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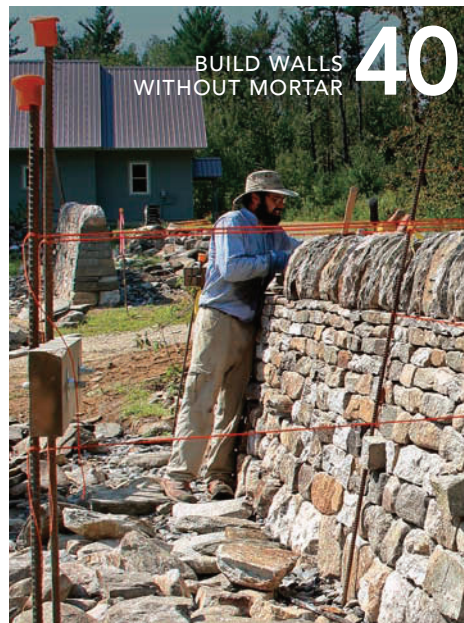
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BY JOE CIARALDI

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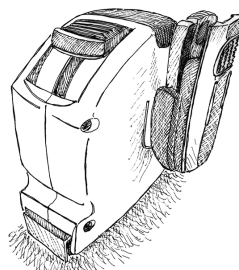
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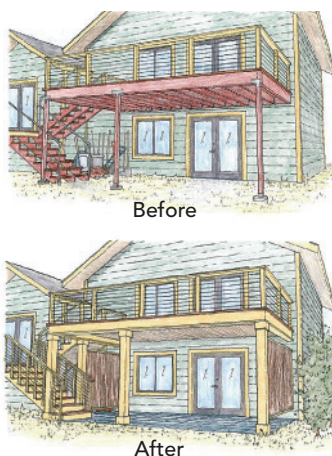
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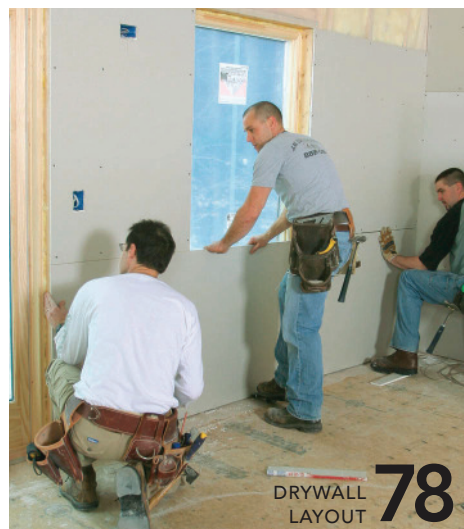
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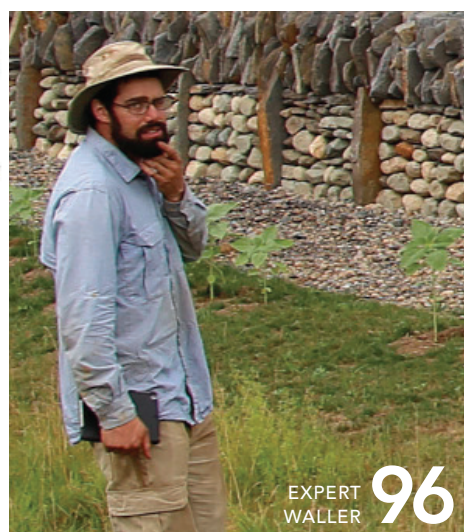
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ON THE COVER *Fine Homebuilding* editor Justin Fink puts the finishing touches on a shop-built cedar pergola. Read about his approach to no-fuss timber-frame-style construction on pp. 30-37. Photo by Rodney Diaz.

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Fresh farmhouse

Photographer Susan Teare offers a look into an elegant farmhouse.



An interview with the editor

Builder Matt Risinger discusses Justin Fink's contrary take on the hot topic of "resiliency."



Special guest: The Energy Nerd

The guys sit down with Green Building Advisor's own Martin Holladay to discuss all things energy efficiency.

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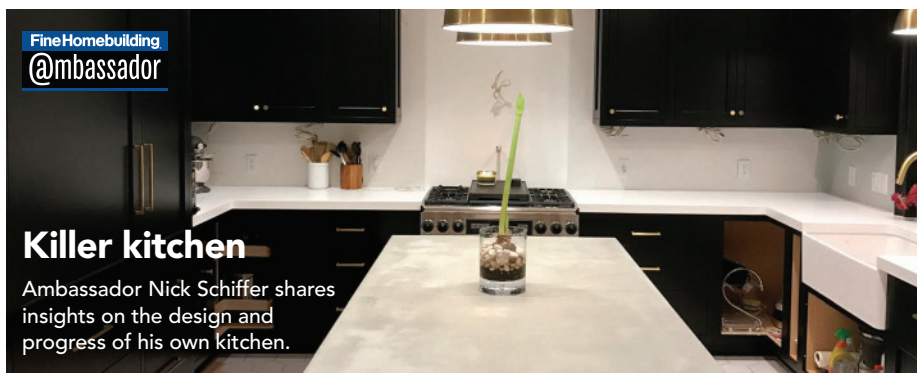
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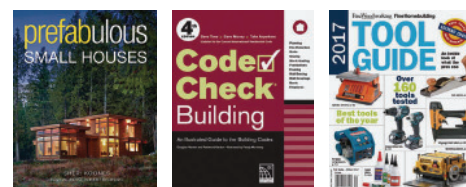
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contributors

THE VOICES OF EXPERIENCE



BRIAN POST ("Stone Walls That Stay Built," pp. 40-45, and "Keep Craft Alive," pp. 96-97) began building dry stone walls at age 10. He is a Master Craftsman-level waller certified by the Dry Stone Walling Association of Great Britain, founder of Standing Stone Landscape Architecture, and executive director of The Stone Trust, a non-profit education center for dry stone walling. Brian splits his time between stacking stones, designing projects, and teaching walling.

Born and raised in Oakland, California, **ANDREW MICHLER** ("Passive House Goes Pueblo," pp. 60-67) found his way to a pine forest in the Colorado Rockies where he has lived off the grid for 20 years. He is a Certified Passive House Consultant, author of *[ours] Hyperlocalization of Architecture*, and designer and builder of the first certified International Passive House in Colorado. He works as creative instigator at NEEDBASED, Inc.



Combining a lifelong interest in plants and nature with his passion for design, **JAMES M. DRZEWIECKI**, Assoc. AIA ("The Groundwork of Landscape Design," pp. 48-53), creates innovative outdoor environments for his clients. An award-winning landscape designer and founding principal at Ginkgo Leaf Studio, James is currently an instructor in the horticulture department at the Mequon Campus of Milwaukee Area Technical College.

RUSSELL HAMLET started his firm Studio Hamlet Architects in 2004 to focus on small design-oriented homes. He takes pleasure in the construction and expression of how parts and materials come together, and he appreciates the dedication and craftsmanship of all those who are committed to building quality projects. Russell believes in the philosophy, "It takes a team to realize a dream." In this issue, he writes about making a room under a deck (pp. 92-95).



write an article

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PHOEBE SCHENKER.

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Much more than a magazine

Soon after I took leadership of *Fine Homebuilding Magazine*, I found myself changing the way I talked about this brand. I began to drop the word “magazine,” and started referring to what we do as “content” rather than “articles.” This shift in language is subtle, but represents a substantial expansion in *Fine Homebuilding’s* focus. We aren’t just a magazine anymore.

At a time when other publications are shrinking and struggling, *Fine Homebuilding* continues to expand. Last year, in addition to providing our usual magazine content, we made time to redesign and relaunch FineHomebuilding.com, create a popular weekly *Fine Homebuilding* podcast, build our first ProHOME demonstration house (FineHomebuilding.com/prohome), launch the Keep Craft Alive movement (keepcraftalive.org) to celebrate craftsmanship and raise awareness of careers in the trades, and sign on a group of talented ambassadors who embody the *Fine Homebuilding* brand. I’m proud of what our small staff has accomplished in the span of a year, but we’re just getting started.

The first big change for 2017 is an internal one. To keep up this momentum and better position us to shepherd new initiatives, I’m shifting my focus to finding and developing new ways to give you the best building content possible, and I’m turning over the day-to-day operations of the magazine to Justin Fink. Fans of *Fine Homebuilding* will already be familiar with Justin’s work in print, as a voice in many of our videos, and as the host of our podcast. I challenge anyone to find an editor who is better versed and more engaged in their publication’s subject matter. His combined experience on job sites and creating content make him an ideal choice for the editor position, where he will continue to bring a level of understanding and a commitment to quality that you’ve come to demand from this brand.

Stay tuned—it’s going to be another exciting year for *Fine Homebuilding*.

ROB YAGID
editorial director
@Rob_Yagid

The Passive House debate continues

In *FHB* #265, I was frustrated by Martin Holladay’s “How much insulation is too much?” and his dogged insistence on reducing the question of Passive House to one of cost effectiveness. I don’t deny that it should be a serious consid-

eration, but should it be the deciding factor? Some of us build Passive Houses because it’s a phenomenal technical challenge and because it’s reassuring to know that our energy costs will always be a tenth of most of the homes built today. But we also do it because it’s good for the planet. Sometimes


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—JUSTIN FINK
editor

doing the right thing isn't the most affordable thing.

—SARAH COBB
via email

Senior editor Martin Holladay replies: As you point out, homeowners often make decisions based on factors other than cost-effectiveness, and that's appropriate. That said, even Wolfgang Feist, the developer of the original Passivhaus standard, understands that at some point (R-60? R-80? R-100?) thicker insulation can no longer be justified.

