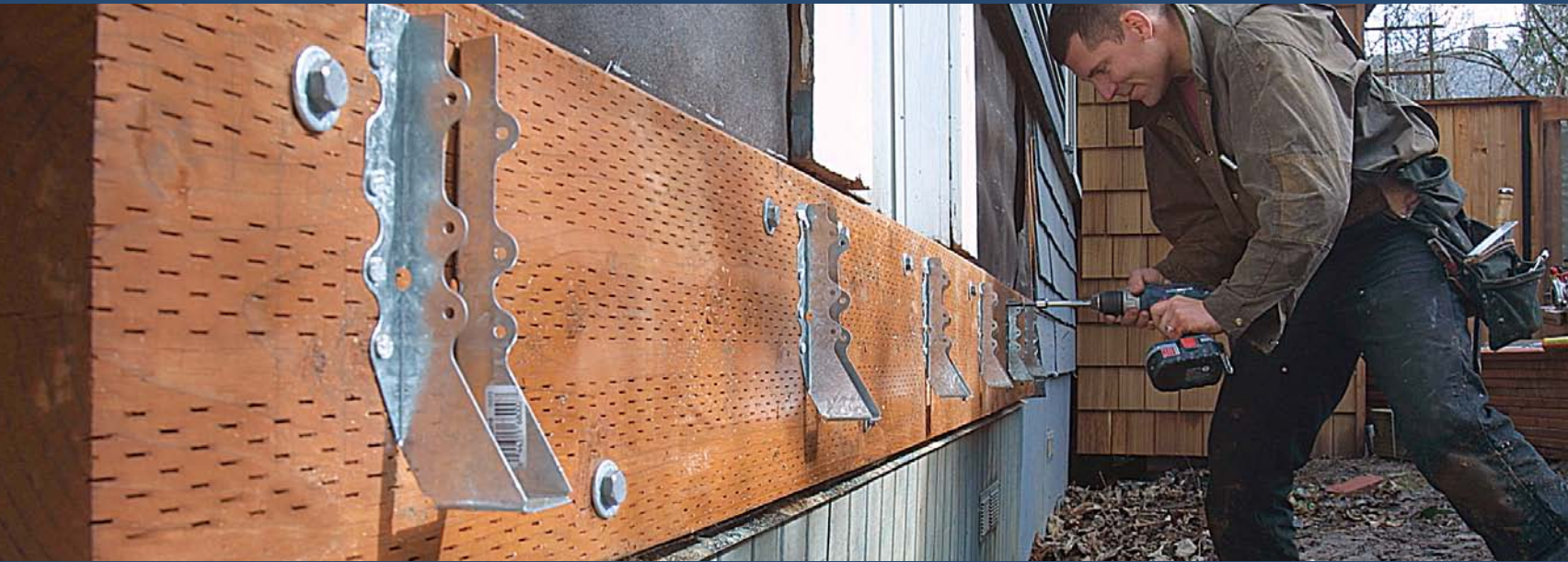


Make Any Deck Ledger Secure



Code updates have made standard ledger attachments safer than ever, but you still need to judge when they can be used

BY MIKE GUERTIN

There are more than 10 critical connections that keep any deck in place and safe. The one that's received the most attention by code officials and deck builders over the past few years is also one that I see done inadequately more often than done well: the ledger-to-house connection. There are two parts to any ledger connection that must be addressed when building a deck: the vertical load and the lateral load. My focus here is on the vertical load. For more information on the lateral load, visit FineHomebuilding.com/extras.

The cause for concern is obvious: An improperly attached ledger can lead to a deck collapse. While the 2012 International Residential Code (IRC) is a minimum construction standard, in the case of deck ledgers it reaches close to the level of best practices for lag-screwing and through-bolting, and it includes a prescriptive fastener table (table R507.2). This is good news—provided you recognize where the prescriptive methods can be used and, more important, where they can't.

