

The Complete Guide to Building a Deck

Annapolis 2013



Peer over the shoulders of Clemens Jellema and his crew as they build this low, multilevel deck in Maryland. The project illustrates basic deck construction as well as real-world solutions, and it features diagonal synthetic decking, hardwood railings, and a separate area for a hot tub. Jellema explains the process step by step, from digging footings and erecting framing to crafting a built-in seating area for seasons of spa-side gatherings.

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 this article, this symbol will alert you to where you should make sure your deck conforms

Check✓Code

to local 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 the framing of an unfinished deck with no railing.

A low deck is spiced up with curves and custom details

BY CLEMENS JELLEMA

When I build a deck, I want the result of my design and construction to improve the homeowners' property as well as their lifestyle. In this case, my crew and I were hired to build a replacement for my clients' old deck, a simple 24-ft. by 14-ft. rectangle. They rarely used that deck even though they loved to entertain outdoors. It was time for a change.

My clients wanted a dining area that wasn't too close to the house and a place to relax where they could grill. They also wanted a hot tub, but they weren't sure if the tub was possible because of space and privacy concerns.

After discussing the project with the homeowners, I made a number of computer-generated drawings and came up with a design they liked: a low, two-level deck that curved along one side. (For 3D renderings, I use a program called Realtime Landscaping Architect by Idea Spectrum.) Several large trees limited the buildable space, but a curve on one side was an ideal way to optimize the space without resorting to a traditional rectangle.

After demolishing the old deck, we started to build the new one. Because the deck was nearly on grade, much of the work was easier than if we had to work from ladders. Our first task was to establish the footing locations, then dig the holes and pour concrete. At the same time, we formed and poured the hot tub's pad. Framing, decking, stairs, and skirting followed in sequence.

Clemens Jellema's company, Fine Decks Inc., is based in Owings, Md. Photos by Charles Bickford, except where noted.



Photo this page: Anice Hoachlander. Drawings: Toby Welles, WowHouse.

LEDGER INSTALLATION

A deck needs a ledger-to-house connection for support and extra rigidity. Although the design of this low deck made it a self-supporting structure, I still paid careful attention to the details of the ledger, which would act as a fail-safe support for the deck.

Flashing the ledger protects the house from water damage that could compromise the ledger's connection to the house, as well as the house itself.



Vinyl is first. The crew tacks up 14-in.-wide vinyl flashing along the deck's perimeter at the house, making sure to extend it up behind the siding and under the doorways.



Establish a level guideline. The doorsill sets the height of the 2x8 pressure-treated ledger. It's tacked into position, and later secured to the house's rim joist with 1/2-in. by 4 1/2-in. hot-dipped galvanized lag screws.

Behind the ledger, a 14-in.-wide piece of vinyl flashing extends up behind the siding.

2x8 pressure-treated ledger

A 4-in.-wide piece of vinyl counterflashing covers a 6-in.-wide piece of self-adhesive membrane.

The 1/2-in. by 4 1/2-in. galvanized lag screws and washers alternate 2 in. from top and bottom, 12 in. on center, and are doubled at the ends.

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Recent changes to the International Residential Code (IRC) spell out spacing requirements for ledger bolts and require the installation of additional hardware to increase the strength of the deck-ledger connection. For more information, consult with your local code official to determine how the code applies in your area.