I'd like to make two other points. First, installing uneconomic levels of insulation may not be our best response to the climate-change crisis, if these expensive levels of insulation make other, more cost-effective investments impossible. Second, the argument that your

did not comply with modern energy codes.

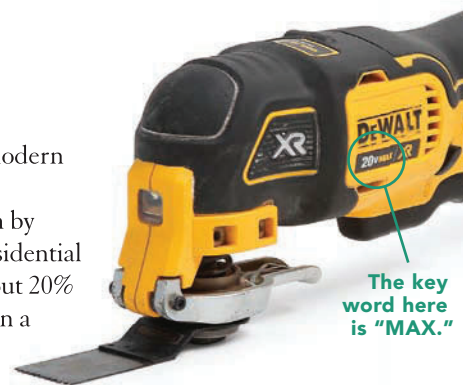
According to research by Marc Rosenbaum, a residential energy expert, only about 20% of the total energy use in a net-zero-energy house is devoted to space heating and cooling. Moreover, United States energy codes are far more stringent than they used to be, so most new American homes—even those that make no attempt to comply with the Passive House standard—use far less energy for space heating than the older German homes that Feist used as a benchmark in the 1990s. That's why a new Passive House building will use much more than one-tenth as much energy as a comparable code-minimum building.

Is it 18v or 20v?

In *FHB* #265, the Tool Test article is titled "18v Cordless Multitools." Yet the winner of Best Overall and Best Value is a DeWalt 20v tool. Was this tool chosen because the author was unable to find an 18v here in the United States? I have an arsenal of DeWalt cordless tools but the one tool I cannot find domestically is the 18v multitool. It is widely available from European tool-seller sites. Am I looking in the wrong places, or is it really not available here?

—STEVE KLEEBERG
Livermore, Calif.

Assistant editor Patrick McCombe replies: First, it's important to clarify that the DeWalt 20v MAX multitool is indeed an 18v tool. DeWalt's 20v description refers to the battery's maximum voltage, which occurs only briefly when the battery is freshly charged. If you're looking for a multitool that accepts



The key word here is "MAX."

DeWalt's older 18v tower-style battery, it's not offered. In fact, the tool you see on European tool suppliers' websites is the same tool as the one we tested, but in Europe the tool is described as 18v instead of 20v due to different regulations.

Tracking down solids content in paint

"Paint problems and how to solve them" (*FHB* #264) was interesting and informative, but what I don't understand is the relationship of paint content as explained in the sidebar on p. 69. The dialogue states that paint with a higher percentage of solids is preferred, but where in the percentage of contents do the solids reside?

—WILLIAM CHORNEY
via email

Sharon Kraus from the Dow Chemical Company replies: Solids content is mostly driven by the pigment and binder, which account for a majority of the volume in a paint can aside from water. For example, a paint can with 60% water, 20% pigment, and 20% binder/additives in its formulation will have a lower solids content than a can of paint with 40% water, 25% pigment, and 35% binder/additives in its formulation. It's worth noting that a higher solids content does help facilitate a thicker dry film for better hiding and durability, but higher solids doesn't always guarantee the best paint—no single ingredient assures top quality.

"The argument that [Passive House] energy costs are a tenth of most of the homes built today is based on a myth."

energy costs are a tenth of most of the homes built today is based on a myth. The statement is a warped version of a claim that was made by Feist in the 1990s: namely, that the heating energy costs (not the total energy costs) of a Passive House would be one-tenth of the heating energy costs of an older German building that



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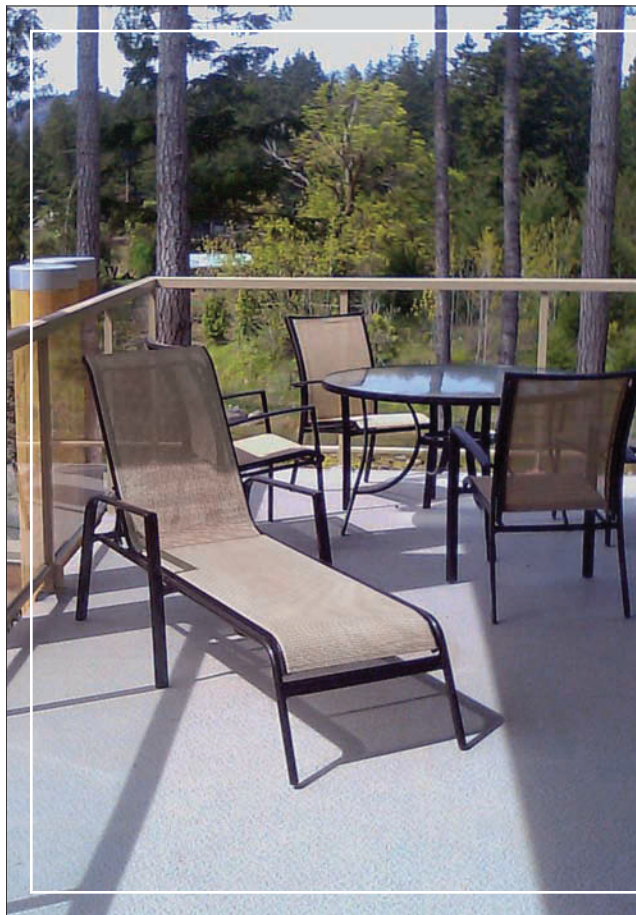
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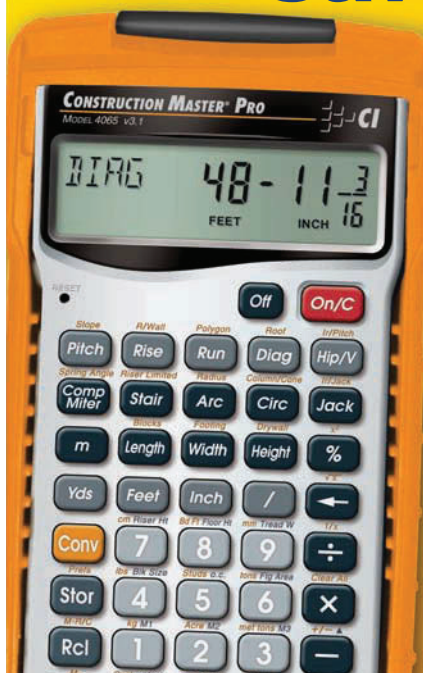
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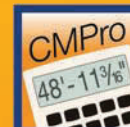
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I love my 12-in. dual-bevel sliding compound miter saw, but I don't love carrying it. The saw weighs 65 lb., and as a remodeling contractor I often face a long trek from my truck to wherever I'm setting up shop for the day. On a recent job, I was trying to muster the gumption to pick up the saw when I spotted a nylon cargo strap in the back of my truck and had an idea. I adjusted the strap to about 5 ft. and slung it over one shoulder. Then I slipped the strap's hooks into the handholds on either side of the saw's table. When I picked up the saw, my shoulder bore most of the weight and my arms just had to steady the load. Way easier. Now I use the strap all the time.

—CHRIS GREEN
New Milford, Conn.



Keeping the cord safe from the belt

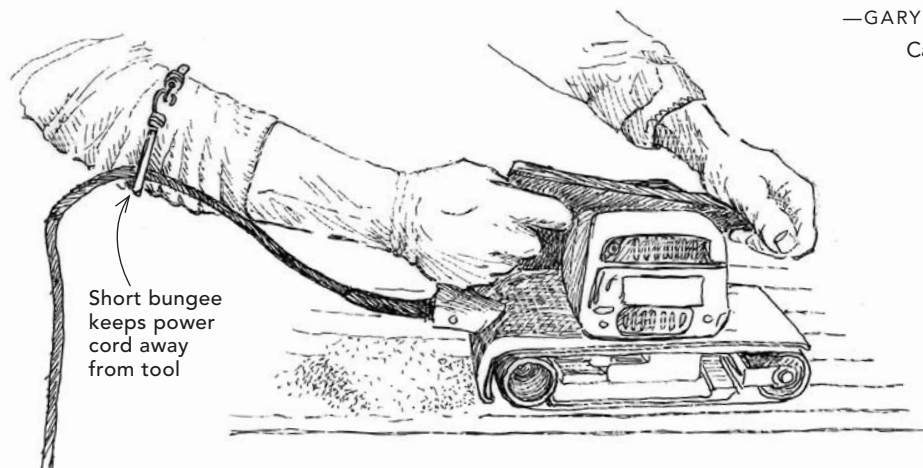
While it is a powerful and useful tool, a belt sander also has many ways of bringing out some of your most colorful language. One of the most annoying ways is when, in spite of a constant struggle to keep it out of the way, the machine's power cord makes brief contact with the spinning belt and gets sucked up into the belly of the beast.

Stopping to repair or replace a chewed-up cord is not helpful for hitting deadlines. Plugging the sander in

behind you and keeping as much wire as possible off the bench helps, but the last foot or so where the cord enters the sander has to be free to move, and is therefore the most vulnerable to damage.

To keep it moving with the sander out of the way, I just lash the cord to my arm near the elbow using a short bungee. It slips on and off easily when it's time to walk away from the bench, and it keeps the cord right where it's needed.

—GARY WILLIAMS
Campo, Calif.



submit a tip

Tips & Techniques is a forum for readers to exchange information about methods, tools, and jigs they've devised. We'll pay for any we publish. Send details to Tips, *Fine Homebuilding*, P. O. Box 5506, Newtown, CT 06470-5506, email them to us at FH@Taunton.com, or upload them to FineHomebuilding.com/reader-tips.