When code doesn't work

A prescriptive code is like a cookbook: Follow the recipe, and you end up with a cake. The code *continued on p. 34*

APPLY CODE WHERE YOU CAN

For situations where the ledger is to be attached to a solid-sawn rim joist and there are no intervening complications, the answer is simple: Follow the code. The 2012 IRC, which includes new tables and schedules and upon which the drawing below is based, provides

the most up-to-date standards for attachment. Keep in mind when following the code's fastener schedules that their design load is limited to a total load of 50 psf (pounds per square foot), which does not allow for concentrated loads, such as a hot tub.

Sheathing

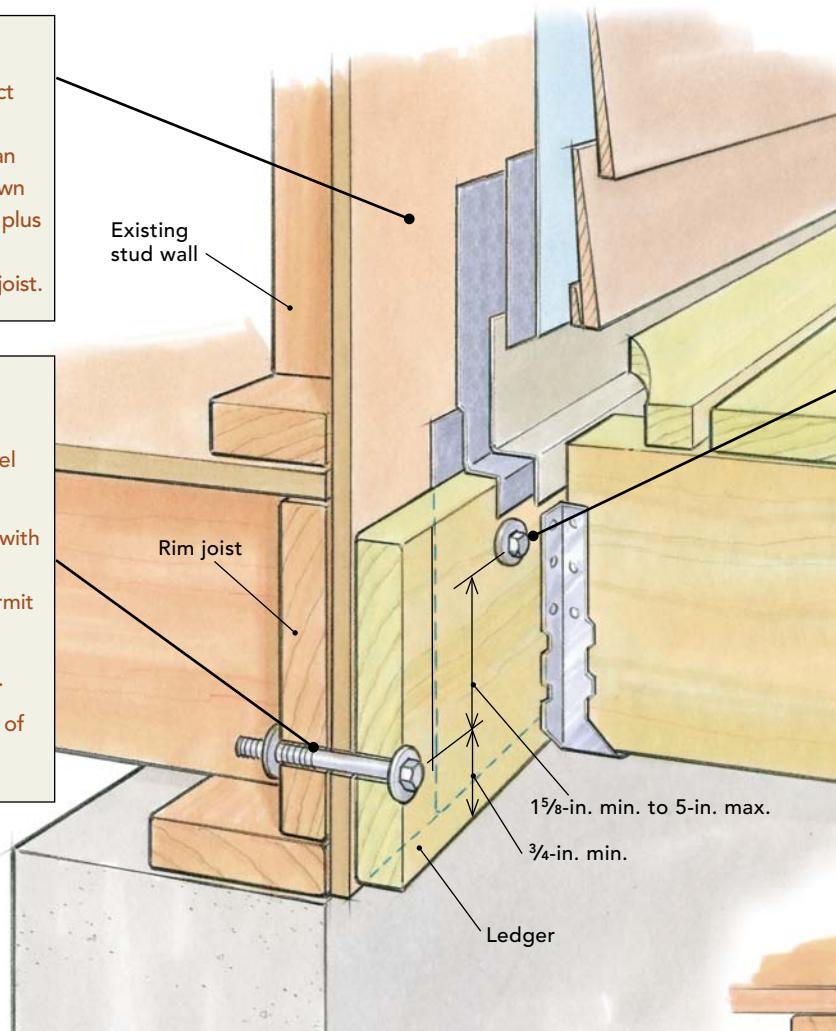
The ledger can be in contact with the rim joist or the sheathing, or if bolted, it can be spaced off 1/2 in., as shown below; however, sheathing plus the space cannot exceed a 1-in. distance from the rim joist.

Fasteners

- Use only hot-dipped galvanized or stainless-steel fasteners.
- Use 1/2-in.-dia. lag screws with washers or 1/2-in. bolts with washers. (Many officials permit only square or hex heads.)
- Don't countersink heads.
- Extend bolts a minimum of 1/2 in. past the nut.

Lags or bolts?