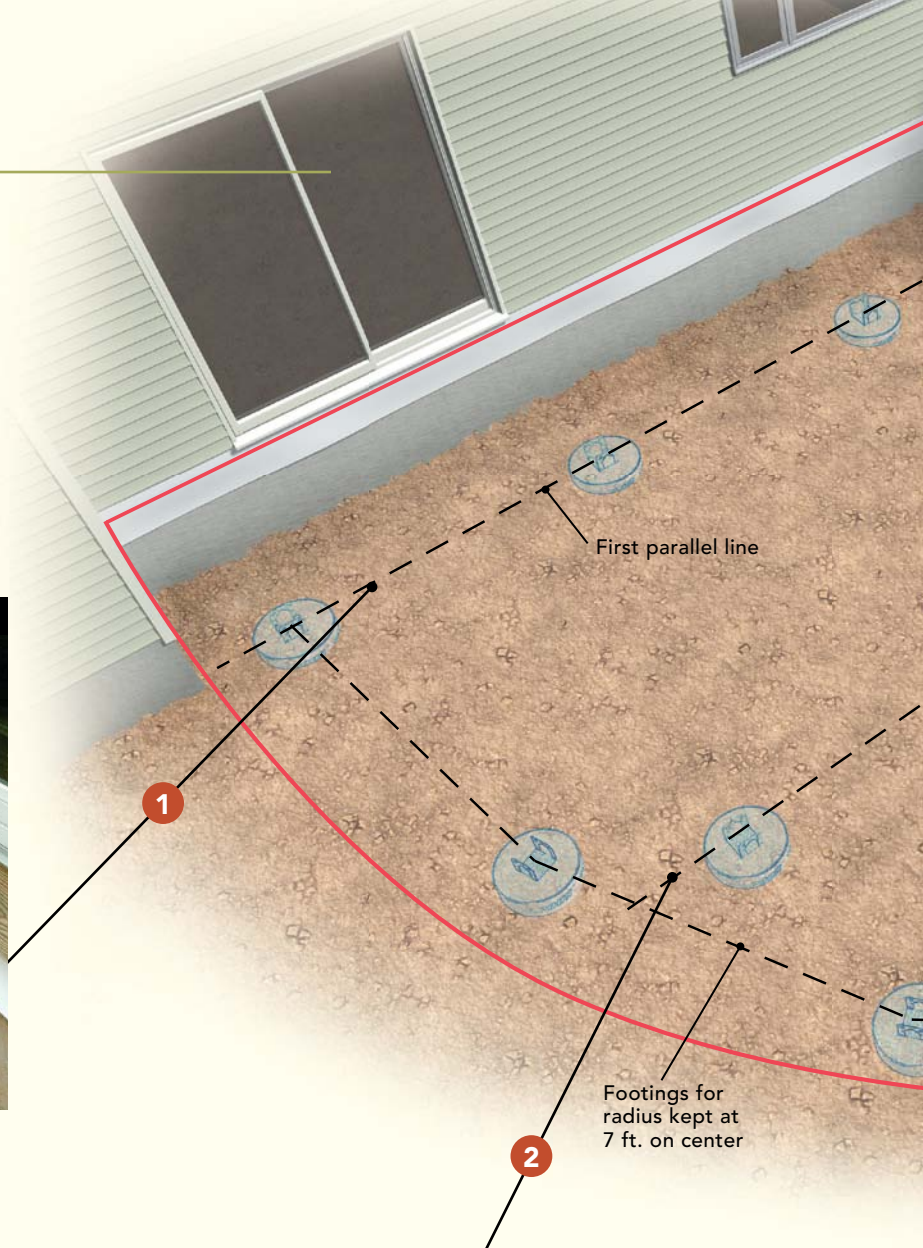
LAYOUT

Deck frames high enough to stand under can be built first on temporary posts that then are used to locate the required footings. This deck's height was less than 3 ft., however, so we had to locate, dig, and pour the footings before we could frame. Working from the ledger, we used stringlines and long lengths of framing lumber to extend perpendicular lines, then temporarily braced the lumber plumb and level. We used those references to measure and plumb down for post locations. The post holes for this project were spaced at a maximum of 8 ft.

1. POSITIONING THE FIRST BEAM



String is easiest. To locate the footings that support the beam closest to the house, the crew stretches a string parallel to the foundation and plumbs it down. Footing centers are flagged.



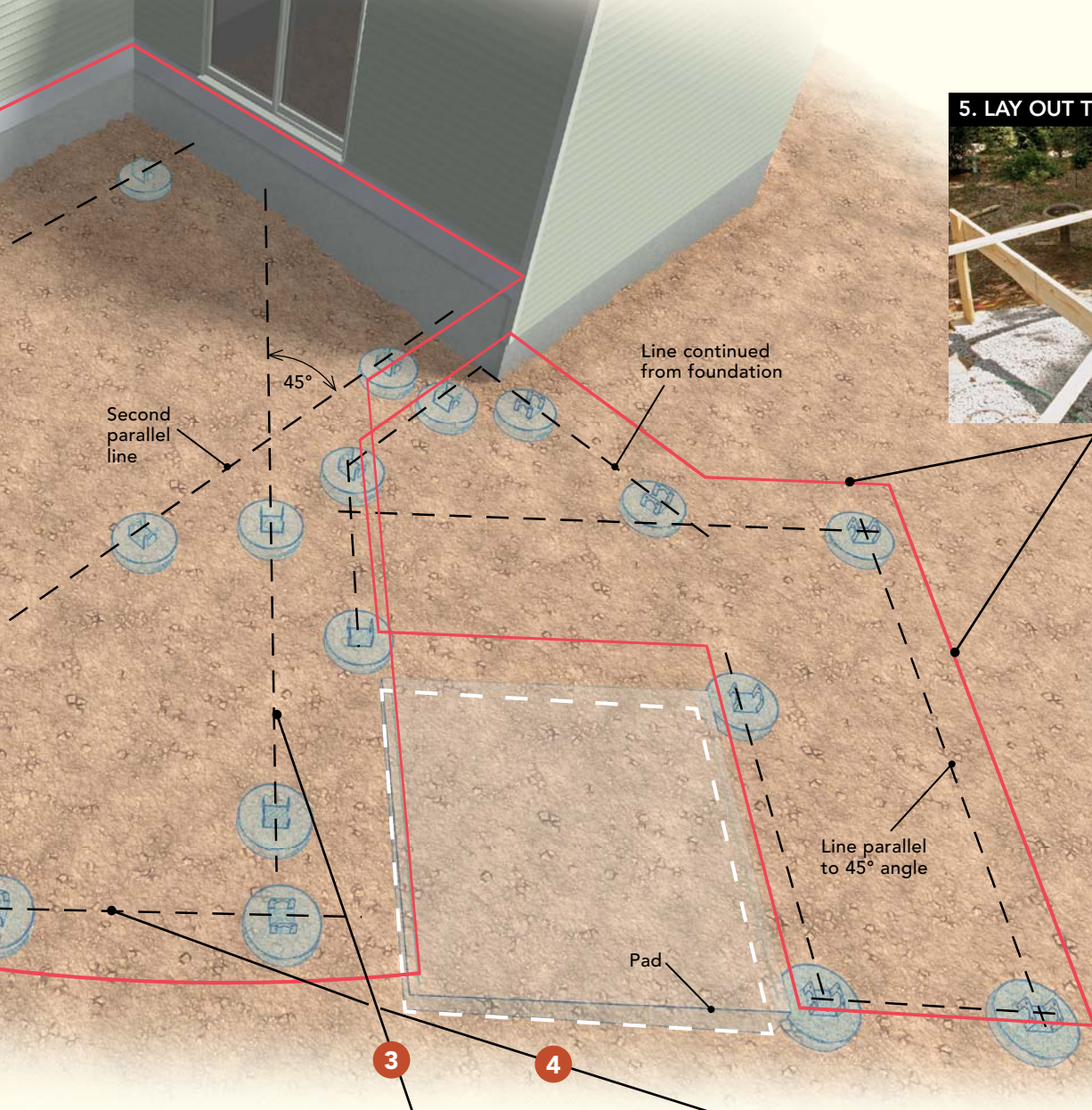
2. POSITIONING THE SECOND BEAM



The ledger reference point is the same. To establish the second beam's footings, the crew tacks a 16-ft. 2x6 to the ledger, then braces it so that it is perpendicular to the foundation and level.