DOGS DROOL

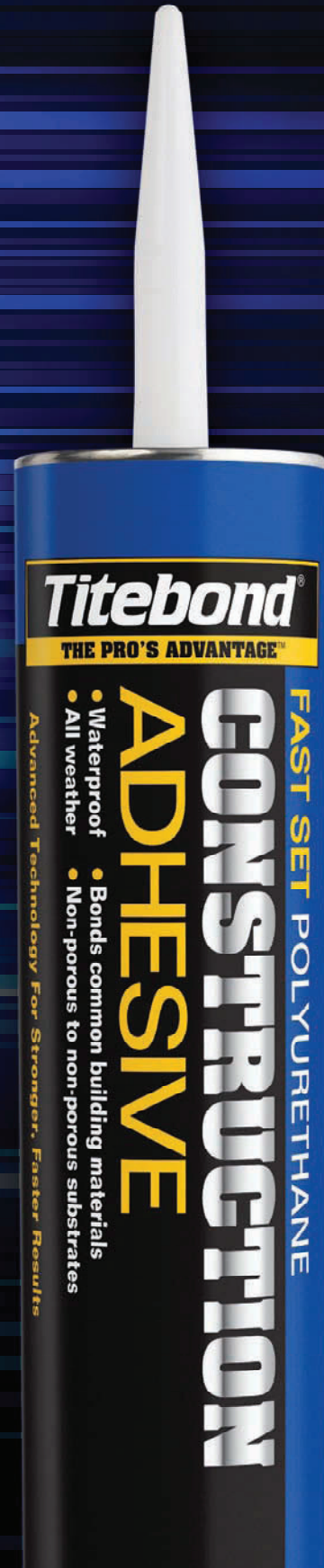


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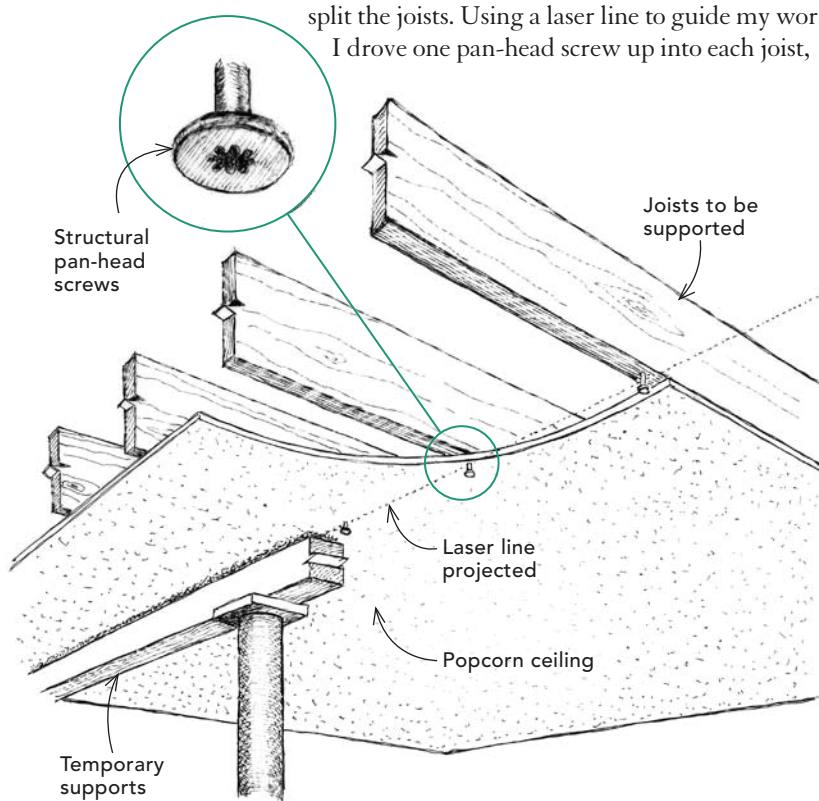
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Preserving the popcorn in textured ceilings

The problem I run into on lots of remodeling jobs where I'm retrofitting a header, replacing a header, or dropping in a beam is that the temporary walls that must go up to support the overhead joists can crush the popcorn in textured ceilings. Trying to patch and match existing textured ceilings is not a lot of fun, so years ago I started playing with the idea of somehow padding the top plate of the temporary walls to solve the problem. I tried a foam sill-sealing gasket as a means to cushion the connection, but it didn't help much. I decided to try FastenMaster HeadLok structural screws as standoffs.

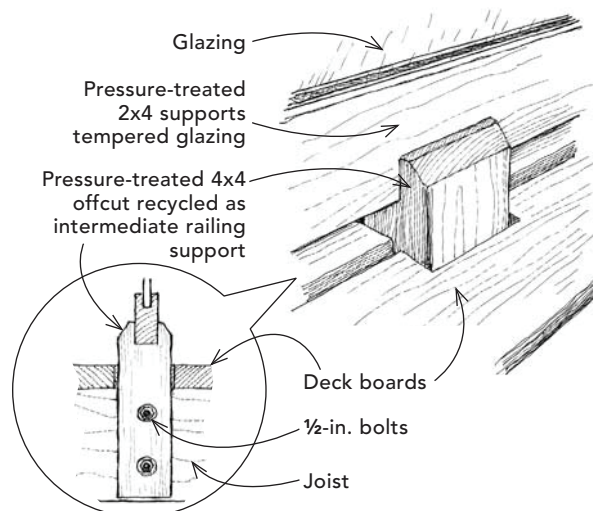
First, I located the joists to be supported and verified their centerlines so the large structural screws wouldn't split the joists. Using a laser line to guide my work, I drove one pan-head screw up into each joist,



holding a scrap of 1x as a depth gauge so each screw head would protrude the same amount from the popcorn ceiling drywall. Then the top plate (this could be a 4x4 or 6x6 if you're using screw jacks instead of building a stud wall) presses up against the pan heads rather than crushing the popcorn.

When the job is done and the temporary supports removed, I back out the screws, I spackle or caulk the holes, and I'm out the door.

—JUSTIN FINK
Plainville, Conn.



Using leftover pressure-treated lumber

When building my deck, I had some short 4x4 pressure-treated offcuts. To help reduce waste and alleviate environmental concerns when disposing of pressure-treated lumber, I found the short 4x4s made excellent intermediate supports for the tempered glass balustrade. I notched the ends to receive the frames and cut chamfers on the edges to make strong and attractive deck elements that saved the cost of buying commercially-made brackets.

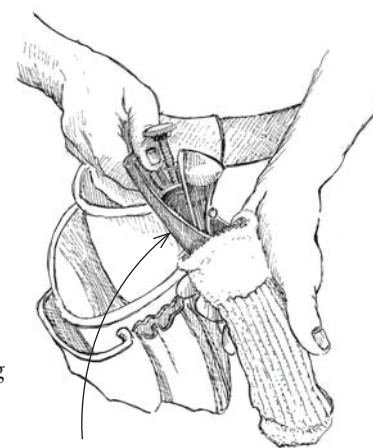
—ROBERT GUNN
Mississauga, Ont.

A block plane in a tool pouch

I often carry a block plane in my tool pouch when doing siding and trim. But carrying the plane in a pouch comes with risks—the blade can easily be dulled by rubbing up against other tools sharing the pouch or I could shave off a few layers of skin blindly reaching into the pouch's dark recesses. While I can retract the blade into the mouth between uses, that takes time.

Instead, I sheath the plane in an old sock before dropping it into the pouch. The plane slides out of the sock quickly, and because the blade is not retracted, it's ready to go to work without adjustment. Thick socks work best, but thin ones are serviceable if you fold them over for double coverage.

—MICHAEL HAYNES
Coventry, R.I.



Store the block plane in a thick sock before it goes into the tool pouch.

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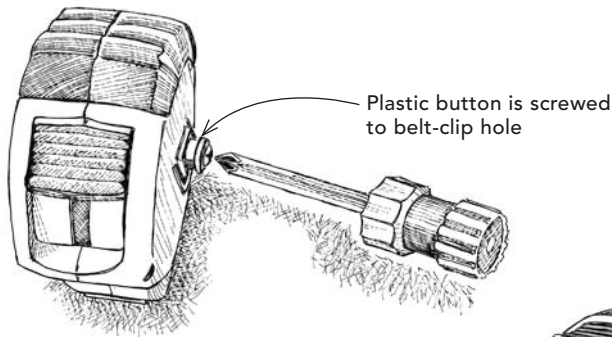
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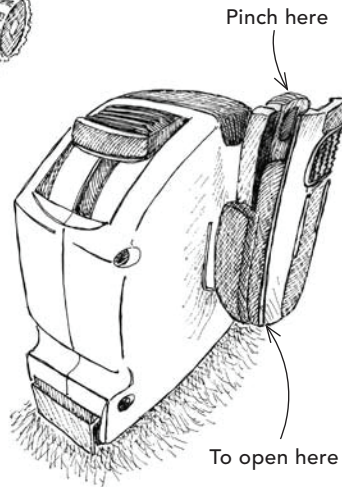
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Swivel belt clip for measurements

When working in the shop or on small jobs, I usually don't wear my tool belt. I just clip my tape measure to my belt instead. But sometimes it can be difficult to find the edge of my belt or pants, or the tape doesn't clip all the way and falls off. To solve this problem, I bought a swivel belt clip like the kind used with cell phones. I took the clip (held on by one screw) off my tape and replaced it with the round tab that comes with the swivel belt clip as shown in the drawing. Then I attached the swivel belt clip, and now it's much easier to remove and secure my tape measure to my side. These belt clips can be found on Amazon for about \$10.

—TIM ROACH
Virginia Beach, Va.