Lag screws have two advantages over through bolts: They're faster to install, and if the ceiling of the floor system inside is finished, you don't need to cut into it to install nuts. However, some jurisdictions where I build require an interior inspection to check screw-penetration distance, so view holes must be cut regardless of which ledger-fastening method I use. In these cases, I generally use through bolts. The IRC table allows almost twice the spacing between bolts as it does for lags, which results in material and labor savings as well as fewer holes to patch.

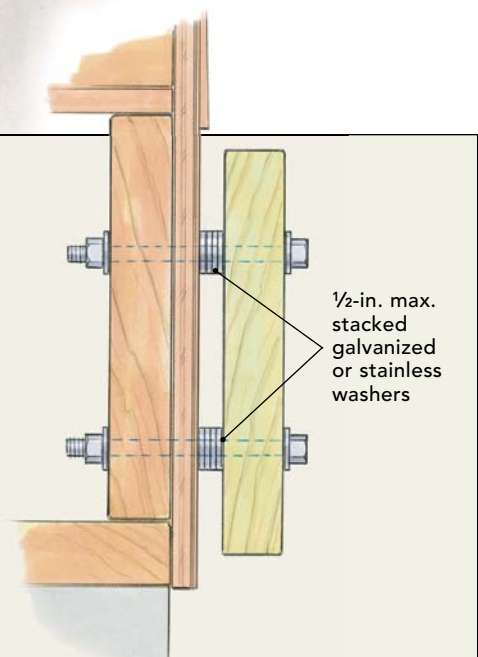


Space or no space?

Spacing the ledger off the wall minimizes moisture damage because water can flow freely between the ledger and the wall flashing. The code permits a 1/2-in. stack of washers as a spacer, or you can use alternatives such as Deck-2-Wall Spacers (www.deck2wallspacer.com; photo below). To ensure that the wall behind the ledger is watertight, I apply a strip of aluminum or PVC coil stock wide enough to cover the top lap on the siding (or foundation) below the ledger and to extend at least 4 in. above the top of the ledger to lap under the siding above. Because the code limits the distance between the back of the ledger and the face of the rim joist to 1 in., you need to reduce the space between the ledger and the sheathing if the sheathing is thicker than 1/2 in. Once the distance from rim joist to ledger exceeds 1 in., the code table doesn't apply, and you'll need an engineered ledger attachment or an approved alternative system (see p. 34).



