

Newtown, Conn. 2014

The Complete Guide to

Building a Deck



Last fall, *Fine Homebuilding* commissioned the construction of a small deck at its building lab, the Project House. Builder and editorial adviser Mike Guertin was chosen for the job, which included a robust ledger, smart framing details, composite decking, and integral benches. Here, Guertin explains his entire process, from the careful layout, concrete footings, and framing to tricks for installing composite decking material.

THINK SAFETY In most areas of the country, you need a building permit for a deck to ensure that it sits on an adequate foundation, is built properly with rot-resistant materials, and is attached securely to the house. Throughout the article, this symbol will alert you to deck-construction details that must conform to local

Check Code

building codes. For your own protection, wear safety glasses when cutting or nailing, wear hearing protection as necessary, and be careful when working from ladders or from the framing of an unfinished deck with no railing.



To see a video series on building this deck, visit FineHomebuilding.com/extras.

Build a custom-size, grade-level deck with benches, planters, and a decorative border

BY MIKE GUERTIN

For this year's whole-deck project, *Fine Homebuilding* asked me to participate in a cooperative effort to add a new deck to the Project House. Maryland-based contractor Clemens Jellema contributed a design for a compact, grade-level deck. I revised his plans to include some of the details that I wanted for this project, such as an integral rim beam, post-to-frame attachment, and robust ledger flashing.

Built with pressure-treated framing and composite decking, this deck doesn't have a railing (none are required for decks less than 30 in. above grade) but still offers lots of fundamental, code-compliant details that can be applied to other decks. You'll also find plenty of valuable tricks, such as site-made footing forms, improved ledger details, and tips on working with composite decking material.

It took me a day to sketch the details, but extra planning paid off by improving my efficiency on the project. Project House editor Justin Fink provided hands-on assistance.

Mike Guertin is a builder in East Greenwich, R.I., and editorial adviser to *Fine Homebuilding*. His website is mikeguertin.com. Photos by Charles Bickford, except where noted.

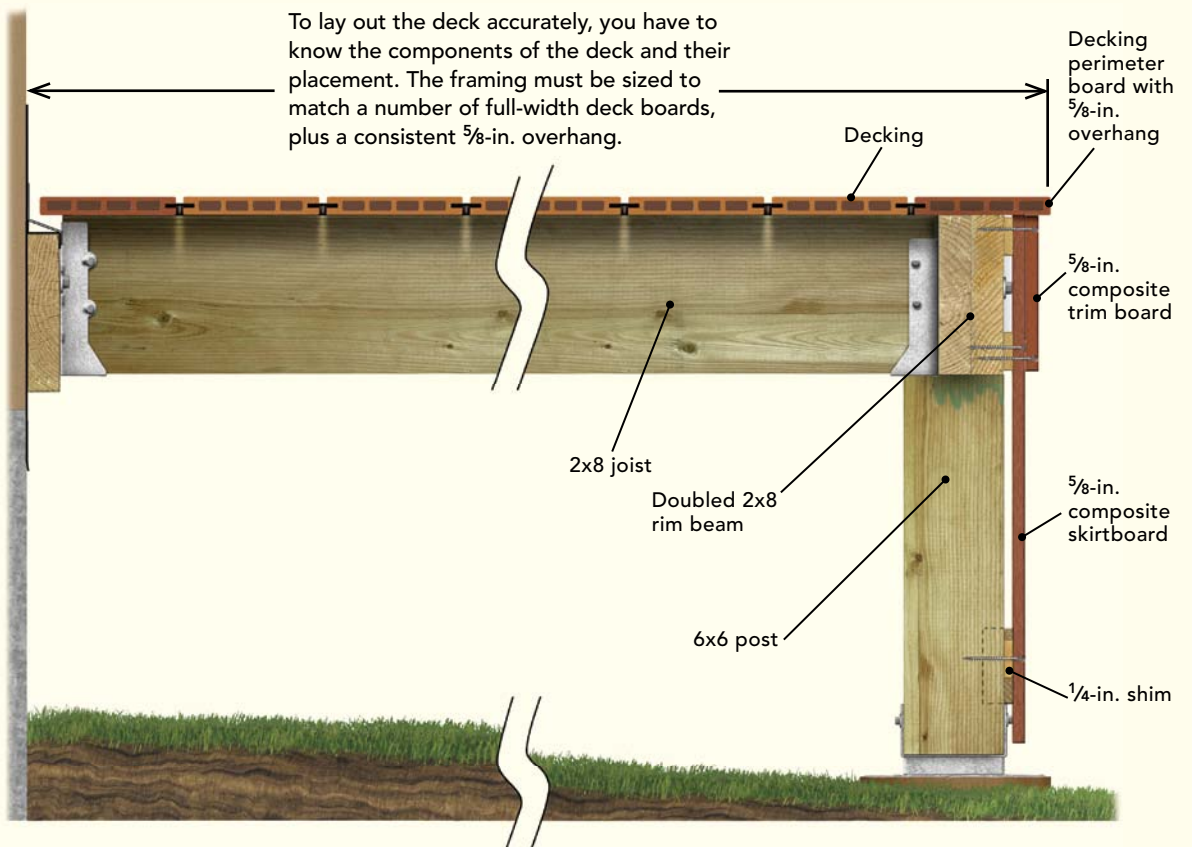


ADJUST THE DECK'S WIDTH

Every deck, even one with a simple plan, still has plenty of elements that must be worked through before it can be built. Here, the plans show framing dimensions of 16 ft. by 12 ft., but they don't include details for things like decking, perimeter skirting, and trim. The composite decking chosen for the project uses a hidden-fastener system that locks into edge slots on the boards. I had to resize the deck frame slightly so that I could build with full-size decking and trim boards, rather than have to rip everything to size and then screw and plug the ripped boards.



Dial in the deck width. The decking width needs to be exact so that the perimeter boards have a consistent overhang. Lay out a series of deck boards, and insert hidden fasteners as spacers between them. Once they're snugged together, measure and extrapolate how many full-width boards will come closest to the target deck width.



LOCATE AND DIG FOOTINGS

To locate the footings that support the outside of the deck, and also the footing for the stairs, I started by locating the ledger on the house. Then I set up a stringline at the location of the deck frame's outermost face. Using the Pythagorean theorem, I created perpendicular lines from the ends of the ledger to the stringline. This established the deck's perimeter, which I needed to lay out and dig the footings.

I calculated the load each footing would carry and determined the necessary size (see "Sizing Deck Footings," pp. 28-33). However, instead of digging 13-in.-dia. holes for the outboard footings and a 16-in.-dia. hole for the middle (which carries a greater load than the outboard footings), I dug 10-in.-dia. holes and flared the holes' bottoms. Plastic bags attached to cardboard form tubes allowed the concrete to fill the holes and create spread footings. The required footing depth in this jurisdiction is 42 in.

