



Top 10 Deck-

Avoid these common problems, and build a longer-lasting, safer deck

BY GLENN MATHEWSON

The process of building decks is not nearly the same today as it was a decade or more ago. While the outdoor environment and the endless design possibilities have remained constant, emerging technologies and new products and materials require a stronger sense of industry codes and best practices for you to be able to build a deck properly.

As a deck builder, inspector, and plans analyst, I have seen a lot of inferior deck-building practices from professionals and do-it-yourselfers. I've also seen an abundance of bad information that perpetuates problematic designs and poor construction practices. A badly built deck is more prone to failure than a correctly built one, and it's dangerous for those who use it.

Here, I highlight the most common errors I see in deck building and offer solutions to help ensure that your next deck is safe and that it lasts.

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MISTAKE 1



FAILING TO INSTALL A CONTINUOUS HANDRAIL ON STAIRS

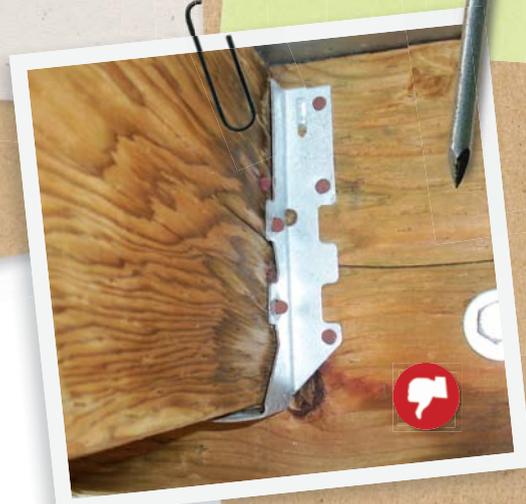
The post in the middle of this flight of stairs interrupts the top of the railing, which was designed to serve as the handrail. A new continuous handrail, albeit an unsightly one, had to be added.

The error: For construction or aesthetic purposes, builders regularly install handrails interrupted with newel posts. It's also common to see a guardrail used as a handrail.

The solution: Code provision R311.7.8.2 requires that a continuous handrail be installed on any set of stairs that has four or more steps. A continuous guardrail free of midspan posts extending through the top can be used as a handrail, but only if it meets specific geometric requirements. To be considered a handrail, the guardrail must be graspable by those walking up and down the stairs.

If a post interrupts a guardrail, a true handrail must be added to the guardrail running along the stairs.

Always follow manufacturer guidelines for appropriate fastener types and sizes, and use stainless-steel or galvanized fasteners if you are using pressured-treated lumber.

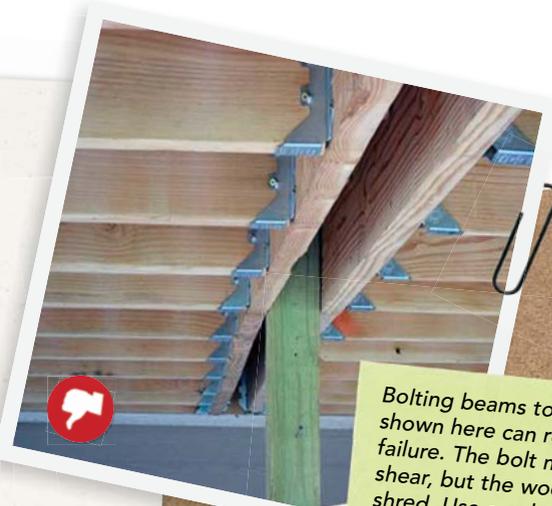


Building Mistakes

BOLTING BEAMS TO THE SIDES OF POSTS

The error: A tragedy brought to us from the aisles of big-box stores: directions to deck builders to bolt deck beams to the sides of support posts. The average backyard deck has relatively few posts. Fewer posts result in greater loads at beam connections. It would take a huge load to shear a 1/2-in.-dia. machine bolt, but long before that occurs, the wood around the bolt would be crushed and distorted, resulting in a failed connection.

The solution: A beam should be bolted to the side of a post only for low-level decks that have short-spanning joists and beams and many support posts. Of course, that means lots and lots of foundation piers, which are not the best choice in a region with a significant frost depth. With all the hardware available to handle various direct-bearing applications of different-size beams and posts, there is little reason not to place deck posts directly beneath beams.



Bolting beams to posts as shown here can result in failure. The bolt may not shear, but the wood can shred. Use a galvanized-steel post cap, and keep the beam firmly seated atop its support post.