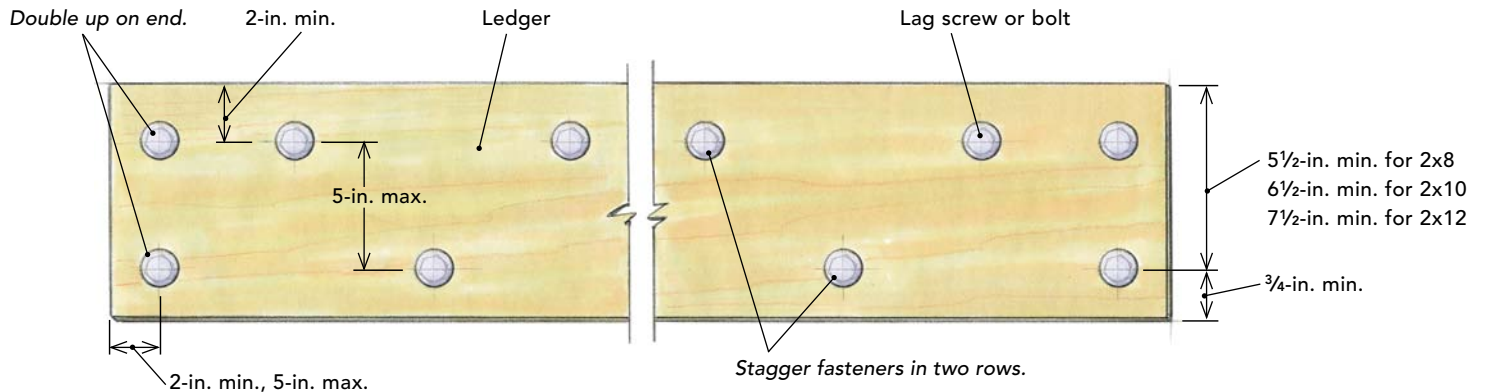
Deck-2-Wall Spacer



NEW CODE, BEST PRACTICES GOVERN FASTENING DETAILS

New to the 2012 code is a fastener-placement table (table 507.2.1) and corresponding figure (reproduced below) that guide where to position fasteners along a ledger. This spacing

is based on the joist span measured between the ledger and the supporting beam in 2-ft. increments, from 6 ft. to 18 ft., as well as the type of fastener (lag screw or through bolt) used.



Fastener spacing

The IRC spacing guide follows two principles. The first is to stagger the fasteners in two lines along the length of the ledger. The second is to locate those fastener lines so that the fasteners penetrate the ledger and the rim joist with enough

“meat” left above or below, depending on the load point, so that they hold fast. Not only do you have to think about where those two fastener lines occur on the ledger board, but you also have to consider the rim joist. You don’t want fasteners too close to the edge

of a board, or the wood can split under load. Of course, there’s bound to be conflict with a joist and/or a hanger. Because countersinking isn’t an option, you’ll have to move the fastener. It’s OK to shift a bolt or screw a couple of inches to the left or right. Just keep the

other fasteners on the same pattern from the starting point, and install the total number needed for the overall ledger length. It’s also a good idea to double up the fasteners at the ends and joints in ledger boards. This keeps the ledger flat to the wall at the ends.

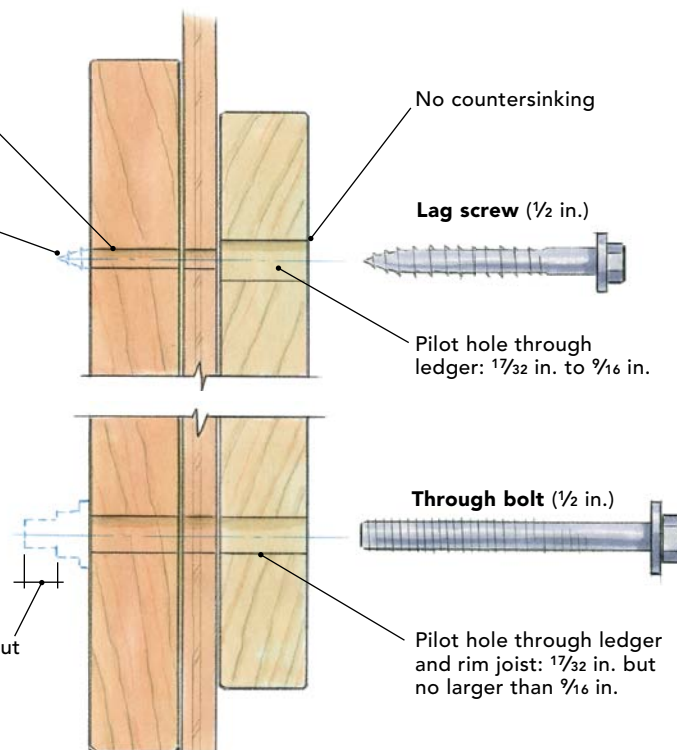
Pilot holes ($1\frac{3}{64}$ in. to $1\frac{1}{32}$ in.) are drilled through the rim board and wall sheathing. The author bores them at $\frac{5}{16}$ in. to avoid splitting the rim joist and to maintain thread holding power.

Lag screw should penetrate rim board by at least $\frac{1}{2}$ in.

Pilot holes

The code doesn’t define the pilot holes for the fasteners, but here are the best practices and guidelines that I follow, based on the American Wood Council’s *National Design Specification (NDS) for Wood Construction*.