After digging the holes and pouring concrete into our modified footing tubes, we placed the anchor bolts and checked their locations with the stringline. Once everything was set, we graded the soil from the footing holes to establish a positive slope away from the house. This was the last chance to adjust the grade beneath the low deck before we started to erect the frame. After raking the footing spoils smooth, we compacted them with a tamper.



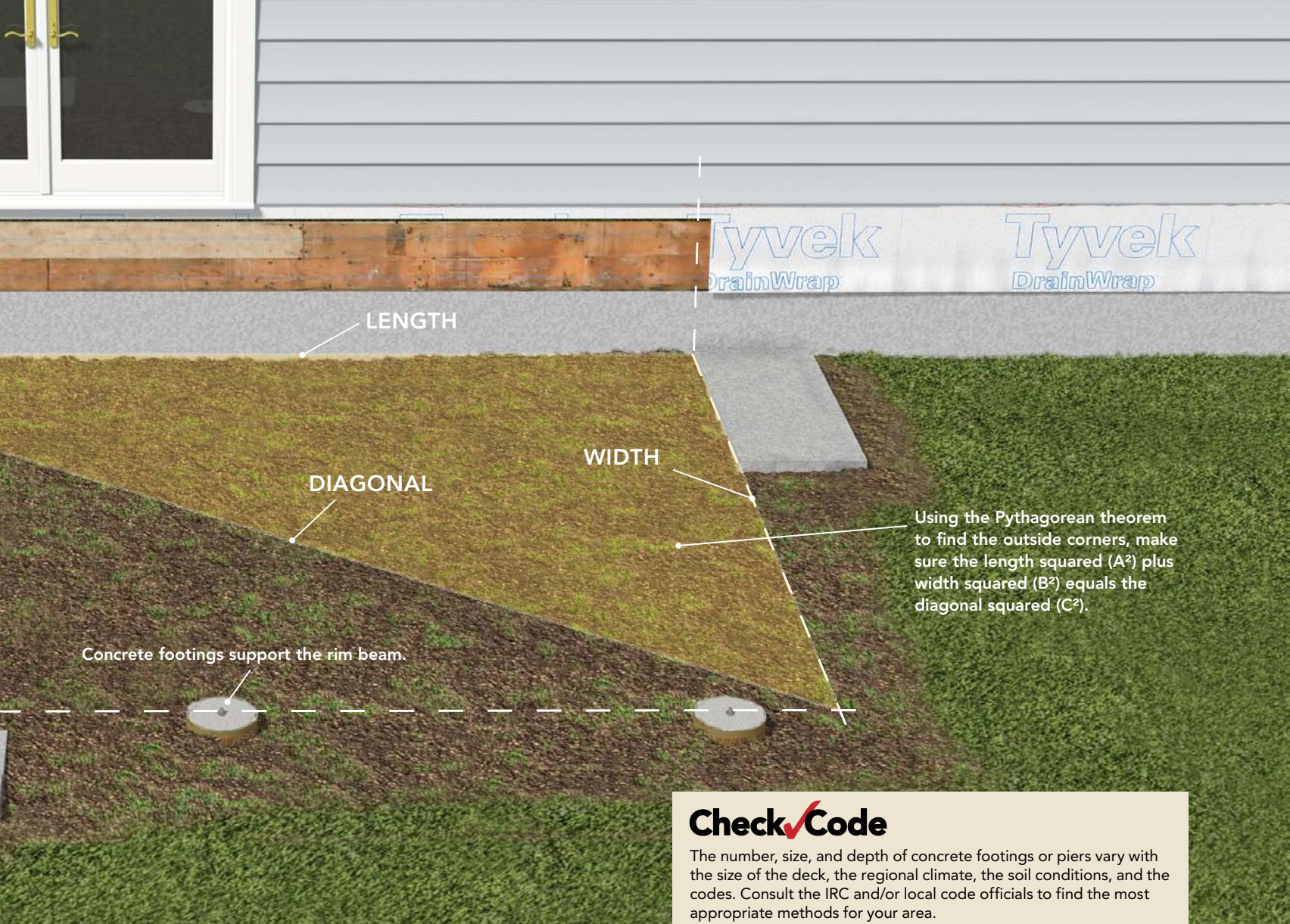
Stringline defines the outside edge of the deck. Set a string between batter boards, and adjust it to match the width of the deck. Diagonal measurements pulled from the ends of the ledger location give the precise outside corners, which in turn determine the footing locations.



An easy job. With only three footings to dig, it doesn't make sense to rent a gas-powered auger. Ten-in.-dia. holes go pretty quickly with post-hole diggers and a digging bar. Widen out the last 12 in. of footing depth to the width of the spread footings.



Economical spread-footing. Tape garbage bags to the bottom of 30-in.-long, 10-in.-dia. cardboard footing tubes. When filled with concrete, the bags balloon into the bottom of the holes to a width greater than the tube.



Check✓Code
 The number, size, and depth of concrete footings or piers vary with the size of the deck, the regional climate, the soil conditions, and the codes. Consult the IRC and/or local code officials to find the most appropriate methods for your area.



The footings must be located directly below the beam. After placing the bags and tubes, pour enough concrete to fill the bags up to the cardboard tubes. Then reset the string, align the tubes to the center of the beam, and backfill around the tubes.



Site-mixed concrete. Mix concrete in a wheelbarrow-style mixer, then shovel it directly into each form. When all are filled, reset the string, and place the J-bolts in the wet mix directly below the string.



Mark and dig the stair footings. Use a 2x as a straightedge to mark the position of the stair footing pads. Dig square and flat holes to the dimensions of the stair frame. Form the top with 2x stock for even edges at the precise position of the stairs.

INSTALL THE LEDGER

Even on a ground-level deck, the ledger is still an important detail that supports the deck at the house. The ledger must be flashed to prevent water from compromising the house structure. On this deck, we used LedgerLok structural screws to attach the ledger, rather than the 1/2-in. bolts or lag screws prescribed in the code. The house's unfinished

basement allowed for easy access to the floor framing in order to install the code-required lateral-load connectors (p. 73). I poked a screwdriver into the wood to see if there was any rot or insect damage. I also used a moisture meter to inspect the framing. It read 10%, confirming that the lumber was dry.

Find the framing. Remove a small piece of sheathing to find the exact locations of the mudsill and rim joist. Mark fastener heights on scrap ledger stock, align the bottom row with the middle of the mudsill, and then mark the top edge of the ledger.



Flashing keeps the house dry. After establishing a level top reference point, snap a chalkline that extends beyond the ends of the ledger. Apply a layer of self-adhering, self-sealing membrane to the wall before the ledger is attached.