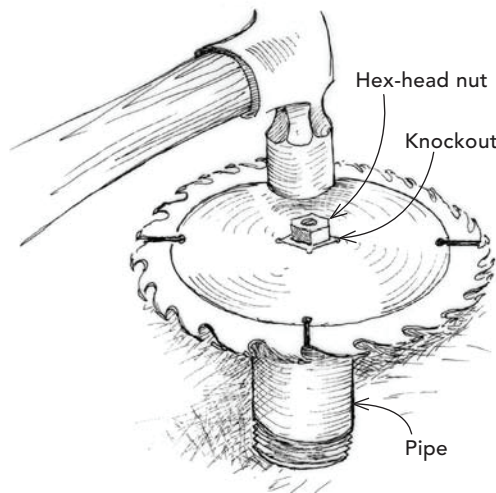
TIP FROM THE ARCHIVES

Removing a sawblade knockout

Several years ago, after watching more than one 7¼-in. circular saw blade mangled and bent by apprentices using framing hammers to beat the knockout from the center, I came up with the method illustrated here. I noticed that the angles on a hex-head nut (or bolt head) were the same (135°) as those on two sides of the knockout. The key to this trick is finding a nut or bolt that is between ½ in. and ¾ in. in size.

Place the nut on the knockout so that their sides are parallel, as shown in the drawing. Center the blade over a short length of pipe, and give the nut a whack with a hammer. The nut delivers the force of the blow exactly where you want it.

—GLENN HOLLOWELL
Cordova, Alaska



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How Can a Toilet System Help Combine Modern Convenience with Traditional Style?

The Lyke home – a 3,500-square-foot contemporary home completed in 2012 – is located in the upscale historic neighborhood in Houston called The Heights. It's a home that pays homage to tradition while giving the homeowners the design that accommodated their busy personal and business lifestyles.

The main section of the residence looks like the typical three-bedroom, three-and-a-half-bath home. Upon closer inspection, however, there is an artist's studio and a separate structure that functions as a hair salon business. With an ADA-compliant bathroom required to make the bathroom accessible for clients of the salon, Geberit became the system of choice. The Geberit system meets ADA requirements and offers the aesthetic richness of a clean, modern

look the homeowners were looking for. "I always wondered why residential construction in America did not use wall-hung toilets like I see in European hotels and occasionally in commercial applications in America," said homeowner Robert Lyke. "They are cleaner, quieter, and more attractive, and they take less space and maintenance."

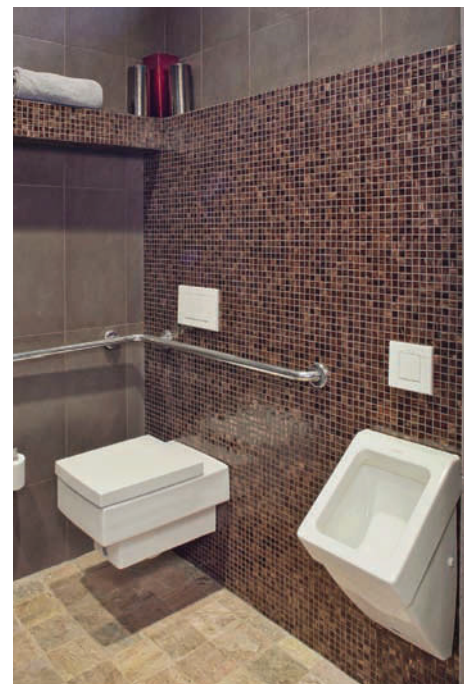
Solution: Geberit

With millions of installations throughout the world, the message was clear: Geberit in-wall systems allowed unique design without reductions in reliability, performance, installation flexibility, and maintenance. Taking the toilet off the floor changed everything.

Geberit in-wall systems offered one way to combine modern convenience with traditional style in bathrooms throughout the Lyke home, where a total of five wall-hung toilets, as well as a urinal, were installed. The salon powder room does double duty: it serves the pool area and is set up as a wet room with a shower. The wet room concept works well with wall-hung fixtures, which keep the entire floor clear for easy cleaning. The low-flow, earth-conscious aspect of the dual-flush toilets was a bonus. Every Geberit toilet system comes with dual-flush built in.

When the Houston chapter of the American Institute of Architects chose the Lyke residence as one of the stops on its home tour open to the public, Greg Swedberg, principal of 2Scale Architects, predicted that the Geberit Concealed Tank and Carrier System with wall-hung fixtures would be one of the most asked-about design components in the home — and he was right. Geberit in-wall systems captivated visitors to the home, just as they had caught Swedberg's eye from the start.

To learn more about how builders, architects, and designers are solving special bathroom construction problems with the help of Geberit, call 866-787-3924 and ask for a copy of *Inspire*, our reference projects magazine. Or visit Geberit on the web at → geberitnow.com/inspire

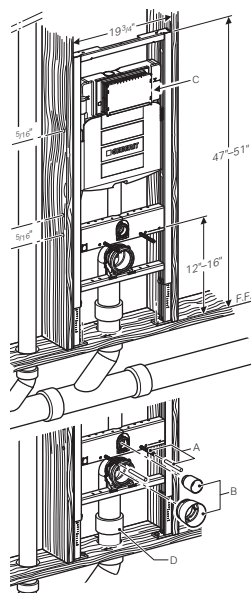


↑ The Lyke Home includes five Geberit in-wall systems for toilet and urinal.

↓ Geberit Toilet Systems give builders tremendous flexibility for their clients, offering benefits like easy cleaning and more clear space in the bathroom.



Easy Installation a Key Benefit

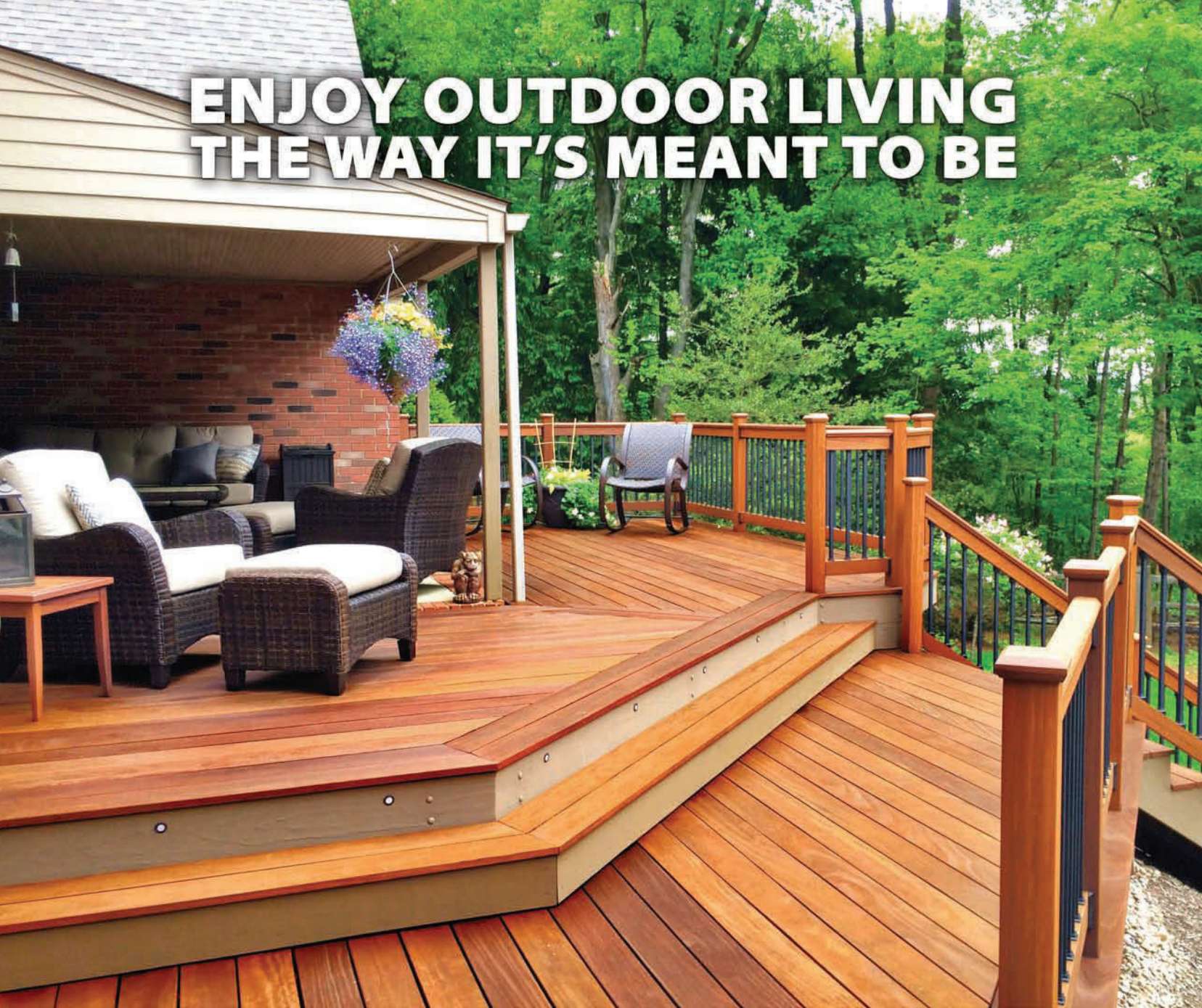


A Install 1/2" rods with plastic sleeves.
B Pipe plugs and
C mud guard during the rough-in installation
D Complete waste elbow connection with 3" DWV shielded coupling (D - provided) to waste pipe.