Minimum $\frac{1}{2}$ -in. extension past nut



ALTERNATIVE FASTENERS RESOLVE ISSUES, COST LESS

Lag screws and bolts aren't the only ways to attach deck ledgers. Alternative systems offer advantages in speed and cost, and they can be used where conventional bolts and lag screws would require additional engineering. Structural screws are the most common alternative, mount faster than hot-dipped

galvanized (HDG) lags, and cost less. Here's a look at some structural screws on the market and their relative cost based on manufacturers' spacing requirements along a 16-ft. ledger for a typical deck (a 12-ft. joist span connected to an SPF rim joist with a 40-psf live load).



HDG LAGS • Cost: 1/2 in. by 4 in., \$2.17 • Spacing: 15 in. on center • Total cost (15 lags with washers): \$32.55

Wide spacing, but higher cost. Lag screws require lead and clearance holes, which take about 30 seconds to bore for each screw. This balances with the extra time it takes to drive the number of structural screws (about twice as many) required for the same ledger. Lags and washers cost up to twice the price of structural screws.

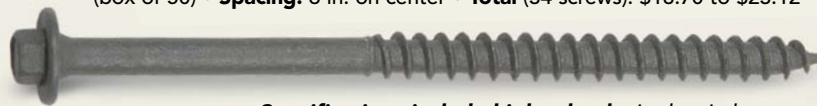
Structural screws mount ledgers fast

Structural screws are smaller in diameter than lag screws and don't require lead or clearance holes through the rim joist or ledger. They zip right in with an impact driver or drill-driver and have a coating that is compatible with ACQ and other wood treatments.

Several manufacturers publish screw-spacing tables that are similar to the IRC fastener table, so it's easy to calculate quantities needed and to plan the layout. Other manufacturers list the technical specs for their screws, so you have to calculate the spacing yourself based on the deck load.

Follow the same best practices when installing structural screws as you would for lag screws: Don't countersink heads, make sure that the screw tips penetrate to the inside of the rim joist, and locate the screws on the ledger and rim joist according to the code figure and to manufacturer requirements.

FASTENMASTER LEDGERLOK www.fastenmaster.com • Cost: 3 5/8 in., 55¢ (box of 250) to 68¢ (box of 50) • Spacing: 6 in. on center • Total (34 screws): \$18.70 to \$23.12



Specifications include higher loads. LedgerLoks come in 3 5/8-in. and 5-in. lengths. A technical bulletin for deck ledgers outlines proper installation procedures, screw-placement requirements, and a fastening-pattern table similar to the IRC table but limited to 14-ft. joist spans. Where the IRC table limits live loads to 40 psf, the LedgerLok table includes rows for 60 psf and 100 psf, useful for regions with heavy snow or with local codes requiring greater live-load limits. LedgerLoks can be used when fastening a ledger to 1-in. or thicker engineered wood (LVL, LSL, PSL).

GRK RSS www.grkfasteners.com • Cost: 5/16 in. by 4 in., 48¢ (coated) to 78¢ (stainless) in boxes of 100 • Spacing: 7 in. on center • Total (30 screws): \$14.40 (coated) to \$23.40 (stainless)



Available in a multitude of sizes. GRK's ledger-board technical bulletin specifies spacing for joist spans up to 14 ft. for the 5/16-in. by 4-in. RSS in both stainless-steel (PHEinox) and coated (Climatek) versions for use with treated lumber. Refer to the "wet-use in-service" tables in the bulletin for deck ledgers. The tables have rows for different wood species and specific gravity and for both 40-psf and 60-psf live loads. RSS screws can be mounted into solid-sawn 2x and engineered rim-board materials provided they are a minimum of 1 1/2 in. thick.