Close to the ground is good. Rather than set the layout string high and then use a level to determine the second beam's footings, it's better to position the line lower, just above the footings.



5. LAY OUT THE LOWER DECK



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Running right angles. For accuracy, the crew does not locate the lower deck's footings until the main deck is framed and the hot-tub pad poured. Instead of using temporary framing, the crew frames the deck perimeter and supports it with temporary posts until the footings are located, dug, and poured.

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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.

3. ESTABLISHING THE ANGLE



An important angle. By measuring an equilateral triangle from the corner of the house, workers can set a temporary 2x at a 45° angle. This side of the deck determines the location of the hot-tub pad and the termination of the outside radius.

4. MARKING THE CURVE



Swing the arc. A tape anchored at the corner of the deck layout establishes the outer radius. A crew member walks it off, marking where it intersects the temporary 2xs. Pieces of 1x3 strapping (photo right) mark the radius's position and the location of the footings for the beam that will support that side.



FOOTINGS

With the footing locations marked, we started to dig. Because we had more than a dozen 18-in.-dia. footings to dig, I went straight to labor-saving devices and rented a power auger. Rental for a two-man auger was \$49 for four hours and \$78 for a full day. Because the diameter of the power auger's bit was 16 in. and the footing forms were

17½ in., we needed to do some digging by hand to enlarge the holes before setting the forms.

In this county, the code calls for 30-in.-deep footings. We cut the forms 36 in. long so that about 6 in. or so protruded above the hole. To plumb up the forms, we used a short level to check the top in two directions.



Hang on. Nominally a two-man machine, the aggressive auger sometimes required three operators as it dug into the hard-packed soil. The auger rental saved time and money.



Form prep, production style. The easiest way to cut cardboard footing forms to length is to use a circular saw while a helper rotates the form. The cuts should be as square as possible.



Plumb the footings. A short level held across the top indicates when the form is level and, therefore, plumb. When the forms are plumb, they are backfilled.



Dig, fill, and clean up. As the builder's forms are placed and backfilled, the site is raked to slope away from the house in preparation for a layer of landscape fabric and gravel beneath the deck. The gravel minimizes moisture transpiration and creates a safer working surface.



The truck won't reach. Due to limited access to the site, the crew has to transfer the concrete from the truck to a wheelbarrow. Plywood pathways make it easier to roll between the truck and the footings.



Prep for the next step. Once the footing is poured, a wooden float is used to screed off the excess so that the concrete is flush with the top of the footing form.

THE HOT-TUB PAD

With the concrete truck coming to pour the footings, we had to get the hot-tub pad ready, too. The pad needed to remain crack-free and stable over the long term while supporting a ton or more of water. We used 2x8s to make a square box form, then leveled it, tacking the box's sides to stakes driven into the dirt on the downhill side. Pieces of 1/2-in. plywood filled the gaps between the form and the sloping grade and were braced with 2x diagonals nailed to stakes.



The pad needs a solid base. After leveling and staking the pad form into place, a worker compacts the dirt to lessen the chances that the pad will shift after it is poured.

Reinforcement required.

After cutting and tying the 1/2-in. rebar into a grid of approximate 12-in. squares, the crew drops it onto wire supports that keep it in the center of the form.



No-stick spritz.

Instead of the traditional oil-based form release, the crew uses common bathroom spray cleaner; its surfactants perform the same function as oil.



Fill and screed. Workers place the concrete carefully in the form so that the rebar isn't knocked off its supports. When the form is filled, they use a straight 2x on edge with a relaxed back-and-forth motion to level the top. They finish the surface with a float.

FRAMING

Our default framing method is to cantilever the joists over a carrying beam supported by 6x6 posts. Because this deck is fairly low to the ground, the ledger's support is less critical and serves more as a termination for the joists. We minimized the distance the joists spanned by adding a second beam closer to the house. As when we located the footings, we ran a 16-ft. 2x8 joist out from the ledger and braced it level and square. We then set the height of the outer beam by bracing it beneath the first joist and extending it across to the house just beneath the ledger.

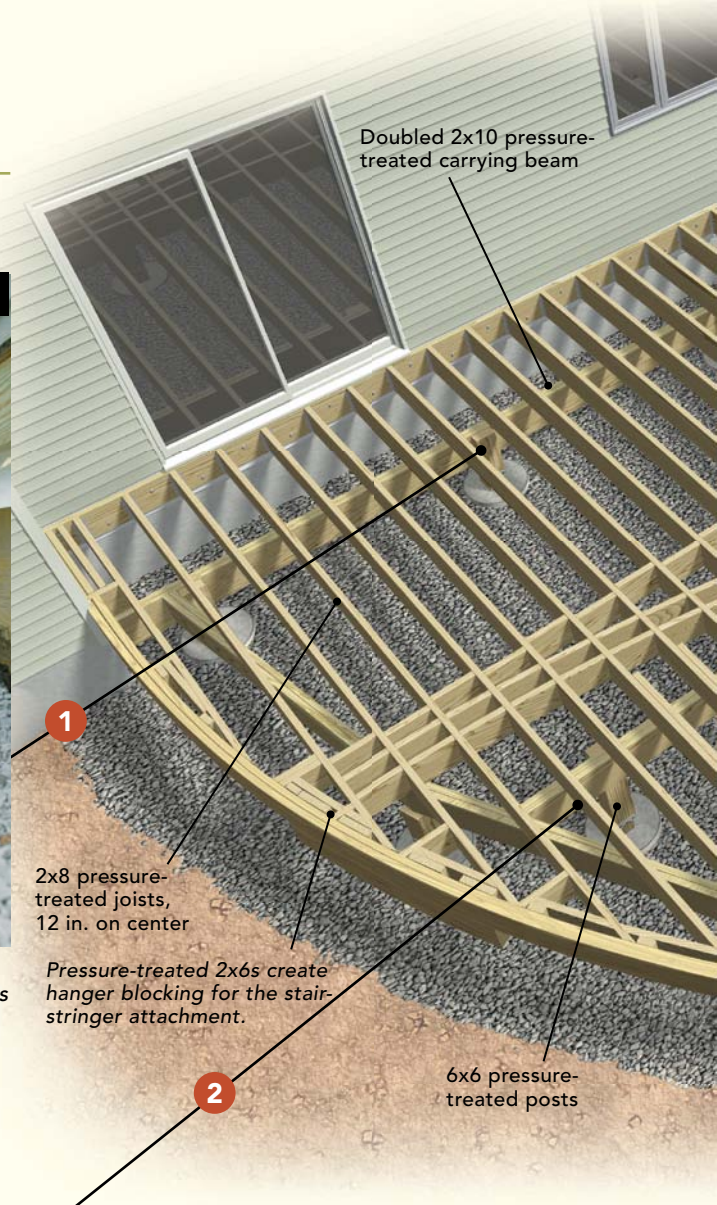
Working backward, we established the inner beam's height by spanning the tops of the outer beam and the underside of the ledger. Because the inner beam was more than 16 ft. long, we made it from four pieces of 2x and arranged the joints so that they landed over post locations.

