Working With the IRC Ledger Bolting Table

by Glenn Mathewson

While some builders may resent the limitations imposed by building codes, many code provisions actually simplify design by providing pre-engineered structural criteria that assure a structure is sound while saving the designer the cost of an engineer. This is true of the ledger bolting table in the 2009 IRC: It does limit builders by prohibiting some very common ways to handle concentrated loads, but it also gives pre-engineered criteria based on loading to assure a sound ledger connection.

Table R502.2.2.1 specifies bolt sizes and spacing for attaching ledgers to the house (see "Common Code Violations," January/February 2008; deckmagazine.com). Before it was added to the IRC, a lot of deck builders and building inspectors just guessed. The table is based solely on the length of the joists, which determines the tributary area of the load, and the maximum loading of 50 pounds per square foot. (It doesn't consider the size or spacing of the joists, as those factors don't affect the load on the ledger connection.) For joist spans that exceed those in the table, the engineering in the table is insufficient.

The additional loads the double joist in this photo carries are not assumed in the engineering behind the IRC's new ledger bolting table, so this common connection is now prohibited without further engineering.

Section R502.2.2.2 of the 2009 IRC goes on to state that "girders supporting deck joists shall not be supported on deck ledgers or band joists." Call them beams, headers, trimmer joists, or any other term, they are girders and can no longer be attached to the ledger without engineering. Whether carrying a stair landing, a frame around a chimney, joists that wrap around the corner of a house, or a change in joist direction, the same beams we have been attaching to our ledgers for years are out.

To simplify the engineering, the new ledger bolting table is based on uniform joist loading. A beam collects the loading from all the joists it bears, and concentrates this tributary load at both bearing ends of the beam, oftentimes unequally. Without a specific analysis of the loads, it's impossible to know whether they exceed the limitations of the ledger bolting table. While the additional load from a small stair landing might not exceed the bolting table's parameters, a beam supporting multiple joists probably would. For simplicity, they were all prohibited.

Decks can still be designed under the IRC with concentrated loads that occur at the house, but the loads can't be borne at the ledger when you use the IRC ledger bolting table as your design criteria. Concentrated loads must be supported by direct bearing. This can be achieved by cutting a slot through the exterior sheathing and band joist and supporting the beam on the top of an interior bearing surface such as a wall plate or foundation plate. This approach to support the concentrated vertical load at the ledger is completely code-compliant and would not require engineering. It would, however, require careful flashing to keep out water.

Another option is to install an additional post below the beam near the house, but there are caveats to this installation. Adding a post may not fit with the aesthetics of the design — particularly if the deck is elevated and the post would interfere with a view. And if located in a backfill zone, the footing for the post will have to extend to the depth of the home's foundation.

An "alternative" to the IRC could be submitted for approval. This could be expensive site-specific engineering or pre-engineered provisions from other sources.

For example, the American Forest and Paper Association (AF&PA) has published an updated version of its Design Criteria for Acceptance #6 (DCA 6), *Prescriptive Residential Wood Deck Construction Guide,* based on the 2009 IRC (free at awc.org/publications/dca/dca6/dca6-09.pdf). Pages 19 and 20 provide guidance to

address concentrated loads at ledgers that may be approved by a local building official.

The general concept is to *bolt* a hanger through the ledger and into the band joist. DCA 6 provides loading limitations for beams and joists. However, I found that Simpson Strong-Tie, for instance, has no product that meets the exact hanger requirements in the AF&PA detail unless Simpson's SDS wood screw could be used in lieu of bolts. The AF&PA says the fastener type is not its concern, just that the loads provided in Table 7 of its document are transferred through the ledger to the band joist. As long as the concentrated load is applied directly to a fully supported band joist, an appropriate hanger is selected, and the loading limitations in the DCA 6 are followed, approval should not be a problem.

While this new prohibition in the IRC may seem like a thorn in your side, it was necessary for the inclusion of the ledger bolting table and is a big step forward in simplifying the construction of decks. It's my hope that educated inspectors will evaluate each deck design individually, consider the actually loading, and become comfortable approving installations with minimal concentrated loads. For example, the typical installation of a small stair landing partially supported by a beam would almost always pass my inspection (but I likely won't be your inspector). An easy calculation of the actual loading often reveals that the additional loads are minimal, and following a tighter bolting schedule from the table would suffice (see illustration, right). ❖

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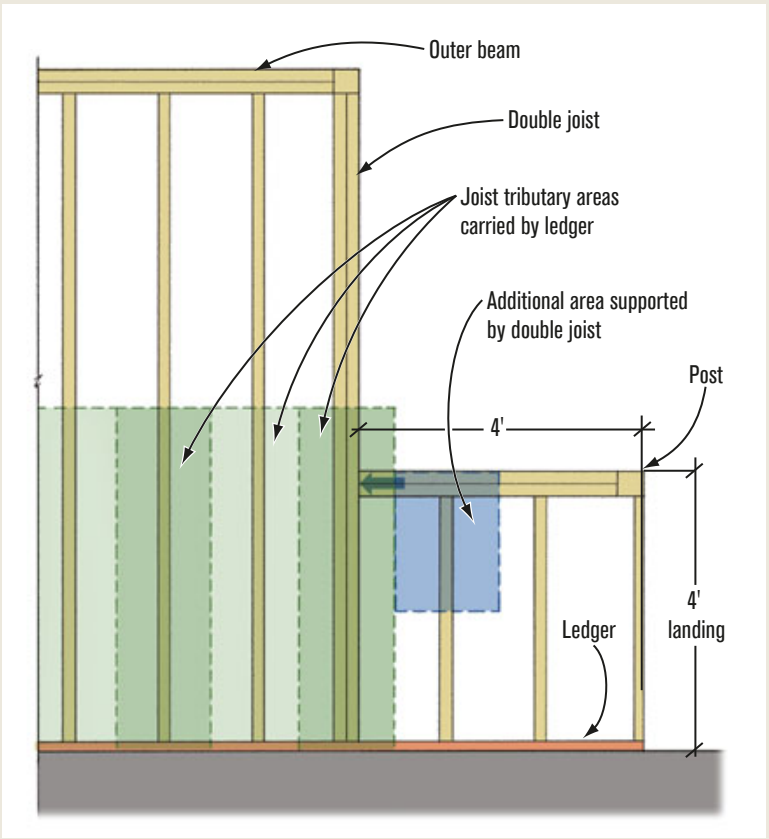
How Much Load Is There, Really?

If the actual loading of a beam is analyzed, it often turns out there is a smaller tributary load than it might seem. In the example here of a 4-foot-square stair landing, only a quarter of its load is supported by the beam, a double joist at the edge of the deck. The other three-quarters of the load is supported by the corner post and the ledger. So, of a 16-square-foot landing, only 4 square feet is supported by the double joist. And of that, 1.33 square feet falls within the expected loading of the joist anyway, so the additional tributary area of that double joist is only 2.67 square feet. That equates to about the same loading as 2 additional feet of joist length.



It's a little more complicated than that, though. For the purpose of figuring ledger bolting, joist loads are assumed to be split evenly between the outer beam and the ledger. That's true with normal, uniform loading. However, the point load from the landing is assumed to be entirely borne by the ledger side of the double joist, so this load actually is equivalent to 4 additional feet of joist length. If the deck joists are 10 feet long, the bolting schedule for 14-foot-long joists in the IRC Table R502.2.2.1 could be used. You would essentially be engineering the ledger as if it were carrying longer joists, when it's really carrying tributary loads from other joists. Keep in mind that while this may be rough engineering, it's also not rocket science.