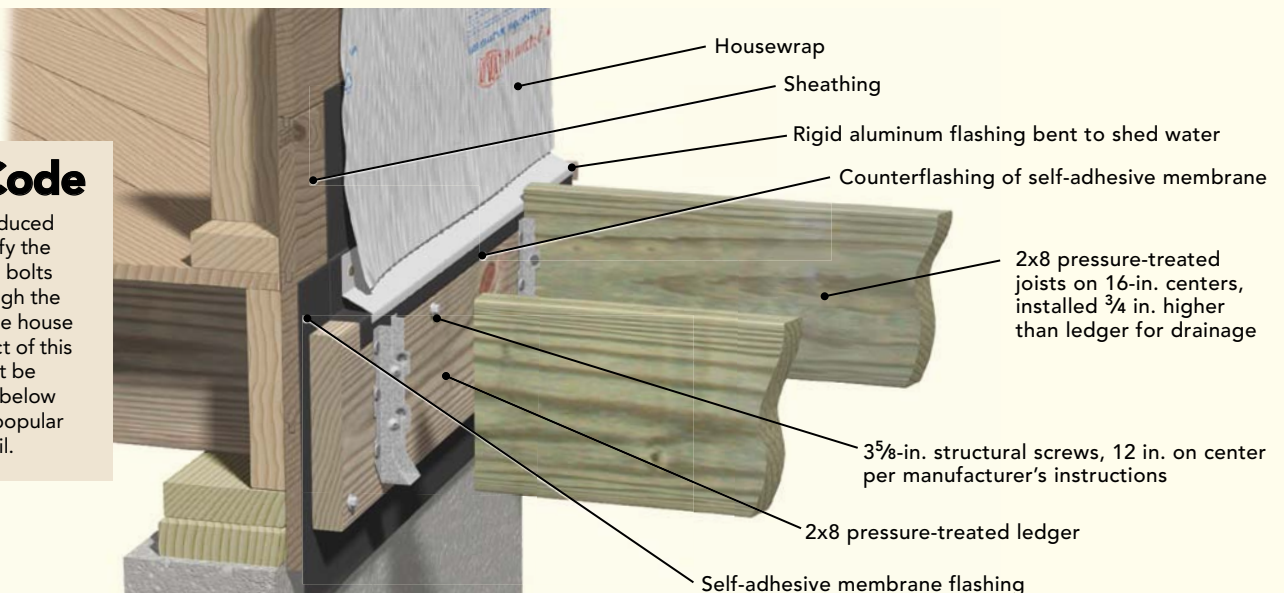
Attach the ledger. After installing the first layer of flashing, snap a chalkline on it to indicate the top of the ledger. Snap chalklines onto the ledger to indicate screw rows, then mark the screw and joist layouts. Fasten the ledger to the house at the chalkline with structural screws.



Counterflashing completes the waterproofing. After installing the ledger, apply another strip of self-adhering membrane over the top and down the face of the ledger by at least 1/2 in. To make installation easier, cut the membrane into 3-ft.- to 4-ft.-long pieces. Last, install rigid drip-cap flashing over the ledger.

Check Code

The 2012 IRC introduced changes that specify the placement of 1/2-in. bolts or lag screws through the deck ledger and the house rim joist. One effect of this is that ledgers can't be dropped one step below the house floor, a popular snow-country detail.



SET THE RIM BEAM

This deck is so close to the ground that a doubled rim beam is a better choice than are cantilevered joists over a beam, which would take up too much room below the deck. Supported by notched 6x6 posts and framed flush with the

deck joists, the rim beam allows plenty of clearance between above-ground treated lumber and the soil, and it provides better air circulation. The next step in the framing process is to attach the posts and notch them.

Line up the post bases. Once the concrete is set, reattach the layout line to the batter boards, bolt the post bases onto the footings, and align the bases to the stringline.



Post blanks marked in place. Cut the 6x6 posts to a long rough length, set them atop the post bases, plumb them up, and mark the beam seat cut precisely using a laser level and a square.

An efficient notch. After fastening the posts to the bases, crosscut the seat with a circular saw. The plumb cut can be made with a handsaw, but careful use of a chainsaw makes quick work of the job.



Set the inner rim beam. With the notches cut, the newly exposed wood must be treated with a copper-based wood preservative such as copper naphthenate. Mark the joist layout onto the inner beam, set it on the post notches, and attach it at each post with a clamp (photo below).

Temporary bracing. Until the outside joists are attached, it's a good idea to stabilize the beam with lengths of strapping screwed to the ledger and the beam.



CheckCode

Cuts in pressure-treated lumber need to be treated with preservative according to standard M4 of the American Wood Protection Association (AWPA).

HANG THE JOISTS

Unlike larger designs, this deck has a straightforward arrangement of 2x8 joists on 16-in. centers that span between the ledger and the inner rim beam. With the rim in place, we installed the two outer joist hangers and joists, and then squared up the resulting box by comparing the diagonals. When the diagonals were equal, we clamped the rim to the posts. We then installed the joist hangers and joists on the ledger before nailing them to the rim. Each hanger is nailed with pneumatically driven 1½-in.-long joist-hanger nails. Three-in.-long framing-connector nails then are driven diagonally through the hanger and the joist and into the ledger or rim beam using a larger pneumatic nailer. After the joists were installed, we bolted the rim to the posts.

SPECIAL CONNECTORS FOR CORNERS

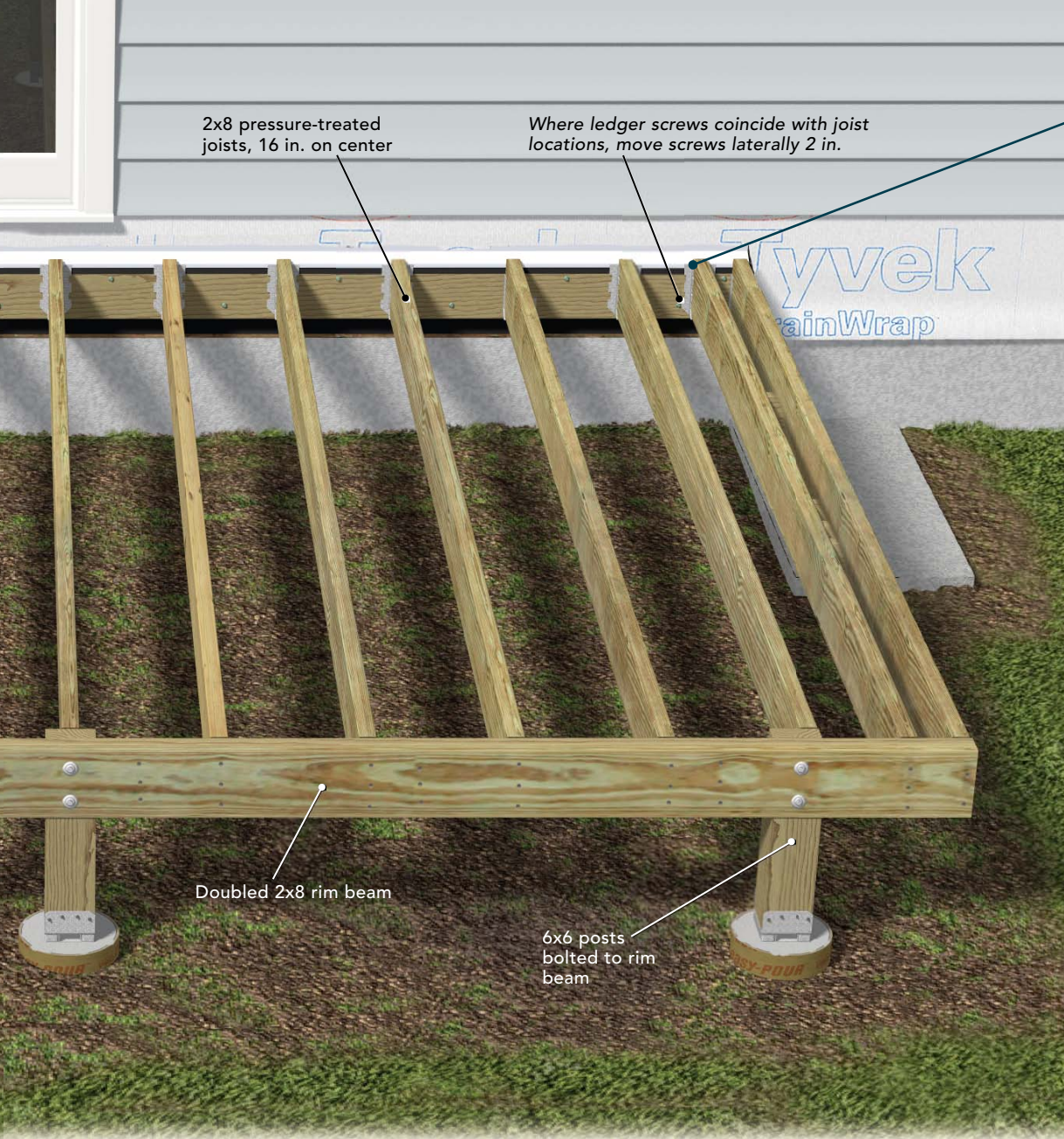
Flanged hangers aren't approved for use on outside corners. Instead, use concealed-flange joist hangers (Simpson LUC26Z or similar) attached with structural screws to the rim or ledger.