Once the beams were up, we nailed the joists onto the ledger, 12 in. on center. (Joist hangers are installed after the joists are nailed up to reduce the discrepancies in height from board to board.) To prevent water from collecting between sistered joists, we covered them with strips of self-adhesive membrane. We used W.R. Grace's Vycor, as we do in most cases.

1. STRING LOCATES POST BASES



Get it while it's still fresh. While the footing concrete is still wet, the crew sets up stringlines and long straight edges that replicate the positions of the carrying beams. Next, the post bases (Simpson PB66) are set in the tops of the forms, and their alignment is checked with stringlines.

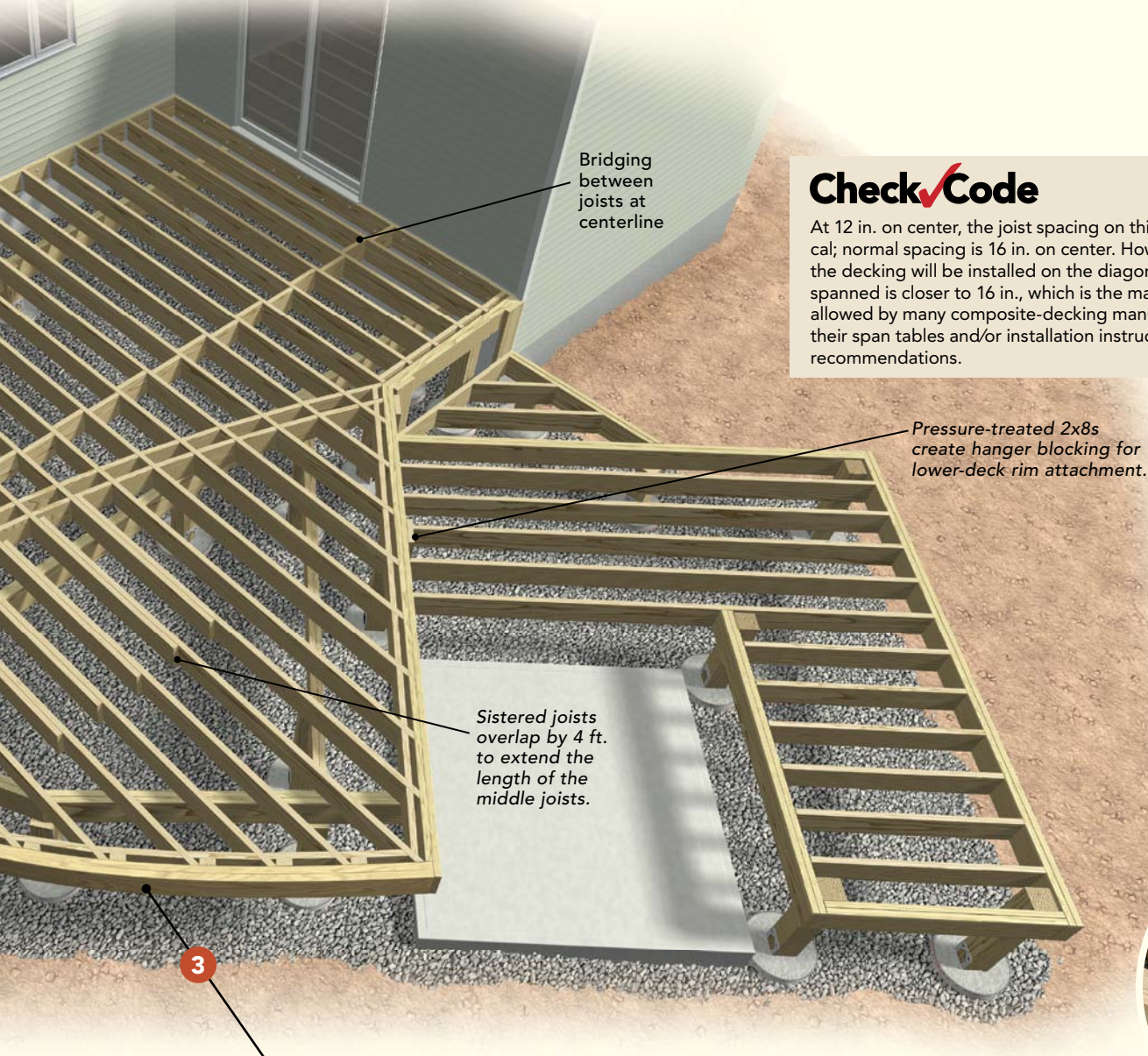


2. THE FIRST JOIST SETS THE BEAM



The outer beam comes first. After tacking a long joist to the ledger and bracing it plumb and square, workers position the outer carrying beam beneath it. They cut 6x6 posts to length, bolt them half-lapped to the beam with two 1/2-in. by 8-in. through bolts, and repeat the process with the inner beam.