MISTAKE 3

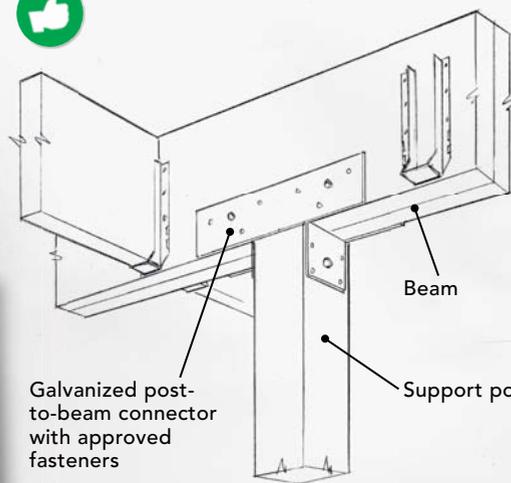
MISTAKE 2

INSTALLING HARDWARE INCORRECTLY AND USING THE WRONG FASTENERS

The error: Incorrect fasteners in hangers are a notorious mistake. For example, deck screws are not a proper way to attach joist hangers, and using 1 1/4-in.-long 10d nails where 3 1/2-in. 16d nails are required is a sure sign that manufacturer instructions were not followed.

Fasteners that don't have the correct corrosion-resistance rating will fail quickly when installed in treated lumber. Also, using only one-half of a two-part post-to-beam connector and installing under-size bolts in 6x6 post bases are common installation errors.

The solution: For hardware to work as the manufacturer claims it will and the way the inspector expects it to, follow the manufacturer's installation instructions. Proprietary hardware is not specified in the code; therefore, it is considered an alternative. Alternatives are approved via testing or engineering, and that information must be provided to the building official. The only way to be sure hardware will perform as expected is if it is installed as it was tested or designed. Beyond code compliance, valid product warranties depend on proper installation.





OVERSPANNING COMPOSITE DECKING

The error: The maximum span of wood-and-plastic composite decking generally depends on the type of plastic used in the product. It's important to follow the span limits of a specific product as outlined in the manufacturer's installation instructions, which some builders fail to review. Overspanning composite decking is most commonly a problem when deck boards are run diagonally over joists or when they're used as stair treads.

The solution: Floor joists for a deck are typically installed at 16 in. on center, which won't properly support some composite-decking products when installed on an angle. In new construction, be sure floor joists are installed at the correct spacing. In existing decks, adding more floor joists is the only remedy. Similarly, additional stair stringers might have to be added to stairs where composite decking serves as the treads. Stair treads must be able to resist a concentrated load of 300 lb. over an area of 4 sq. in.

This requirement puts a lot of pressure on the actual tread material to support concentrated loads. Some composite products are limited to an 8-in. maximum span when used as stair treads, which require the support of four stringers in a 36-in.-wide stairway.



To meet the span tolerance of this diagonally installed composite decking properly, additional joists and hangers had to be added to the existing deck framing.

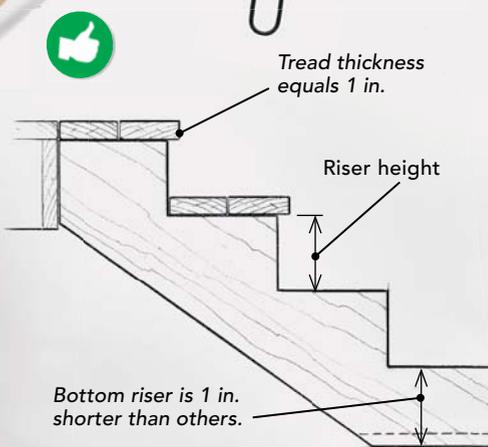


MISTAKE 4

BUILDING STAIRS WITH INCORRECT RISER HEIGHTS

The error: Often, the bottom step on a set of deck stairs is roughly 1 in. taller than the rest. Code allows a maximum variation of only $\frac{3}{8}$ in. between riser heights. This guideline often confuses inexperienced carpenters, who insist that they cut every notch in the stringer the same.

The solution: Every notch cut into a stringer has an identical riser height except for the bottom one. The steps notched out of the stringer in the middle of the flight have treads placed above and below each step, effectively adding the same tread thickness to each riser height so that they remain constant. The bottom step doesn't have a tread below it, though, so you must subtract the thickness of the tread from the height of the bottom riser, which is the bottom of the stringer.



Once you have determined the rise and run of your stairs, stringer layout is straightforward. One detail, however, is easy to overlook. The bottom riser needs to be one tread thickness shorter than the rest.