Make sure the box is square. After the outermost joists are installed, compare the diagonal measurements. If they aren't equal, unclamp the rim beam, and adjust its position until the measurements are the same.



Lock the posts into place. Once the box is squared, lock it in place with a diagonal piece of strapping screwed to the frame at each end. Next, loosen the clamps, recheck the posts for plumb, and retighten the clamps.



2x8 pressure-treated joists, 16 in. on center

Where ledger screws coincide with joist locations, move screws laterally 2 in.

Doubled 2x8 rim beam

6x6 posts bolted to rim beam

PRODUCTION-STYLE JOIST HANGERS

The joists' width varied by less than $\frac{1}{8}$ in., so all the joist hangers on the ledger were set at the same level using a T-shaped jig. The leg of the jig is the same width as the joists, and the bottom registers the hangers at the same level. Each joist hanger is held onto the jig with a spring-steel clamp (Joist Clip, \$11; fastcap.com) and nailed to the ledger.



Nail the joists in place. Mark the crowned side of each joist, orient the joist crown up, and drop it into its hanger on the ledger end. On the other end, hold the joists flush to the top of the rim, and through-nail them.

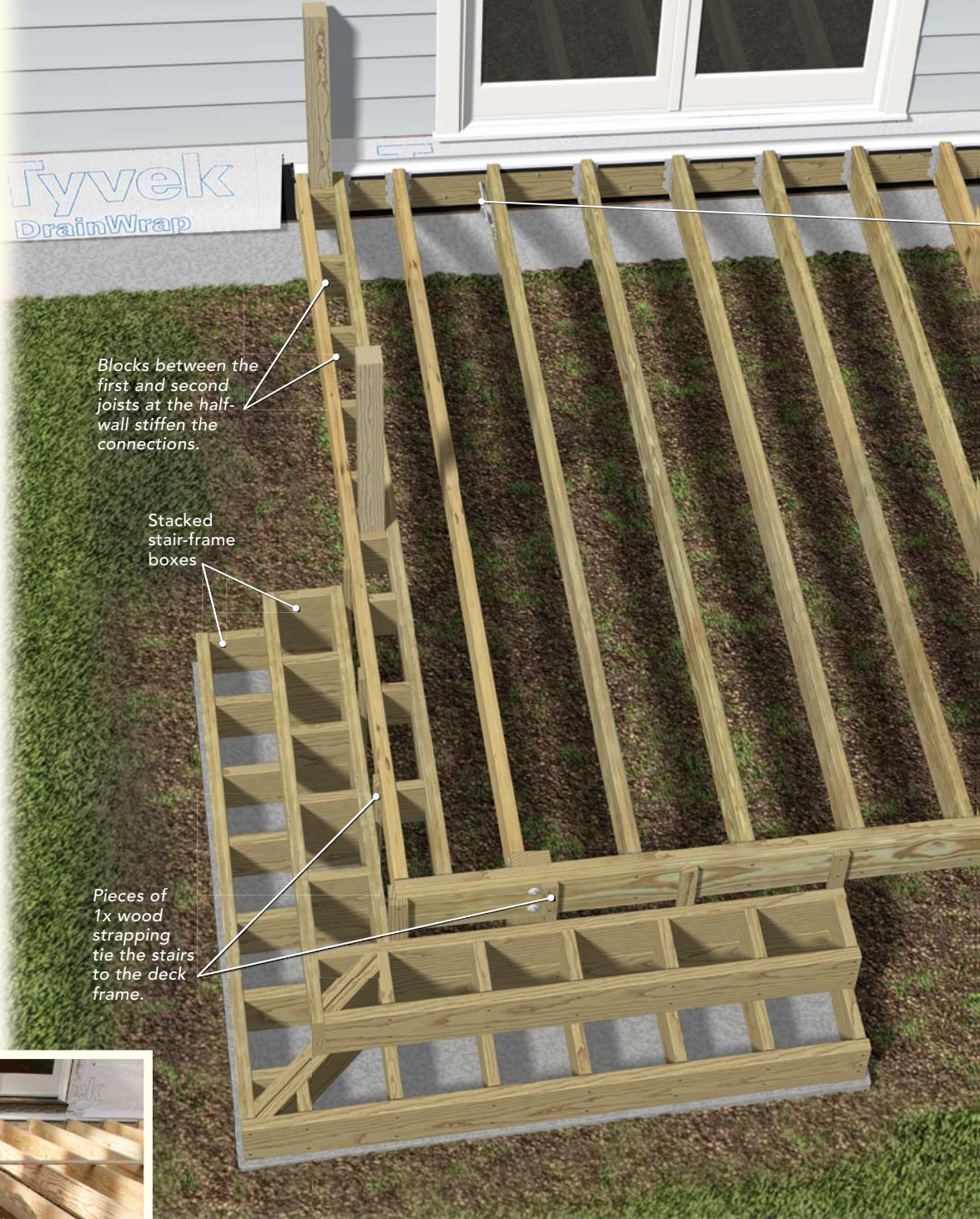


Add the second rim layer. After all the joists are nailed, align the second rim flush to the top of the first, and nail it off. Fasten the posts to the doubled rim with ThruLok bolts, and install the hangers.