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At 12 in. on center, the joist spacing on this deck is atypical; normal spacing is 16 in. on center. However, because the decking will be installed on the diagonal, the distance spanned is closer to 16 in., which is the maximum span allowed by many composite-decking manufacturers. Check their span tables and/or installation instructions for specific recommendations.



3. A FAIR CURVE DEFINES THE EDGE



Marking the radius. The joists are run long on the side of the deck that will be curved. The radius is marked on each joist by holding a tape at the inside corner and swinging it across that side of the deck.



Angled cuts create the curve. The top marks are carried down across each joist's face, and a reciprocating or circular saw is used to make the cut.



The easiest way to bend a rim. The rim joist is curved by cutting $\frac{3}{4}$ -in.-deep sawkerfs every inch or so along the inside face and then nailing it to each joist as it is bent. Blocking between the rim and the joists strengthens the doubled rim (inset).

DECKING

The decking is the finish that everyone notices, so the material choice, installation, and design are important. First, it should provide a durable finish for the deck.

After years of trial and error, I've decided that capstock composite decking is the best. (Capstock has a thin skin of tough plastic applied to its surface. Capping makes the surface last longer and increases its resistance to staining and fading.) We used Fiberon's Horizon decking on this job, but I also like the capped products made by Trex, Azek, and EverGrain. They cost \$1 to \$2 per ft. more than regular composite decking.

The Fiberon decking is installed with hidden fasteners, which give the deck a clean look. We screwed and plugged the perimeter and accent boards, which couldn't be securely attached with the hidden fasteners.

The homeowners didn't want to see any field joints in the decking, but that meant board lengths would exceed the 20-ft. pieces available. I decided to use a one-board outer perimeter of a darker color, and then run an accent board bent in the same radius across the center of the deck. The accent board provides a clean break in the decking and lends some flair to the field.

1. TRACE THE ACCENT



Template for blocking. The easiest way to locate the blocking for the curved accent is to lay the board in place and mark its position (sidebar facing page).

2. BLOCKING COMES NEXT



Proper support counts. Workers cut and nail blocking on each side of the accent strip to provide a nail base for the decking ends that terminate against the strip.

3. DECKING IS LAID OUT



Diagonal layout starts from the corner. To add visual interest, the decking is installed at a 45° angle. After snapping a reference line at the deck's midpoint, the crew works toward the house, then back toward the hot-tub deck.

4. TRIM CREATES AN ACCENT



A long, careful cut. After the decking is installed and rough-cut to end at the decorative strip, the curved accent strip is scribed onto the decking. The line is then cut with a saw set to a shallow depth.

Low-tech bending techniques

We couldn't kerf the decking as we did the rim because the required bend was across the flat, not the edge. Luckily, we needed to bend only three boards, they were made of plastic, and it was summer. First, I cut a template of the curve from a pair

of 2x12s laid end to end. On a hot day, I laid a 16-ft. length of decking on the driveway. After a few hours, the decking was about 120°F and limp as a noodle. I clamped it between both sides of the template, screwing a brace across the top every few feet. I cooled the board with cold water, bringing down the temperature enough to keep the correct radius in place. I reinforced the curve by keeping the board in a brace until I was ready to use it.



The initial layout line is derived by establishing an equilateral triangle from the inside corner of the house.

First, decking was installed from the layout line toward the house.

Next, the decking was installed toward the hot-tub side of the deck.

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5. WRAP THE PERIMETER



Perimeter goes on last. Once the decking is run past the edge, the perimeter board is scribed in place. The decking ends are trimmed, and the board is installed with screws and plugs.

6. BE SURE TO KEEP DECKING PARALLEL



Don't assume perfection. Despite the fact that the decking is factory-made, the layout can get off track due to inconsistencies in the material and the hidden fasteners. Checking the measurements every three or four boards keeps the layout under control.

MAIN ENTRANCE STAIRS



Because this deck is fairly low to the ground, the stairs were relatively simple. The main entrance stairs are on the radiused side of the deck and are wide enough to be inviting without taking over the entire side of the deck. The stringer spacing for composite decking is 12 in., and I installed six stringers cut from 2x12s. Because the deck has a radius on the side where the stairs are built, the stringers flare slightly outward, creating a similar radius on the risers and treads.

Each stringer is secured to the hanger with galvanized hardware (Simpson A35Z).

A 2x8 header is kerfed to bend along the radius and is attached to 2x6 blocking.

To bend the treads, the stock is left long, attached at one end, and levered along the radius as it's fastened.

PVC risers bend along the stringers' curve.

Stringer ends are tied together with a kerfed 2x8.



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The IRC is very specific about stair construction, and it includes guidelines on stringer size and span, riser height, tread width, and overall dimensions. Be sure to consult the code or your local code official before designing stairs.

SKIRTBOARDS

To give the deck a more finished look, we usually add a screen of skirtboards below the fascia. Here, we used the same decking boards, attaching them with two screws at each end while maintaining a 1/4-in. space between for ventilation. We kept the screws close to the end of each board so that they could be covered with a trim piece later.