One of the benefits builders find attractive about the Geberit system besides its aesthetic appeal is the ease of installation and maintenance. The product ships complete with everything the builder needs. For example, installing the tank and carrier is simple because it's all one unit. After locating the carrier within the stud with the face plate flush with the front of the surrounding studs, anchor and bolt hole locations

are marked, as well as the location for the 3" DWV discharge pipe. Then the system is removed, holes are drilled, and a 4" hole is bored through the sole plate and floor to accommodate the discharge waste pipe. Once the discharge is installed through the floor and connected to the waste line, the system fits back into the framework and bolts in place.

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QUICK HITS FROM THE BUILDERS' SHOW

This year's International Builders' Show and Kitchen & Bath Industry Show, held jointly at the Orlando Convention Center in January, revealed a number of useful building products and tools. Here are some of my favorites.

Patrick McCombe, Associate Editor



Guilt-free foam

Despite its excellent air-sealing potential and high R-values, one downside of most closed-cell spray foam is the global warming potential (GWP) from commonly used HFC blowing agents. Lapolla's Foam-Lok 2000-4G uses Honeywell's Solstice blowing agent. With a GWP of 1 (equivalent to CO₂), its GWP is hundreds of times lower than the competition. The foam can also be sprayed in 5½-in. lifts, making it a faster installation in 2x6 walls—and installation cost is said to be the same.



Faster roof framing

Skip the agony of installing hurricane ties with FastenMaster's FrameFast screw gun. The corded driver makes a code-approved connection between trusses (and rafters) and top plates with a 6-in. structural screw. An alignment fork nests against the truss sides to ensure the screw is in the right spot and an extended housing eliminates ladders and staging. The driver sells for \$549 and screws go for between \$0.60 and \$0.40 each depending on quantity.





Far better abrasive

In the 15 years I've been writing about tools and building products, I have never seen a product demonstration as jaw-dropping as a 3M Cubitron II grinding disc wearing away a $\frac{3}{8}$ -in. by 3-in. stainless-steel bolt to nothing in about 10 seconds. The new ceramic grit is mind-blowing in its speed and durability. You'll find the new abrasive on belts, discs, grinding wheels, and cutting wheels. Prices are competitive with traditional abrasives.

Connectors you don't conceal

Ordinary metal connectors can really detract from an otherwise attractive outdoor structure, so Simpson Strong-Tie has introduced its Outdoor Accents line of metal connectors to combat this issue. The black powder-coated connectors have a zinc base layer for increased corrosion resistance. Each connector includes matching structural screws and oversized washers that help the assembly look like a bolted connection. Expect to pay 10% to 20% more for Outdoor Accents vs. regular galvanized connectors.



Self-cleaning toilet

I have yet to meet anyone who gets excited about cleaning the toilet. According to American Standard, their new Acticlean self-cleaning toilet eliminates routine cleaning. With 1-minute and 10-minute cycles, the maker claims the on-board cleaning fluid sanitizes and removes stains, even under the rim. The toilet also boasts the best possible flush rating (1000-g MaP score) and a 1.28-gal. flush. Prices start at \$350.



Capable Caulk Gun

I have been using Cox's model 41004-2T high-leverage caulk gun (\$40) for five years now and I wouldn't go back to an ordinary caulk gun. The Cox has double the mechanical advantage of most caulk guns, so even in cold temperatures you can easily squeeze out a uniform bead of polyurethane sealant. There are two other features you won't find on most guns: an ABS cage that prevents dropped tubes during loading and a swivel that allows you to rotate the tube tip while the plunger is extended. The latter feature is especially handy as it eliminates the need to contort the whole gun (and therefore your hand and shoulder) in awkward positions. The only downside: the standard Cox gun takes 27 squeezes for the plunger to travel the full length of the cage, so it's not ideal for dispensing large volumes of material quickly, like warm subfloor adhesive. Otherwise, it's an exceptional tool that I recommend without reservation.

Steve Smith, a remodeler in Seattle



Photo this page: courtesy of COX

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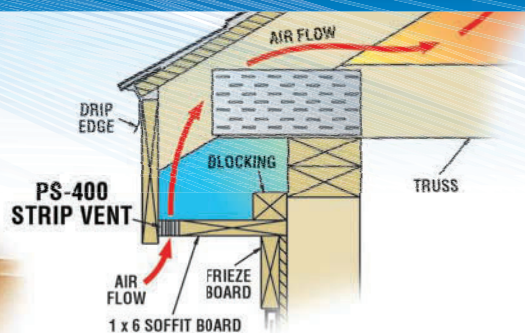


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Ear-Protecting Earbuds

Plugfones are in-the-ear hearing protectors that allow you to listen to audio (and one model even allows phone calls). All of Plugfone's products have a noise reduction rating (NRR) of 25.

The basic model (\$25) has a standard 3.5-mm jack and a 48-in. cord and includes silicone and foam tips. The tips fit over a plastic post on the end of the wire and can be removed for cleaning or replacement. I prefer the silicone tips because they fit better. When properly seated, the tips block as much sound as most in-the-ear plugs that don't have audio capabilities. The VL model (\$30) is similar to the basic version, but limits audio to 82 db. to prevent hearing damage.

If you want to cut the cord, you'll want the Liberate model (\$99), which is a set of earplugs attached to a small Bluetooth control



The basic models (\$25) are available in five colors.



The VL model (\$30) limits audio to 82 db.



The Liberate model (\$99) pairs with Bluetooth to your device.

module charged by a proprietary USB charger. The unit pairs easily, runs for about eight hours, and has reasonably good range when the media device isn't with you. It's available with or without a telephone microphone. The mic works well when it's close to your mouth, but the clarity is poor when the control module is on the back of your neck. I like Plugfones because they supply comfortable, effective hearing protection and they're reasonably priced.

David Frane, a remodeler in Alamo, Calif.

Photos this page: courtesy of Plugfones

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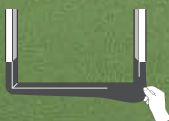
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A man in a white long-sleeved shirt and tan pants is standing on a green step ladder, working on the roof of a wooden pergola. He is using a yellow power drill to secure a wooden beam. The pergola is made of light-colored wood and has a series of horizontal beams forming the roof. It is situated in a yard with a house in the background and trees. The ground is covered with gravel.

Build a Gateway Pergola

This cedar structure combines the look of traditional joinery with contemporary lines—all built with simple techniques

BY JUSTIN FINK

When my friend Brian started talking about building an outdoor structure to create a threshold between his short gravel parking area and the front yard of his house, it was clear that a large pergola would be the ideal solution. Set atop a timber retaining wall and flanked by plantings, the pergola would create an informal, open gateway.

But, like any other widely available, mass-produced outdoor structure, store-bought pergolas have begun to suffer from inelegant designs, subpar materials, and haphazard assembly methods that place a high value on convenience at the expense of durability. I

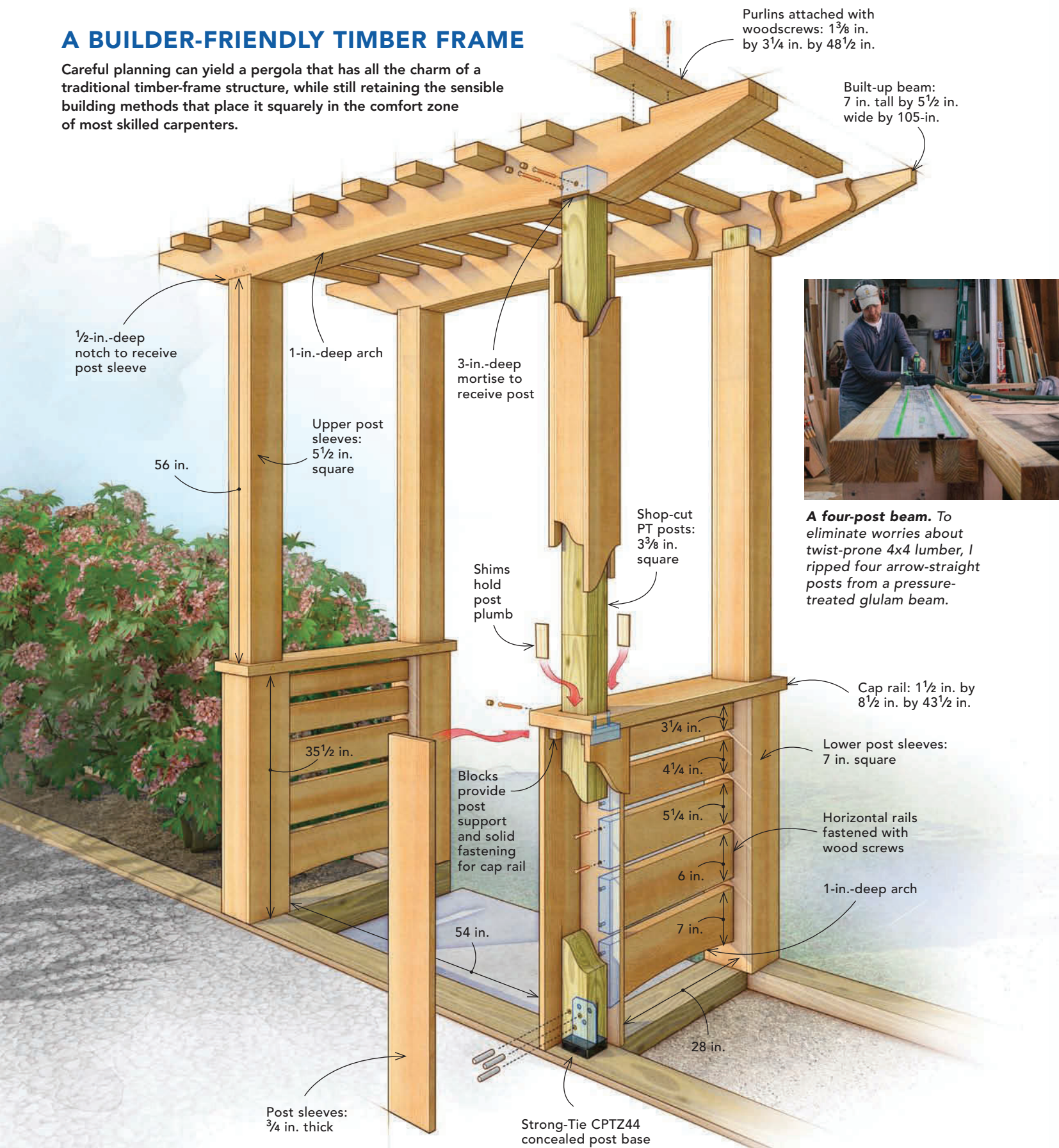
knew we could do better, so we set out to design a custom alternative. The design we came up with reflects Brian's contemporary, Asian-inspired taste, and could be built by anybody, regardless of whether they have access to the large timbers or specialized tools needed to erect a true timber-frame structure.