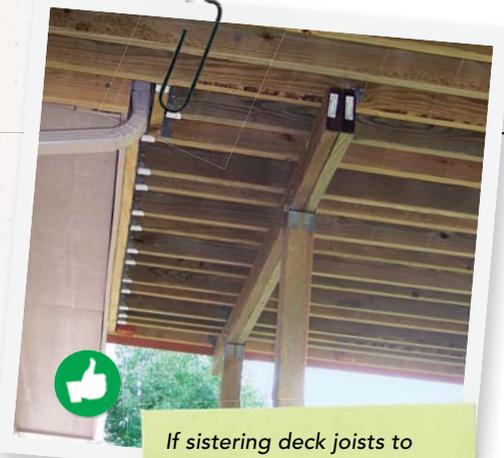
MISTAKE 5

ATTACHING DECK LEDGERS POORLY

The error: The majority of deck plans end with a straight, continuous line at the ledger, rather than details as to what the ledger is connecting to. Unfortunately, the way a ledger attaches to a house is one of the most critical elements in deck construction, and many builders get it wrong. For example, they bolt ledgers straight to brick, stucco, or EIFS cladding. These practices violate the code.

One of the more egregious ledger mistakes is connecting the ledger to a rim joist nailed to the end grain of cantilevered floor joists—those that support a kitchen bump-out, for example.

The solution: Detailing a ledger properly depends on the building type, the cladding material, and the site conditions. Of all the parts of a deck, the ledger can rarely be treated the same from job to job. Long before construction begins, considerations must be made as to, for example, whether stucco needs to be cut back with new weep screed installed or whether a few courses of lap siding need to be removed to bolt and flash the new ledger properly. A ledger connection to a cantilevered floor requires specific considerations. Instead of attaching a ledger to the ends of the cantilevered floor joists, it's often stronger to sister the deck joists to the existing floor joists.



If sistering deck joists to floor joists isn't an option, adding a beam, posts, and footings can help to relieve some of the stress placed on the fasteners connecting the ledger to the end grain of the cantilevered floor joists.

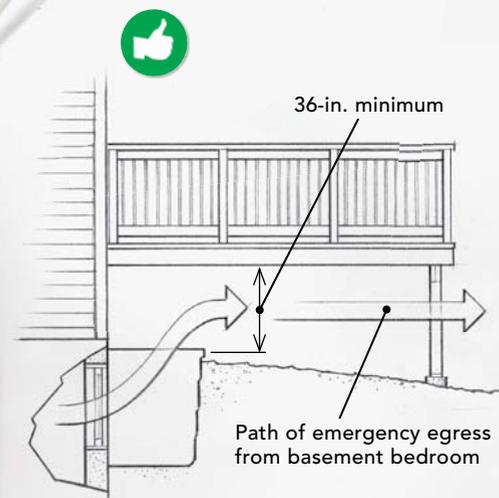
MISTAKE 7

IGNORING CLEARANCES AND INHIBITING ACCESS

The error: Although well constructed, some decks create code violations and safety hazards just by how they interact with the house. For example, some stairs on multilevel decks end up near windows that the builder has not replaced with tempered-glass units. Other decks are built too close to the house's main electrical service panel or the service conductors overhead—which need to be at least 10 ft. above a deck or 3 ft. to the side of a deck, according to code (E3604.2.2).

The solution: No matter what features exist on the exterior of a home—windows, air-conditioning compressors, low-hanging soffits, exterior lights, outdoor receptacle outlets, dryer vents—identify the required clearances before starting a deck design. While some features will influence the shape and location of the deck, other features may require only that appropriate access be integrated into the design of the deck.

Some clearances around a deck are code-required, like providing a minimum 36-in.-tall escape path from a basement egress window, while others are simply practical, like ensuring access to hose bibs. Each clearance should be considered with equal diligence.



MISTAKE 6



SETTING PIERS IN DISTURBED SOIL

The error: When it comes to digging footings for their deck piers, some builders are lazy. Usually, a deck's foundation piers are not set below the region's frost line. To avoid deck-ledger failures, freestanding decks are becoming popular, but the piers nearest the home's foundation are often set atop backfill.

In areas where the frost depth is not an issue and precast foundation blocks are commonplace, they're often set on top of the exposed grade.



The solution: Just about every deck is built on an isolated-pier foundation system. Foundation systems are required to extend a minimum of 12 in. into undisturbed soil (R403.1.4). In cold climates, where the earth is subject to freezing, a pier foundation must extend to a depth below that which is likely to freeze—anywhere from 36 in. to 48 in. This prevents the soil below the pier from freezing and heaving the pier upward.