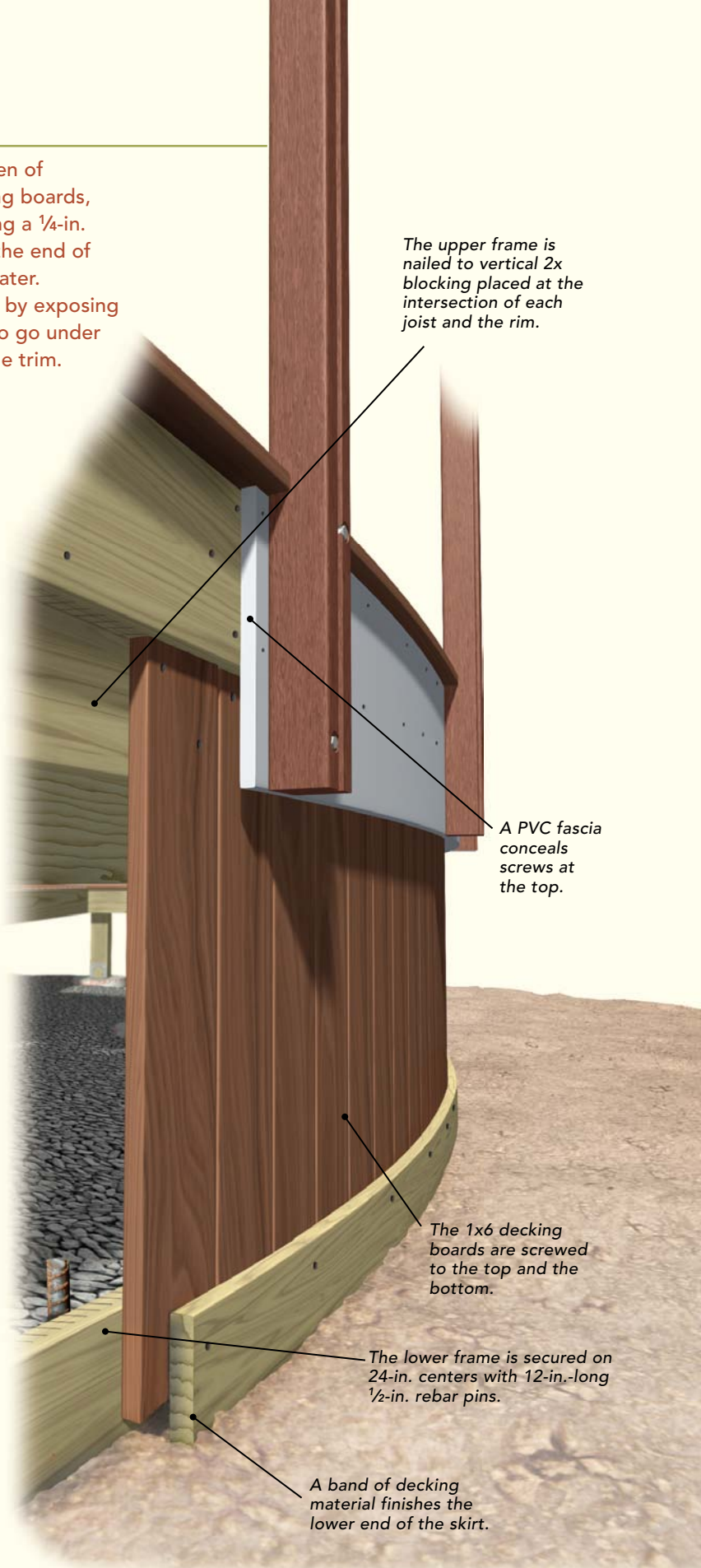
At the corner near the hot tub, we created an access point by exposing the fasteners of the last five boards. If there ever is a need to go under the deck, the boards can be removed without dismantling the trim.



Locating the bottom frame. The skirt frame consists of a kerfed 2x4, top and bottom. After the top 2x4 is attached to blocking, a plumb bob establishes the position of the bottom half of the frame.



Pins determine the curve. The 12-in.-long rebar pins are driven into the ground below the upper frame, and the lower frame is bent around them. The lower frame is secured with more pins driven through pilot holes drilled every 2 ft. along the width of the 2x4.



The upper frame is nailed to vertical 2x blocking placed at the intersection of each joist and the rim.

A PVC fascia conceals screws at the top.

The 1x6 decking boards are screwed to the top and the bottom.

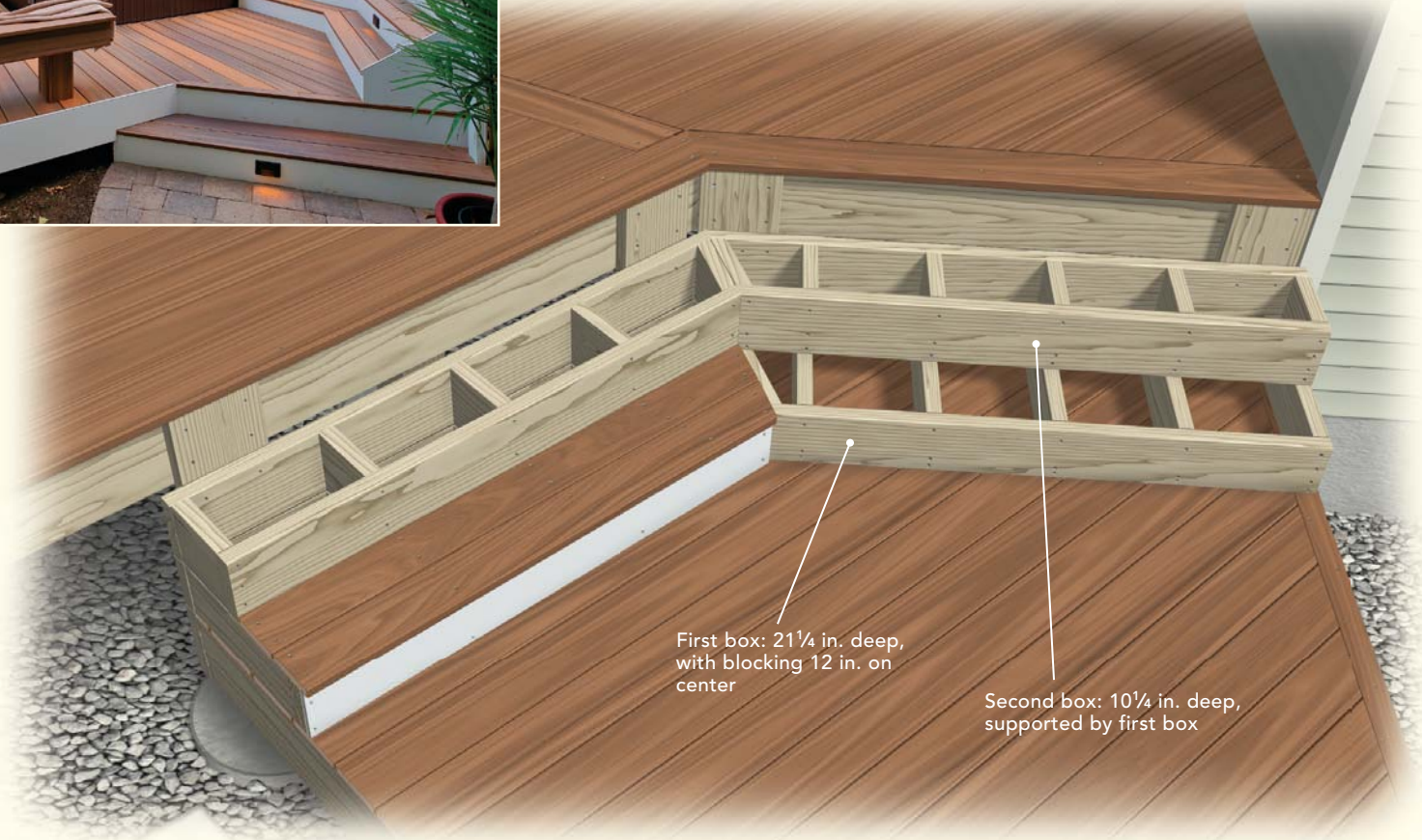
The lower frame is secured on 24-in. centers with 12-in.-long 1/2-in. rebar pins.