Start with a style in mind

The pergola would become the first thing seen and passed through on the way to the house, so it needed to mesh with the architectural style of the home, which had been remodeled to have a somewhat contem-

A BUILDER-FRIENDLY TIMBER FRAME

Careful planning can yield a pergola that has all the charm of a traditional timber-frame structure, while still retaining the sensible building methods that place it squarely in the comfort zone of most skilled carpenters.



A four-post beam. To eliminate worries about twist-prone 4x4 lumber, I ripped four arrow-straight posts from a pressure-treated glulam beam.

Explore the pergola in SketchUp
Download a full-scale SketchUp model of this pergola at FineHomebuilding.com/extras.



BUILT-UP BEAMS

Unlike solid 6x8 cedar, shop-laminated cedar beams allow the individual plies to be cut and curved without a large bandsaw or timber-framing tools.



The curve comes first. After aligning the 1/4-in. plywood router template to the top edge and centerpoint of the 2x beam ply, mark the curve and cut wide of the line with a jigsaw.



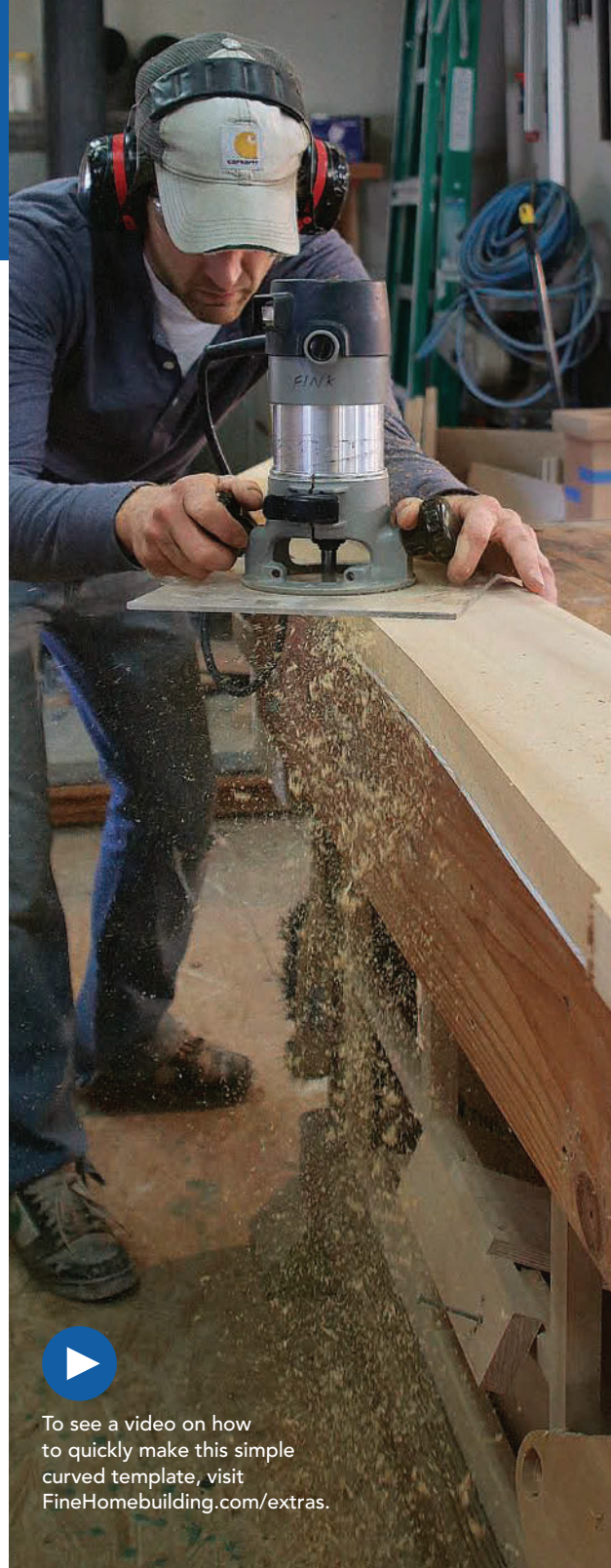
Tapers with a tracksaw. With the curve marked, lay out the rest of the beam with a framing square before cutting the tapers on either end of each ply with a track-guided circular saw.



Blunt the beam ends. After cutting all the tapers, remove the point of each beam ply. These cuts don't have to be exact, as they'll get cleaned up after the plies have been laminated.



Bearing-guided cleanup. After rough-cutting each 2x, realign and attach the template with double-stick carpet tape, then set the depth of a spiral-cutting, bearing-guided router bit to ride on the edge of the 1/4-in. plywood.



porary exterior—lap siding mixed with vertical siding, paint mixed with natural wood, and several levels of landscaping, hardscaping, and attached structures. The look leans towards an Asian aesthetic, which also happens to be the basis of the Arts and Crafts style. So, it made sense to build on this concept by including the look of traditional mortise and tenon joinery and clean, square edges. The contemporary feel came into play with the incorporation of some Asian design elements—subtle curves, recessed purlins, and crisp horizontal lines—which became a good opportunity to deal with crucial issues of

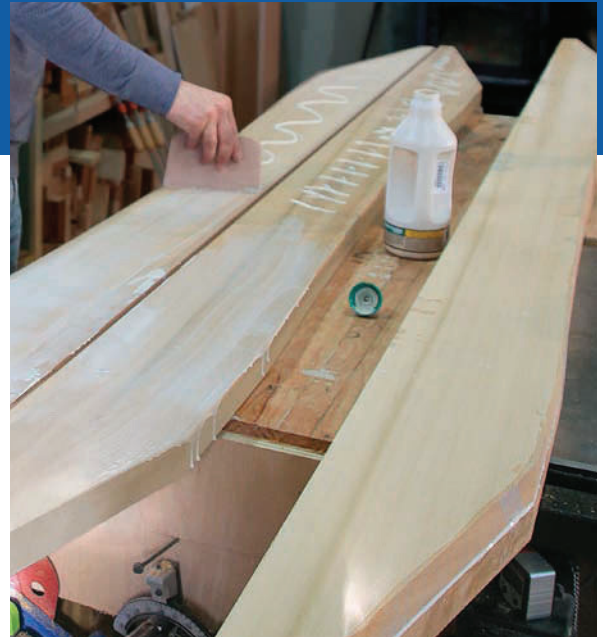
proportion. Because the space demanded a fairly large structure, we worked hard to keep it looking well rooted with a sleek, airy feel for the upper portion, flowing down to a substantial base.

Materials and methods that make sense

A conventional solution for building a post-and-beam-style pergola like this one would be to use—you guessed it—solid wood posts and beams. But solid timbers require traditional joinery, and that means lots of time spent on mortises. This wouldn't be a dealbreaker on



Rip the remainder. Set the tablesaw fence to a 7-in. rip cut to trim the excess from the bottom of each beam ply, creating flat spots where the posts will later meet each assembled beam.



Don't be shy with the glue. Spread a thick coat of exterior wood glue—as much for sealing the wood between pieces as it is for adhering them—across both mating surfaces before joining the pieces and securing them with screws every 4 in. around the perimeter.



Clamps assemble pairs. After the glue holding each pair of plies has set, back out the screws used to clamp the pieces, then glue and clamp pairs together with screw holes facing inward where they will not be seen.



Sand and shape. Don't fuss over perfect alignment during glue-up. Use 10 minutes and some 80 grit sandpaper for the inevitable task of blending and smoothing seams.

a simple four-post, two-beam pergola, but our design included five horizontal rails that would need to be mortised between pairs of posts, upper posts of different dimensions than the lower posts, and a wide cap rail on each side that would have to tie into the posts with through-mortises.

Although it didn't offer much cost savings (cedar is expensive no matter how you slice it), I set aside the idea of solid posts and beams and instead opted to laminate more commonly available 2x cedar to create the top beams, which I then set atop pressure-treated posts

wrapped in 1x cedar. This approach allowed me to install the rails faster, eliminated worries about tying the cap rails into the posts, simplified the required tools and the process of shaping the curved beams, and gave me complete control over the apparent width of the posts, which could now run uninterrupted from base to beam.

Choosing a material for the structural posts was a challenge, though. Any builder who has worked with pressure-treated 4x4s knows they are prone to twisting, and that movement would wreak havoc on this assembly. In an effort to find a stable, rot-resistant, affordable solu-

TIMBER-FRAME-STYLE JOINERY

With the help of some common power tools, you can add the feel of timber-frame joinery to the beams without too much traditional fuss.