To install deck piers properly, the piers must bear on undisturbed soil and, depending on the region, be set below the frost line. This could mean the need for 3-ft.-deep footings in some areas. However, if the piers are in a backfill region, as is the case with piers nearest the house on a freestanding deck, the footing depth may have to be as deep as 10 ft. to reach undisturbed soil and to comply with code.

Precast foundation blocks must be set at least 12 in. into the ground. However, even in the middle of a lot, the topsoil is tilled roughly 6 in. prior to seeding, so it's likely that the footing needs to be at least 18 in. deep to comply with code. Assume that all deck piers and foundation blocks require some digging.

When set above an area's frost line, footings can heave (top photo). Piers set below the frost line with bell-shaped bases (bottom photo) stay in place and distribute the deck's weight. Even where the ground doesn't freeze, footings must be set 12 in. into undisturbed soil and not directly on grade (middle photo).

MISTAKE 8

MISTAKE 9



Don't use nails or screws to fasten railing posts to deck framing, as shown above. Use bolts. More specifically, use blocking and bolts, as shown below, to create a stronger railing than one with posts connected to rim joists that are nailed only to the end grain of the joists.



MISTAKE 10

MAKING BEAM SPLICES IN THE WRONG PLACES

The error: When a long built-up beam spans multiple posts, many builders run one ply long and extend it beyond the support posts. Many builders believe this practice is good because splices of opposing beam plies are greatly separated as opposed to being only inches apart on top of a post. Unfortunately in these cases, an engineer's evaluation or a rebuild of the beam is required.

The solution: Beams are under two stresses: bending and shear. Shear forces act perpendicular to the length of the beam and are greatest near the bearing ends.

Bending changes the beam's shape, a force called deflection, and is greatest in the center of the beam span. The code lists maximum allowable limits for deflection. In deck beams, the deflection limit is typically reached long before shear limits are a consideration. Any reduction in bending resistance also increases deflection potential and ultimately ends in code noncompliance.

Beam splices that miss the bearing point by a small amount don't greatly affect bending or deflection, and the shear strength of one fewer ply is likely still sufficient. In these cases, the cost of an engineer's review might just get you the OK to build. If a design calls for a splice in the center of a span, it will be smarter and cheaper to build the beam so that splices land atop posts.



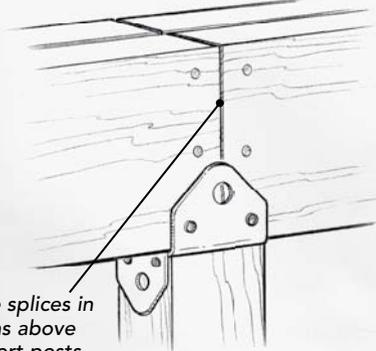
INCORRECTLY ATTACHING GUARDRAIL POSTS

The error: Insufficiently connecting a guardrail post to a deck is among the most dangerous deck-building errors. Fastening guardrails to deck rim joists or floor joists with wood screws is not acceptable. While some builders get the guardrail-to-rim-joist connection correct, they don't always ensure that the rim joist is attached to the deck framing properly.

The solution: The code (table R301.5) requires a guardrail to be capable of resisting a concentrated load of 200 lb. in any direction along its top. Depending on the design of the guard assembly, a stout guardrail-post-to-deck connection can be accomplished with blocking and through-bolts or with horizontally oriented hold-down hardware. In some rail designs, most of the load resistance is handled by the post connection to the deck. In those instances, the post should be attached to the joists, not the rim, because the rim is not usually fastened to the joists in a manner capable of transferring the load. Rims are typically nailed into the end grain of the joist, the weakest possible connection for withdrawal resistance.

The design methods for guardrail assemblies are as vast as the imagination, and homeowners admire that creative expression. However, serious consideration must be made as to how the guardrail is ultimately assembled.

The strength of a guardrail assembly is provided by a lot more than just the post-to-deck connection. The concentrated load must be resisted at any point along the top of the rail. With a common 5-ft. to 6-ft. distance between the posts, the load must transfer through the connection of the horizontal rails to the post. When a continuous top cap runs across the posts, it acts like a horizontal beam to help distribute the load over a larger area. When a post is run long, through the top of the guardrail, there is a considerable reduction in strength.



Make splices in beams above support posts.

Beams suffer the greatest amount of deflection at the center of their post-to-post span. Therefore, strong beams are spliced atop posts. If you can't stagger splices over different posts, then placing them over a single post is permissible.