BUILD THE STAIRS

With the joists installed, the next phase of framing dealt with stairs, installing blocking for benches and the half-wall, and attaching lateral-load hardware. The main stairs are a focal point of the deck and wrap 5 ft. around one outside corner, so they had to look good. I had two framing options for the stairs: stacked boxes or cut stringers.

Stacked boxes made more sense for this project because they're faster to frame, they're self-supporting, and they provide a more stable and straight base for precise trim. Box frames also make the most sense for short, wide stairs. For more than three risers, box-stair frames aren't as efficient a choice because they use more lumber than cut stringers.



Blocks between the first and second joists at the half-wall stiffen the connections.

Stacked stair-frame boxes

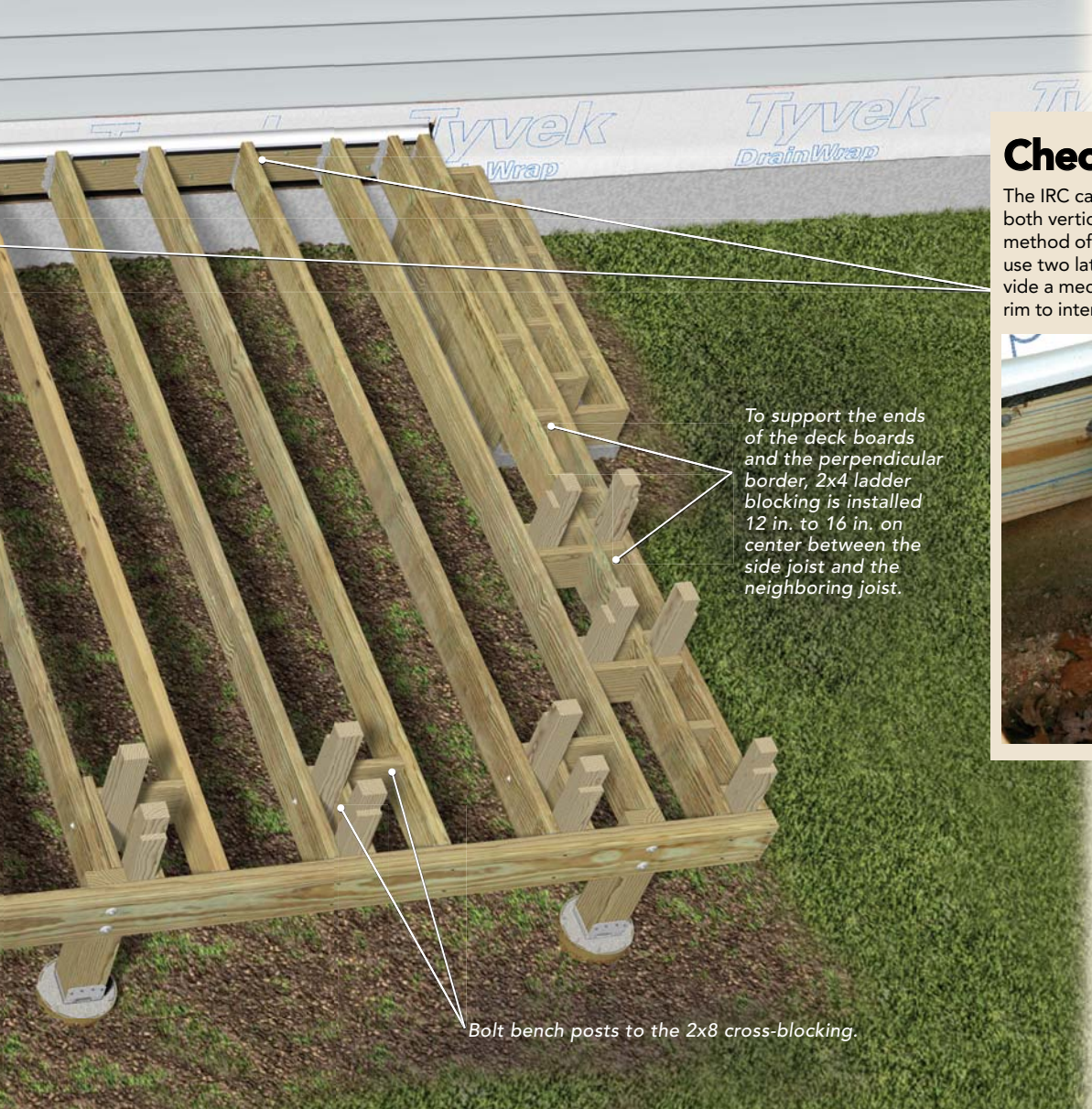
Pieces of 1x wood strapping tie the stairs to the deck frame.



Solid support. The decking manufacturer calls for closer support spacing (12 in. on center) when decking is used for treads. Some manufacturers call for supports to be as close as 8 in. on center.



Stack boxes for stability. Build the bottom box frame twice as wide as the top. Diagonal blocking at the corners provides nailing for the mitered treads. This design locks the boxes together so that the outside corner is less likely to open up over time. Tie the boxes together and to the deck frame with 1x straps that match the thickness of the deck skirt, then push the boxes into place.



To support the ends of the deck boards and the perpendicular border, 2x4 ladder blocking is installed 12 in. to 16 in. on center between the side joist and the neighboring joist.

Bolt bench posts to the 2x8 cross-blocking.

Check Code

The IRC calls for decks to be designed to resist both vertical and lateral loads. The most common method of satisfying this code requirement is to use two lateral-load hardware sets per deck to provide a mechanical connection through the house's rim to interior floor joists.



Blocking and posts for bench seats. Nail 2x8 blocks to support the posts on the deck perimeter. Clamp a jig made from 1x to each post to set it to a consistent height. After tack-nailing the posts to the blocks, check for plumb, and attach the posts with through bolts, such as the FastenMaster ThruLok bolts used here.

INSTALL THE DECKING WITH HIDDEN FASTENERS

We used composite decking from GeoLam (geolaminc.com) for this job. I generally order decking in lengths that minimize waste for a given deck size. Unfortunately, the deck width of 16 ft. was set before the decking was ordered, and it was only available in 12-ft. lengths. This left us two options: install full-length boards with a 4-ft. piece alternating left and right, or use two 8-ft. pieces cut from full length boards. To minimize waste, and for looks, we used the former option.

A single-board border encloses the field decking. We installed the border first, then filled in the center. We placed the first board $\frac{1}{2}$ in. away from the house to allow water to drain.

The decking has grooved edges. To avoid showing a groove, we had to rip one edge of the darker boards used along the perimeter. We fastened the field boards with the manufacturer's biscuit-style hidden fastening system, and screwed and plugged the edge boards.

To keep the decking parallel, we measured the distance from the last board to the rim beam every few courses. It's also a good idea to eyeball the decking to keep it straight.