Notches for post sleeves. Use a simple router template to guide a router collet and mortising bit, creating notches where the upper post sleeves will attach to the beams.



Forstner followed by a chisel. The fastest low-tech method for making deep mortises is to drill holes with a Forstner-style drill bit, then remove the waste with a chisel and mallet.



A dado for each purlin. After taping each side of the beam to prevent tearout, make a series of parallel, circular saw cuts to rough out a dado for each purlin, which are then quick and easy to knock free with a hammer or bend and break with a chisel or pry bar.



Bearing-guided cleanup. With the bulk of the waste out of the way, smooth the bottom of each dado with a bearing-guided bit, which rides along the shoulders of the cutout to get tight into the corners.

tion, I ordered a pressure-treated glulam beam from my lumberyard, which I then ripped into four arrow-straight posts that would be far less likely to twist.

The posts would be secured to the timber retaining wall via 4x4 post bases, but in order to ease this process I chose Simpson Strong-Tie CPTZ44 concealed post bases that use metal through-pins installed from one side rather than the traditional post bases that require nails or screws driven from two sides. This meant I could assemble most of the wrapped posts in the shop—leaving just one side off each post—

and I would still have all the access I'd need for securing the posts to the post bases.

Prefabrication and prep work

The tools required for building this pergola aren't exotic, so there's no reason the whole job can't be done right on site if desired. Personally, anytime I have the option to build a project in the shop versus doing the work on site, I choose the shop. Having my tools organized and close at hand means a faster, more efficient workflow. In this case it

HOLLOW ASSEMBLY CREATES A SUBSTANTIAL BASE

To beef up the appearance of the structural 4x4 shop-cut posts, I used wide, hollow post sleeves infilled with wide horizontal rails and a substantial cap rail.



Three-sided sleeves. Start the lower half of each side of the pergola by assembling the butt-jointed post-sleeves, which are left open on one side to allow access to attach the rails and, later, to secure the hidden 4x4 posts to their bases.



Keep the rails simple. Drive a pair of screws through the post sleeves into the endgrain of each horizontal rail to hold them tight, in line, and on layout, ensuring their position with a spacer board under the rails and a 1 $\frac{1}{4}$ -in. spacer block between each end.



Make way for the posts. Drill a $\frac{1}{2}$ -in. hole on either side of the cap rail to provide access for a jigsaw to make each square post-hole cutout without resorting to an awkward plunge cut.

Fasten the cap. After adding blocks to hold the posts steady in the oversized sleeves and to provide fastening for the cap-rail screws, add a spacer to ensure the open side of the sleeves are held to the right width before fastening from above where the screws will be hidden by the upper post sleeves.



was an added convenience, as I prefabricated as much of the pergola as I could on cold late-winter days in anticipation of an only slightly warmer early-spring installation.

The goal was to leave the shop with subassemblies of parts that could then be put together in place. I started with the top beams, which were the most labor-intensive part of the build. I laminated each of the two beams from four 2x8s that I individually rough-cut and then curved with a template-guided router before joining them together with a healthy coating of waterproof exterior wood glue.

Once the beams were glued up, I did the fit and finish work, including thoroughly sanding with both 80 grit and 100 grit sandpaper and creating pockets for post sleeves and mortises for the posts themselves as well as dadoes across the top of the beams to receive the purlins.

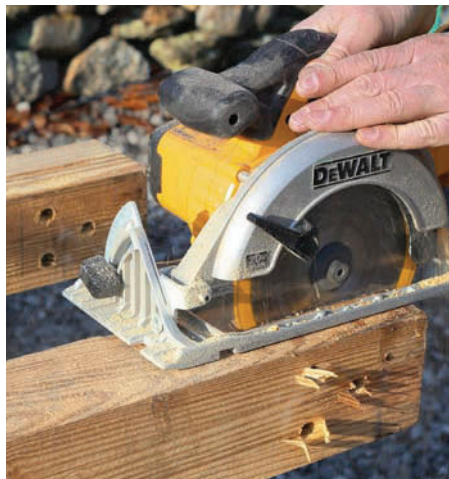
Everything below the beams and purlins can be broken down into a pair of lower halves and a pair of upper halves. The lower halves consist of wide post sleeves and horizontal rails, which are crowned with a hefty cap rail with jigsaw-cut square holes. These square holes allow the shop-cut 4x4 posts to slide into the lower assemblies and be

PREFAB PARTS ASSEMBLE EASILY ON SITE

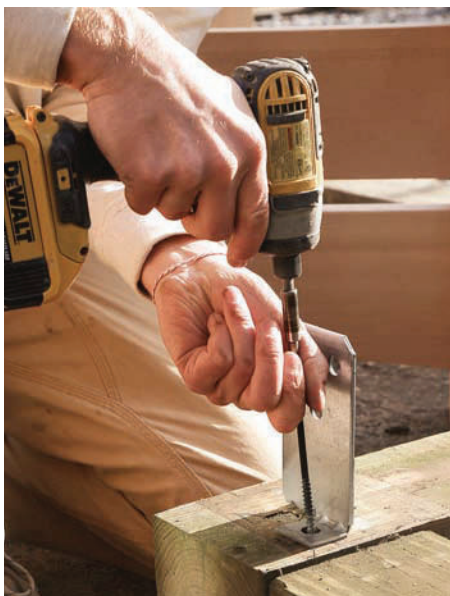
If the shop portion goes as planned, you can arrive on site with two nearly complete lower assemblies, four posts and upper sleeves, two beams, a stack of purlins, and a fairly straightforward half-day of work.



Convenient template. Clamp the CPTZ44 post-base bracket to the post, using it as a template for boring the holes to receive the metal pins.



Easy kerfs. Make parallel passes with a circular saw on both sides of the post to create the $\frac{3}{16}$ -in. kerf necessary to receive the vertical fin of the base bracket.



Set the bases. Pan-head structural screws provide a quick connection between the post base and the timber retaining wall.



Pins for the win. Unlike conventional post bases, these allow the posts to be fastened from one side, so the lower assembly can already be in place.



Shim it plumb. Using a long level, plumb each post in both directions and hold them in place with shims. Cut the shims flush to prevent interference with the upper post sleeves.

attached to the post bases once on site. Then the upper post sleeves can be slid onto the posts before the beams are installed.

The on-site assembly work started with locating and setting the concealed post bases, being sure to orient each so that when the lower assemblies were later dropped into place there would be access for driving the metal pins through each post before fastening the final piece of cedar on the lower sleeve. With the lower assemblies and posts located and locked into their plumb positions, it was a matter of

hefting the beams up and onto the post tops, where structural screws make the permanent connection. The last step was to drop the purlins into their dados.

We chose to let the cedar fade to a natural gray, but a penetrating oil would also be a suitable, relatively low-maintenance finish. □

Justin Fink is editor. Photos by Brian Pontolilo, except where noted.



Sealed connection. After masking off the surrounding cap rail, apply a bead of marine adhesive sealant, then slide the upper post sleeve into place and tack it with finish nails.



Finish the base. Coat the edges of each remaining post sleeve, slide them into place, and fasten with finish nails.



Beams drop on. Apply sealant to the top of each post sleeve, then lower the beams into place and fasten them to the posts, bunging the holes for a clean, finished look.



Purlins come last. Tap each purlin into place and fasten with exterior wood screws, which are then covered with a smear of adhesive to protect against pooling water.

A Simple Screened

A photograph of a modern wooden screened porch. The porch has a dark wood deck, a wooden railing with horizontal cable infill, and large glass windows with dark frames. A wind chime hangs inside the porch. The background shows a lake, trees with autumn foliage, and hills under a clear sky.