STRONG-DRIVE SDS, SDWH, SDWS SCREWS www.strongtie.com • Cost: 50¢ (coated) to \$1.33 (stainless) in boxes of 50 to 100 • Spacing: 6 in. on center • Total (34 screws): \$17 (coated) to \$45.22 (stainless)



SDS



SDWS

Detailed technical information. SDS ledger screws are 1/4 in. dia. and come in 3 1/2-in., 4 1/2-in., and 5-in. lengths in corrosion-resistant coated steel and stainless steel; the new SDWH and SDWS screws have double coatings and come in lengths of 3 in., 4 in., 6 in., 8 in., and 10 in. The SDWS's flat star-drive head minimizes conflict with joists and hangers, but still presents a problem for hanger nails. Simpson's technical bulletin is detailed, with corresponding code provisions and separate spacing requirements based on the rim-board material and 40-psf and 60-psf live loads. Tech letters for the new screws parallel that of the SDS, making it easy to determine fastener spacing based on joist depth. Pricing is also comparable.

GETTING AROUND OBSTACLES: TWO SYSTEMS

I've had success with two unique deck-ledger mounting systems for new and retrofit installations: the Maine Deck Bracket and Attach-A-Deck. Both are designed to space the ledger off the wall by several inches—enough space for the siding to be run on the wall behind the ledger position. The extra space

makes it possible to install a ledger over a thick nonstructural cladding such as synthetic stone or stucco, and even over a thick layer of rigid foam. Each system is unique and has specific installation details. For more on working with these attachment systems, visit FineHomebuilding.com/extras.

MAINE DECK BRACKET www.deckbracket.com

The Maine Deck Bracket is a thick aluminum I-beam section that bolts to the rim joist and the deck ledger. The 3½-in.-deep web stands the deck ledger off the building so that the exterior cladding can be detailed between the ledger and the building for maximum weather resistance.

To achieve the tested capacity of 1000 lb. per bracket (1½-in. rim stock) or 1160 lb. (3-in. rim stock), the bracket's rim-joist flange must be bolted directly to the rim itself without any plywood or OSB sheathing between.

The system is simple to use on new construction when the brackets can be through-bolted to the rim joist during the framing process. They also can be retrofitted to existing houses by stripping back the siding and cutting the sheathing to expose the rim joist.

The extradeep space provided by the Maine Deck Bracket works great for homes clad with stucco, synthetic stone, or EIFS, where regular deck-ledger flashing becomes complicated by the thickness of the cladding. The bracket works with wood, fiber-cement, or vinyl siding as well. I've used these brackets on homes retrofitted with up to 3 in. of rigid-foam insulation and still had ½ in. of airspace behind the ledger. The Maine Deck Bracket ICC-ES Report does not list engineered lumber, so you're limited to using them on houses with dimensional rim joists.



ATTACH-A-DECK www.attachadeck.com

The Attach-A-Deck is a heavy-duty plastic cup-and-plug device that spaces the ledger off the wall. You supply the lag screws or bolts that fasten the ledger through the Attach-A-Deck and to the house.

Attach-A-Deck devices work great for mounting a ledger over existing siding (vinyl, clapboard, fiber cement, stucco, shingles). You drill 2½-in. holes through the siding to the face of the sheathing, apply the Attach-A-Deck devices, and mount the ledger to the house. The devices are 2 in. deep, so they can handle siding up to 1½ in. thick and still leave a ½-in. airspace.

The plunger-and-cup design back-caulks and seals the siding hole, filling the gaps from the inside out. This is accomplished by filling the Attach-A-Deck cups with sealant before screwing or bolting the ledger to the wall. The plug part of the system works like a plunger in each cup and forces sealant out of the series of holes around the perimeter of the cup. As you draw up the ledger fasteners, sealant is forced through the holes to seal the perimeter.