A band of decking material finishes the lower end of the skirt.

STAIRS FOR THE LOWER DECK



The three-riser stair that leads from the upper deck down to the hot tub follows the angle of the deck edge so that the transition in height becomes part of the deck. Instead of cutting stringers, we built these stairs as two stacked boxes.



First box: 21¼ in. deep, with blocking 12 in. on center

Second box: 10¼ in. deep, supported by first box



Concealed fasteners. To attach the treads securely without visible fasteners, the crew drills pilot holes before driving screws. Plugs cut from the decking conceal the screwheads.



Squared away. The stairs are a focal point, so it's important to keep the details sharp by aligning the tread ends and miters at the center of the stairs.



A clean finish. Once the treads are installed, the risers are covered with PVC trim, and a skirt of the same material is applied over the tread ends.

HANDRAIL

This handrail consists of 4x4 ipé posts, 2x4 rails, and a 2x6 railing cap combined with balusters and railing brackets manufactured by Deckorator. The railing is 36 in. high, and the posts are spaced at a maximum of 5 ft. For structural

and aesthetic reasons, my designs usually place the railing posts inside the frame. In this design, however, I decided to install them outside to maximize the deck space and to make the installation on the curved portion much easier.

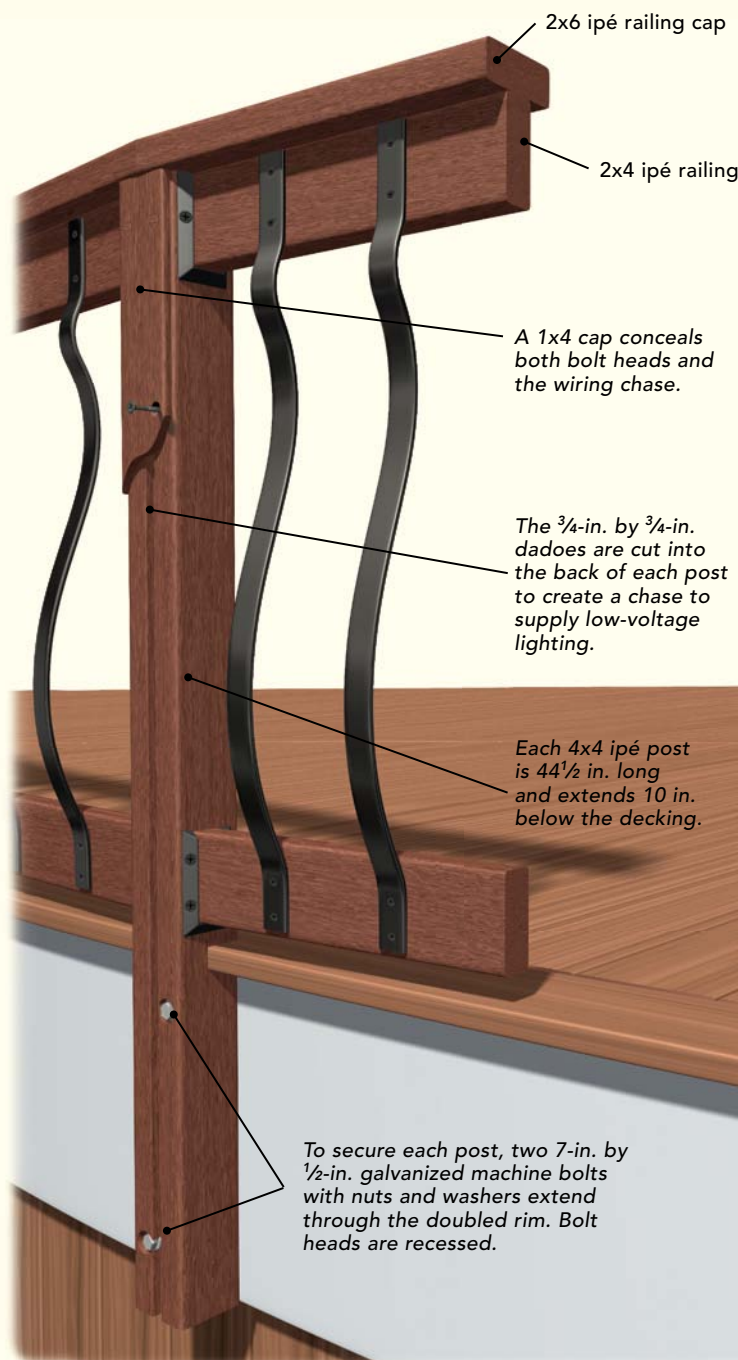
Rail-to-post connection. After bolting the posts to the rim, the crew attaches the railing connectors by screwing them to the ends of each rail, then screwing the assembly to the posts.



