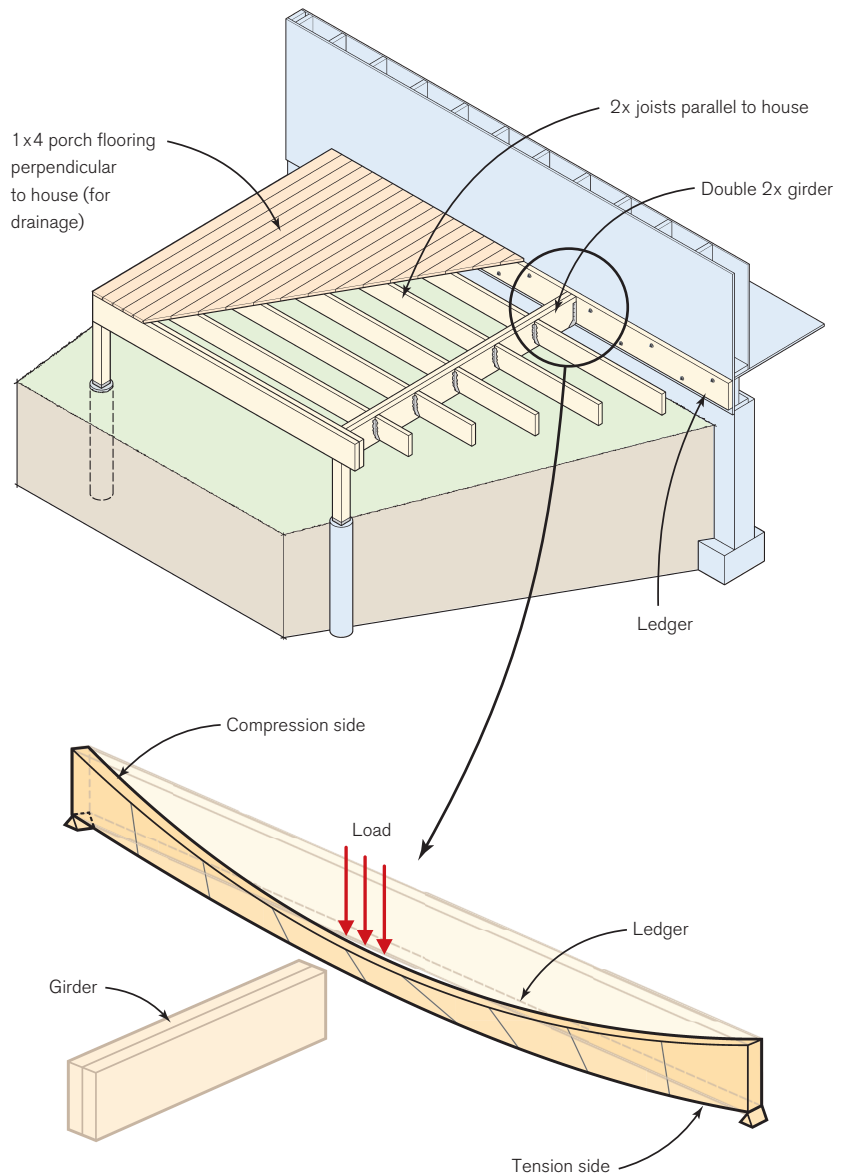


ILLUSTRATION BY TIM HEALEY

continued from page 14

The design loads on deck ledgers from joists are typically in the neighborhood of a couple hundred pounds, but the design load from a girder can easily be in the thousands of pounds. While it might be intuitive to the contractor to upsize the hanger for a girder, it may not be so obvious that the large increase in a point load on the ledger could cause a failure in the ledger; hence the subject code provisions. In the case of a deck, some inspectors may allow the contractor to hang doubled joists directly from the rim joist without requiring the stamp of an engineer, but as the load gets larger, the inspector may question the adequacy of the connection to the rim joist. For larger decks and larger loads, both the ledger and girder support may need to be engineered.

A Design Problem

From a more general engineering standpoint, the main concern with attaching a beam or girder to a ledger or a rim joist is the potential for lateral torsional buckling. This is where a long, slender beam with little to no lateral support twists under load, sometimes under its own weight. Beam rotation is actually quite common in cold-formed steel framing, and somewhat common in hot-rolled steel. In fact, our firm once investigated a case where this failure mode occurred on a grand scale during construction of a steel box girder for a bridge.

We don't always think about beam rotation as a possible failure mode in wood construction. Wood framing is relatively stiff along its long axis, though as any contractor who has installed them knows, long I-joists are very unstable prior to floor sheathing installation because of their tendency to roll outward.

Similarly, a rim joist—a long, tall, and narrow 1 1/4-inch by 14-inch single-ply LSL girder—with a notable point load would also seem to be prone to rotation. But inspectors and engineers rarely question this failure mode, presumably

The design load from a girder can easily be thousands of pounds.

because the top and bottom plates it's sandwiched between are helping to brace the beam.

The type of rim joist—dimensional vs. engineered—is also an issue. If the rim joist is engineered, as is often the case these days, I would always call the manufacturer and ask for its recommendations. I've noticed, for example, that some engineered-lumber manufacturers specify web-stiffener blocking when the joists are parallel to the rim joist, regardless of a deck attachment.

No Prescriptive Solution

In the case of a deck, some inspectors may simply require a tighter ledger bolting schedule where girder loads are minimal, such as where joists have been doubled to support a stair header. When girders are supporting larger loads—such as the joists for porch flooring in the example above—he may allow you to omit the ledger and hang the doubled joists directly from the band joist, without requiring that the connection be designed by an engineer. For very large loads, girder support may need to be engineered.

As always, factors such as the type of sheathing and cladding (stucco, EIFS, siding, and the like) should also be considered to ensure they do not interfere with the load transfer to the rim joist.

Of course, for some projects, an engineering analysis may be required. If the situation is relatively straightforward and the rim joist is an engineered material, a call to the manufacturer might just give the green light to please the inspector. ♦

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