Decking anatomy. This biscuit-style fastener is screwed to the joist and engages the grooves of the adjacent boards. Leave the screws a little loose so that the leading edge of the fasteners easily engages the groove of the next deck board. After the following board is placed, the fastener screws can be tightened. Note the deck board's hollow structure, which adds strength without excess weight.



Slotted screw holes permit movement. Drill $\frac{1}{8}$ -in. pilot holes 16 in. apart along the border decking, then elongate the holes from the underside with a drywall spiral cutter. Cut the slots progressively longer (up to $\frac{1}{4}$ in.) toward the ends of the boards. Do not slot the center hole on each board.





Cap the joists for long-term performance. To shed water, cap all single joists with 3-in. staple-on plastic tape (York Wrap, yorkmfg.com), and the doubled rim beam with a 6-in. tape. This reduces the amount of water that can wick into splits in the wood where preservative may not have penetrated or be as fully concentrated.



The other hidden fastener. Unlike the field decking, the border can't be attached with hidden fasteners and must be face-screwed through pilot holes that are then plugged.

GAP THE DECKING IN COLD WEATHER

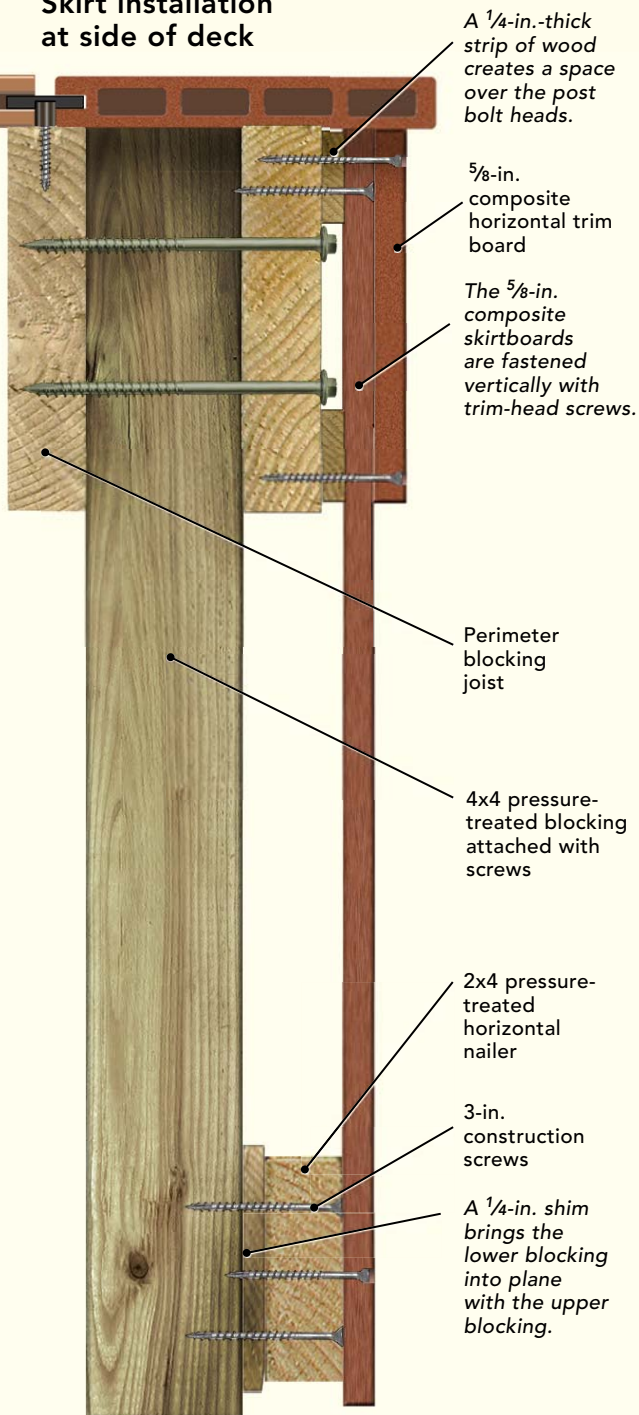
Composite material expands and contracts along the length of the board with temperature changes. To accommodate this seasonal movement, install the decking with a 1/4-in. gap at each end when the weather is cold. In warm weather, install without gaps.



DRESS UP THE PERIMETER

Our design called for the perimeter of the deck to be enclosed by a skirt made from 5/8-in.-thick composite trim boards installed vertically. To create nailing for the skirt, blocking hangs from the side joist.

Skirt installation at side of deck



Appearances matter here. To keep a consistent gap between each board, use a trim-head screw as a spacer at the top and bottom. Cut the skirtboards to reach from the top of the deck frame to grade, which can vary around the deck.

FINISH THE STAIRS

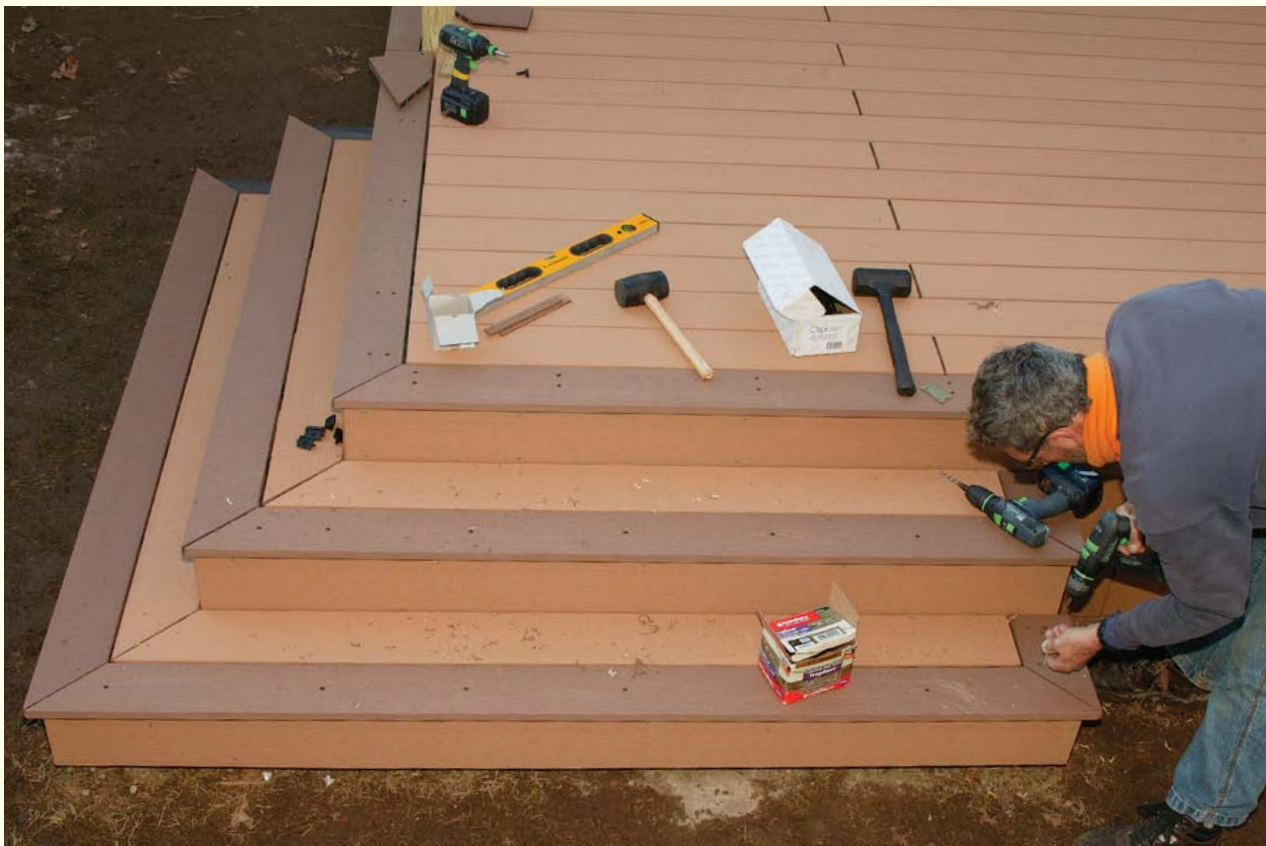
The horizontal trim board that runs across the top of the skirt also serves as the top stair riser, so this was a good time to install the stair risers and treads, which feature the same border treatment as the main deck.