The system has been tested for mounting to both LVL and strand-type engineered rim boards. Attachment schedules include deck loads of 60 psf, 70 psf, and 80 psf and joist spans from 6 ft. up to 16 ft. Attach-A-Deck does not have an ICC-ES Report, so you'll want to check with your local building official before using this system.



table for lag screws and bolts has limitations, however. It is applicable only for decks with southern-pine or hem-fir ledgers mounted to a house with a 2-in. nominal SPF rim joist or 1-in. by 9½-in. Douglas-fir LVL rim board. There are other qualifications listed in footnotes. Half of the last 10 houses I built decks onto had conditions that fell outside the IRC guidelines, so I had to look to other attachment methods. Still, the IRC is a good place to start an examination of ledger-mounting methods because it includes some best practices that apply to many ledger-attachment schemes.

While I refer to the IRC for code references, keep in mind that your local official is the final authority, so check before applying any practices or alternative materials mentioned here.

Skipping the ledger altogether

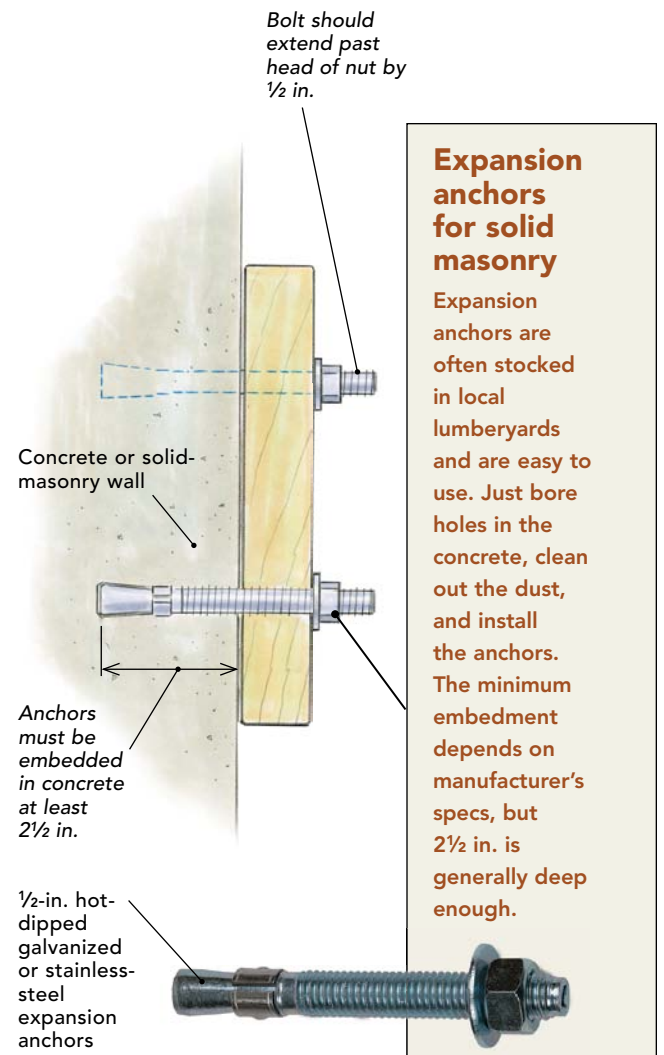
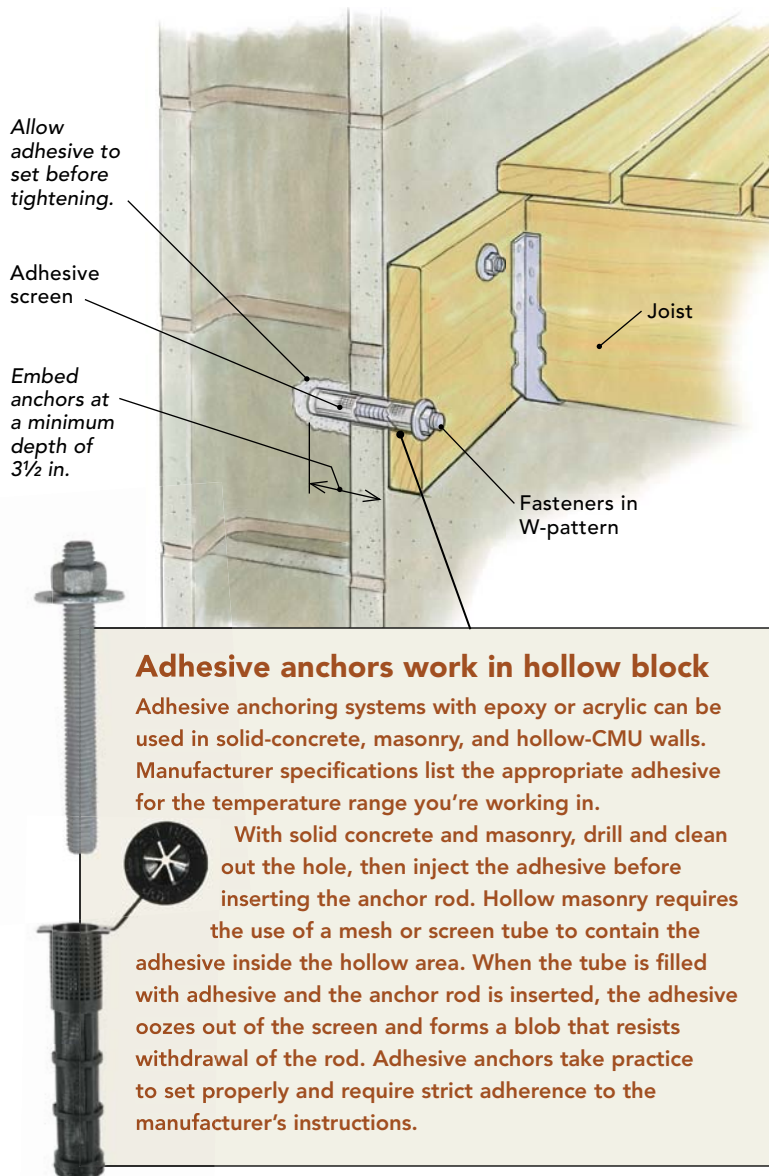
Because of the cladding type or framing details, you sometimes can't mount a deck ledger to a house without employing a unique engineered design. Veneer brick, stucco, and stone claddings aren't structural, so the ledger either must be mounted directly to the frame