Balusters go on next. After using a template to lay out the correct spacing (less than 4 in. between balusters), the crew screws the curved balusters to the top and bottom railings.



Grab rail satisfies code. Here, the 2x6 railing cap is structurally sound but larger than code specifies, so the crew installs a smaller 2x2 grab rail by screwing through its mitered return at each end.



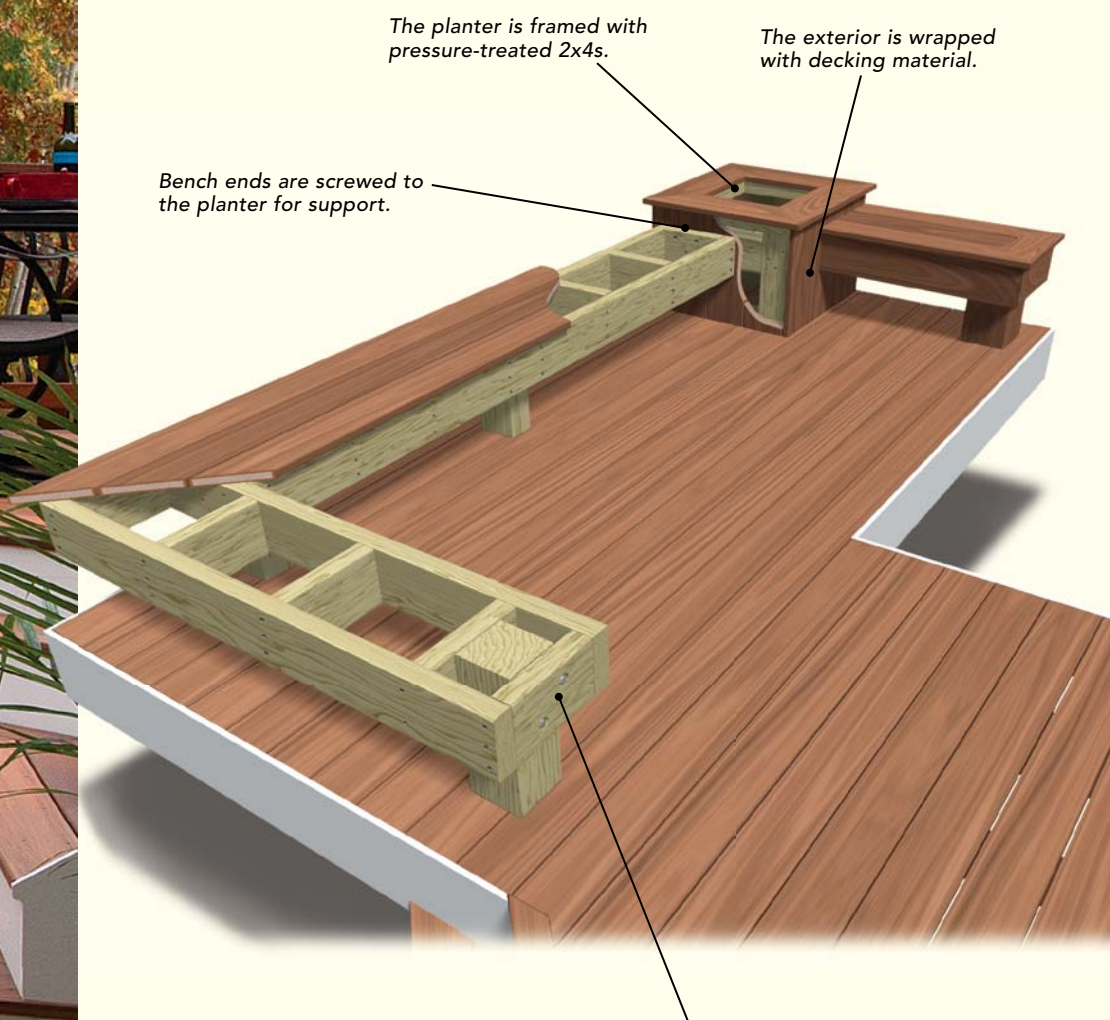
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The IRC requires guardrails when the grade within 36 in. of the deck perimeter is 30 in. lower than the deck. The railings must be 36 in. or higher and should be able to withstand an outward force of 200 lb. per sq. ft. The space between balusters must be less than 4 in.

BENCHES AND PLANTERS

Originally, the design called for a 2-ft. by 2-ft. by 3-ft. planter box in the corner of the lower deck, anchoring the ends of two 20-in.-high benches. After the framing was complete, however, the homeowners were concerned that the height of the planter would obscure the view of the woods from the hot tub. We lowered the planter's height to 2 in. above the benches. At the same time, we decided to add a third bench to create a U-shaped layout.

A waiting room for the tub. Benches on the exposed side of the hot tub make a good place to socialize. Mitered borders and a darker center strip give these benches additional detail.



The planter is framed with pressure-treated 2x4s.

The exterior is wrapped with decking material.

Bench ends are screwed to the planter for support.

The 2x6 pressure-treated bench frame is attached to 6x6 pressure-treated posts with 1/2-in. by 10-in. galvanized bolts.