Trim board hides top screws. The skirt's top screws are covered by the horizontal trim board, which becomes the top riser at the stairs. The seamless transition results from the vertical 1x used to hang the stair boxes, which is on the same plane as the skirtboards.



Keeping fasteners hidden. Install the tread boards with the same attention to movement as with the deck boards. At the riser, special half-clips anchor the inboard side of the tread.



Neatness counts. Drill screw holes 16 in. on center along the length of the outer boards. Leaving outside miters open 1/4 in. permits the boards to expand in summer heat.

BUILD A BENCH

Built-in seating on a deck not only defines the perimeter of the deck, but it also provides a great place for folks to relax. We used the same decking, trim materials, and border pattern so that the bench would blend in with the rest of the deck.

Frame sized for three deck boards and 1-in. overhangs

Diagonal blocking supports decking at corners.

Horizontal blocking installed on 12-in. centers

2x4 rim screwed to 4x4 posts

Post sleeves made from mitered composite trim that's glued and nailed

Joist cap tape

Special glue. Composite decking material can be tricky to glue. The glue used here was Scotch-Weld 8010 (3m.com), a two-part acrylic adhesive.



Place post sleeves before installing the bench frame. Rip trim stock with a 45° bevel, then assemble sleeves with two-part acrylic adhesive and stainless-steel micropins.



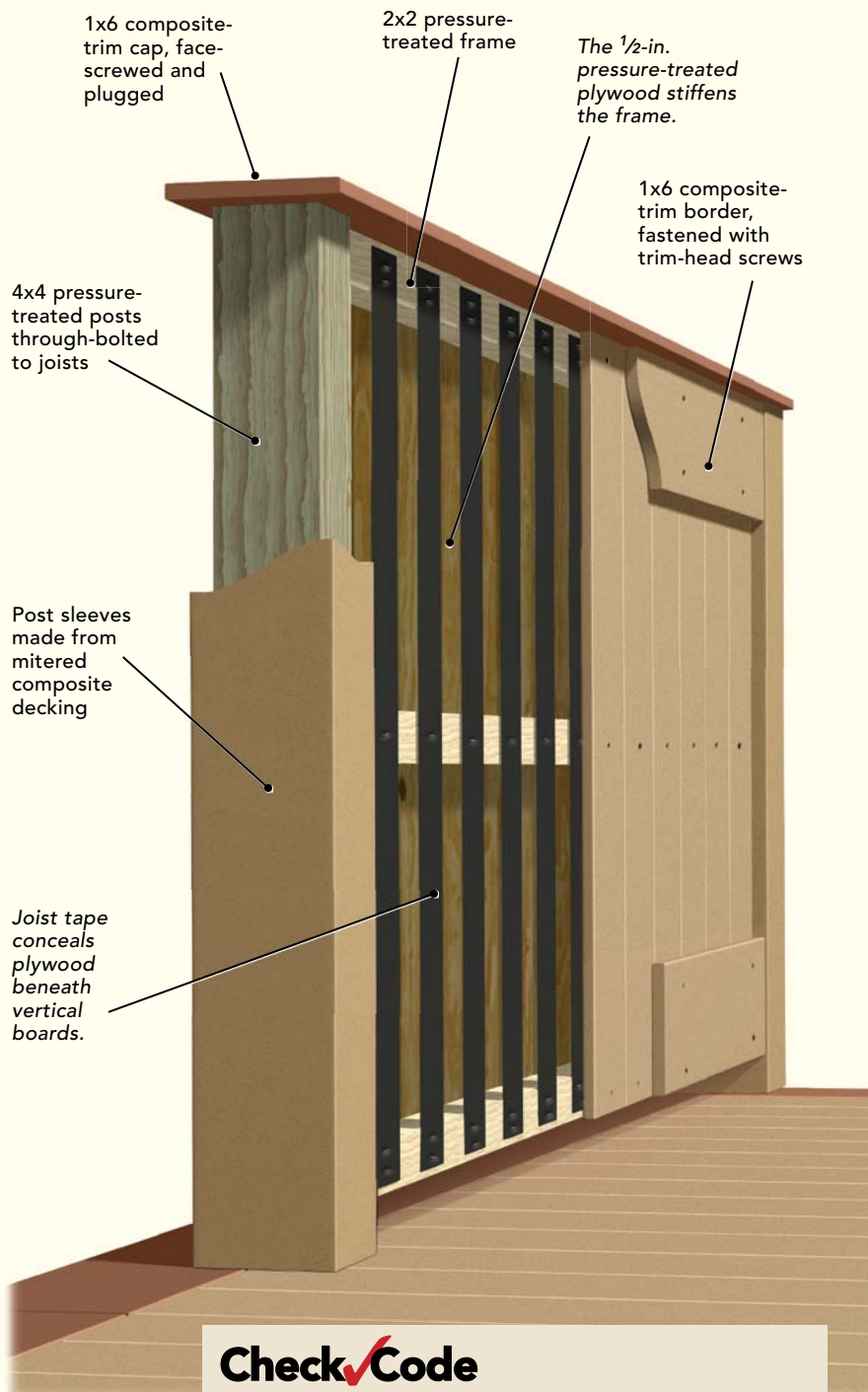
Use placeholders. To locate the first board on the seat, space all three boards with loose deck clips to produce the appropriate overhang. Set the clips, drill pilot holes along the outside, drive in the screws, and plug the holes.



Trim the edges. Cover the edge of the 2x4 frame with trim ripped to 4 in. wide and fastened with color-matched trim-head screws.