SOLUTIONS FOR CONCRETE FOUNDATIONS

Deck ledgers can be mounted directly to solid concrete walls and to fully grouted concrete block using expansion (wedge) or adhesive anchors. Hollow concrete-block cores can be filled with concrete, or special adhesive-anchoring systems can be used. The lag shields we used years ago are inadequate for structural deck loads and must not be used. Likewise, most structural concrete screws cannot be used in exterior applica-

tions, especially when mounting treated lumber. These screws are highly hardened and can fail.

Anchors mounted in concrete are especially strong, but manufacturers don't have prescriptive deck-ledger fastening schedules. One resource I use for this is *Typical Deck Details*, a publication from Fairfax County, Va. (available in PDF form at www.fairfaxcounty.gov/dpwes/publications).



of the house (which involves cutting through and then flashing to the cladding, and supporting the cladding around the ledger), or the ledger must be supported independently of the house. Balloon-framed homes, open-web floor-trussed homes, and some engineered I-joint homes can't support deck ledgers directly. Code doesn't permit mounting a ledger to a cantilevered floor, because the rim joist doesn't bear directly on a wall or foundation. In these cases, you can have an engineer design a ledger connection or employ another workaround (for more details, see FineHomebuilding.com/extras), but it may not

be worth the effort. In these cases, I often opt for a freestanding deck, which can be simpler to build and more cost-efficient when compared to the cost of curing a challenging ledger situation. Freestanding doesn't mean the deck can't be attached to the house; it just means that the deck frame must be self-supporting. As long as the deck has footings all around, you can bolt or screw it to the house frame. □

Mike Guertin is a custom-home builder and remodeler in East Greenwich, R.I. Photos by Dan Thornton, except where noted.