RAISE THE HALF-WALL

A half-wall creates privacy off the deck for a grill, recycling bin, or hose reel. Drill pilot holes before screwing together the 2x2 frame. After attaching 1/2-in. pressure-treated plywood on one side, apply joist tape where the joints for the vertical boards will be. Space boards 1/8 in. apart, and fasten with color-matched stainless-steel screws.



Check Code

Decks that are higher than 30 in. off the ground must have guardrails with a top rail at least 36 in. high. Some jurisdictions measure the guard height from the surface of built-in seating; others measure off the deck surface. Check to see how your local building department applies the code.



A simple base. Size a 2x2 frame to fit between the two trimmed-out posts, but make it 3 in. shorter than the post height to create a gap at the bottom.



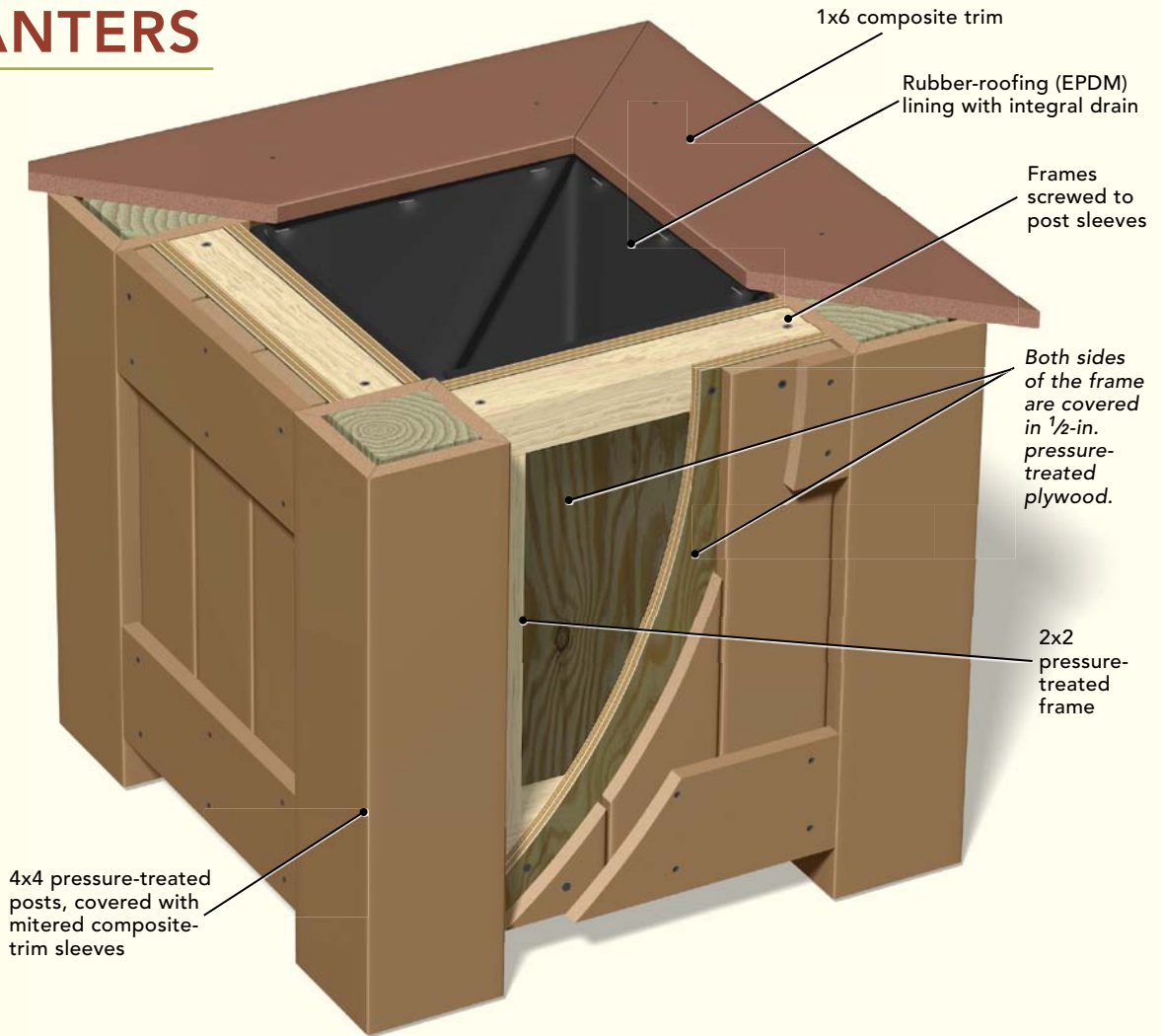
Screw the panel to the posts. Raise the half-clad panel on top of 3-in. spacer blocks, and align it 1/2 in. from the post cover edges. Drive screws through the 2x2s into the posts to secure the panel. Cover the unclad side with black tape, and install vertical trim boards.



Finish with trim. Screw the same trim material used to clad the wall to the top and bottom of the panel. For contrast, cap the top with one of the darker trim boards.

ADD A GARDEN TO THE DECK WITH PLANTERS

Custom-built planter boxes are easy to make from leftover materials. Our boxes were designed to sit on each end of the bench seats, but they could be placed anywhere. Rather than build them into the structure, we built them freestanding so they could be moved off the deck for periodic cleaning and filling. Lined with a waterproof membrane, the planters feature a drain that prevents root rot.



4x4 pressure-treated posts, covered with mitered composite-trim sleeves

1x6 composite trim

Rubber-roofing (EPDM) lining with integral drain

Frames screwed to post sleeves

Both sides of the frame are covered in 1/2-in. pressure-treated plywood.

2x2 pressure-treated frame



A solid framework. As a smaller version of the half-wall construction, the first stage of the planters is built with panels made from 2x2s and plywood that are screwed to corner posts. After assembling the box, add a second layer of plywood to the outside of the frame.



First layer of trim. Clad the exterior of each panel with trim boards backed with strips of joist tape at gap locations. Fasten the boards with trim-head screws.



Box the panel. Apply horizontal trim boards across the top and bottom of each panel. The horizontals and the post sides are in the same plane and complete the frame.

A WATERPROOF LINING AND DRAIN

It's a one-piece liner. Made from rubber roofing material (EPDM), the liner is folded into the planter's interior. Measure and mark the membrane carefully so that there's coverage top to bottom.



Rubber origami. Fold the membrane in half, then push it down into the planter.



Fold the corners. With the membrane covering the bottom, fold the corners so that the membrane forms a bucket shape.



Attach the corners. While holding each corner fold, tack it to the top of the panel's interior with staples or cap staples.



Trim the top. When all four corners are fixed in place, use a sharp knife to cut away excess material along the top edge.



Install the drain. Drill a hole into the plywood bottom just enough to mark the membrane. From the inside, cut a small hole in the membrane and push a length of vinyl tubing through it. From the other side, pull it out so that a 1/4-in. stub remains exposed inside on the planter floor.