Inexpensive screen panels combined with cable railings
create a clever assembly

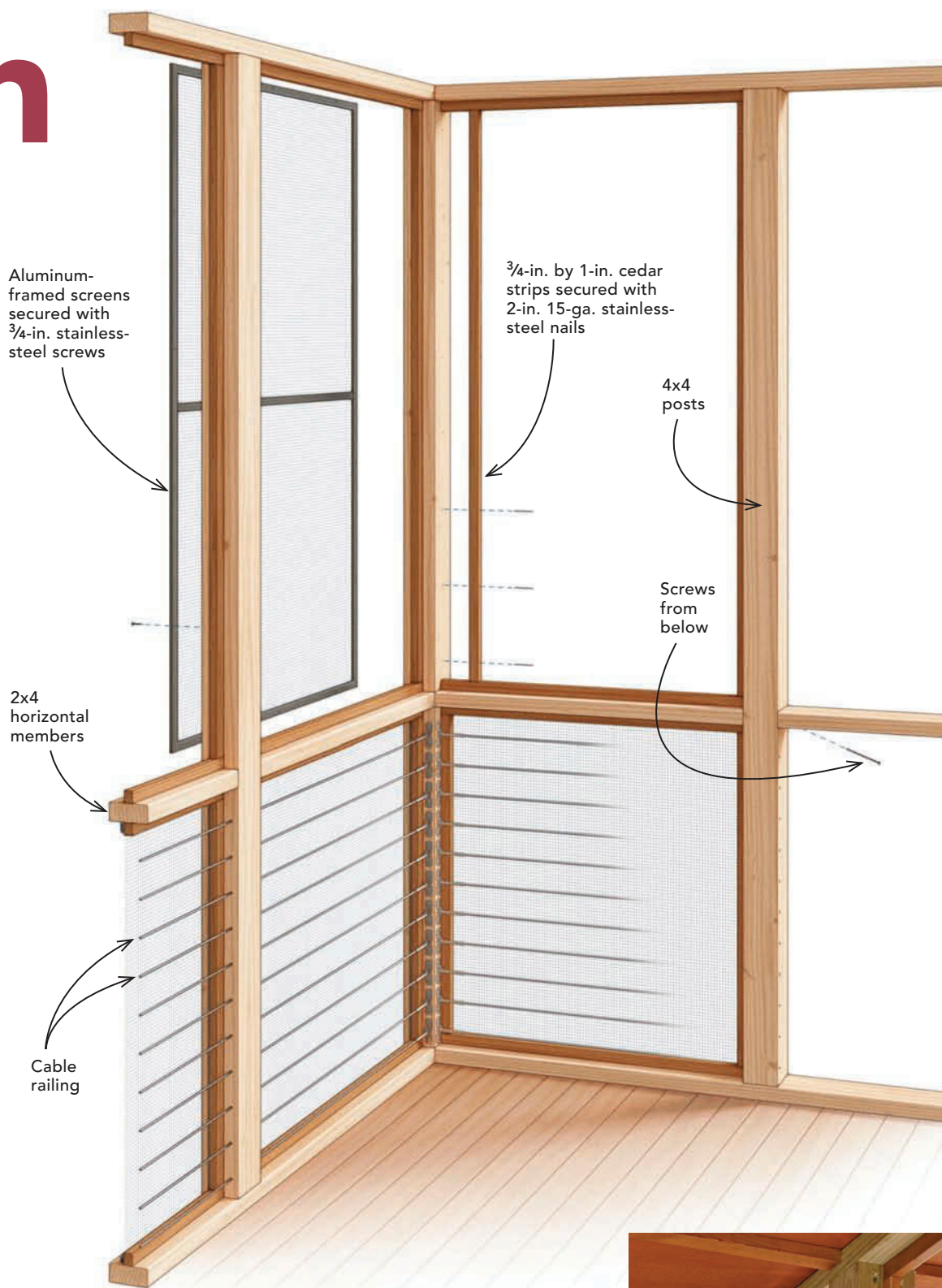
BY ANDY ENGEL

Porch

Brian Kelley's company, Fusion Renovations, Inc., was building a new home on a ridge overlooking upstate New York's rural Harlem Valley when his clients decided to add insect screening to the porch. This isn't an uncommon request, and over the years I've seen carpenters tackle this project in many ways. The most common solutions seem to be either filling the spaces between the posts with wooden screen doors or adding horizontal members, unrolling screening across the assembly and securing it with trim strips. But wood can rot, and there's no elegant way to repair future damage to screen that does not have an individual frame.

Brian and carpenter Eric Paulson took a simple approach to avoid these issues. They used the existing posts to anchor aluminum-framed screens purchased from Metro Screenworks (metroscreenworks.com) for \$30 to \$40 each, depending on size. In this case, the homeowners knew they would be leaving the screens in place year-round, so fastening them from the outside made sense. But for a more convertible approach, the screen panels could be secured to the inside of the cedar stops. Because cable railings had been installed everywhere else on the existing deck to preserve the incredible view to the west, it was an easy decision to continue these railings around the porch as well. Screens are only intended to keep out bugs, but a screened porch built to code will also keep people from falling. □

Andy Engel is a senior editor.
Photos by the author.



AN INSIDE LOOK AT THE DETAILS

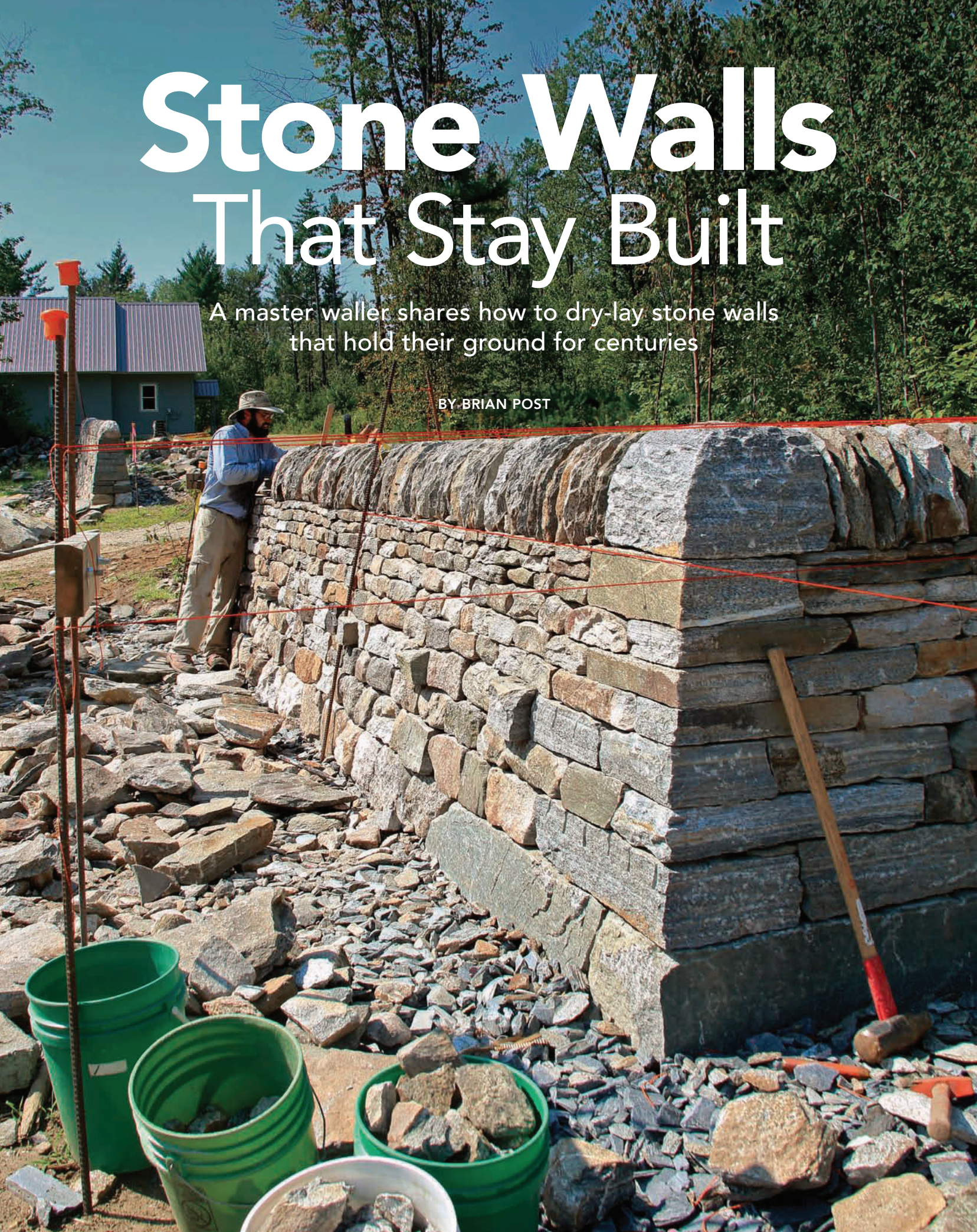
Stops ripped from scraps of cedar and nailed to the framing create attachment points for the screens. A spacer block is used to locate the strips consistently. Stainless-steel screws fasten the screens to the mounting strips. The screens are easily removed should one need repairs. If seasonal removal of the screens had been desired, the screens could have been mounted from inside for easier removal.



Stone Walls That Stay Built

A master waller shares how to dry-lay stone walls
that hold their ground for centuries

BY BRIAN POST



I began my professional training as a waller working under certified craftsmen in Great Britain, a country whose landscape is laced with stone walls that date back millennia. In New England, where I live, two-century-old walls are common. While this may come as a surprise, that's far longer than most mortared walls last. If you learn to properly lay dry stone, you can build walls that outlast your great-grandchildren.

Mortar hurts more than it helps

While it can take years of practice to efficiently build a near-perfect wall, building a good dry stone wall is quite easy. The process starts with forgetting what you think you know about the importance of mortar. One reason for their longevity is that properly laid dry stone walls flex as the ground moves, whereas a mortared wall will crack. This flexibility often allows dry stone walls to be built directly on the native soil, while mortared work requires a concrete foundation below the frost line. And while a dry stone wall allows water to pass through harmlessly, mortared walls can trap moisture that will destroy the wall when it freezes.

In a dry stone wall, the aim is to use gravity to maximize friction. Friction keeps the stones from sliding apart, and their weight increases the friction. But even the best built wall can fail if it is poorly designed.

Base the design on the site and stone

When siting, think about what can damage a wall. In northern areas, set walls back from roads and driveways so that plows won't push snow against them. Trees growing in girth can put pressure on walls, and roots can shift or lift when a tree blows in the wind, pushing a wall up from underneath. A good practice is to stay back at least 10 ft. from trees and roads.

The foundation is the earth or gravel the stones rest on, and it should be dug so that it is level from side to side. If you are building on a slope with less than a 1-ft. elevation change in 20 ft., just run the wall parallel to the ground. On steeper slopes, dig the foundation in

Essential rules

Although there are many more techniques that can help you build a better-looking wall or work more efficiently, those are grace notes to these five rules. Following these steps will lead to walls that last centuries.

1. Set the stones so their lengths go into the wall, not along it.

Like stacked firewood, only the ends of the stones will show. Placing the stones this way maximizes the friction and puts their centers of mass closer to the wall's core. Placing stones counter to this rule is called *tracing*, and is a primary reason walls fail.

2. Heart tightly.

Hearting is key to a strong wall because it adds many points of contact between stones to increase friction and keep them from moving independently. Fill the voids with the biggest pieces you can. Gravel or anything you could readily shovel is too small for hearting and will act like ball bearings in the wall.

3. Cross the joints.

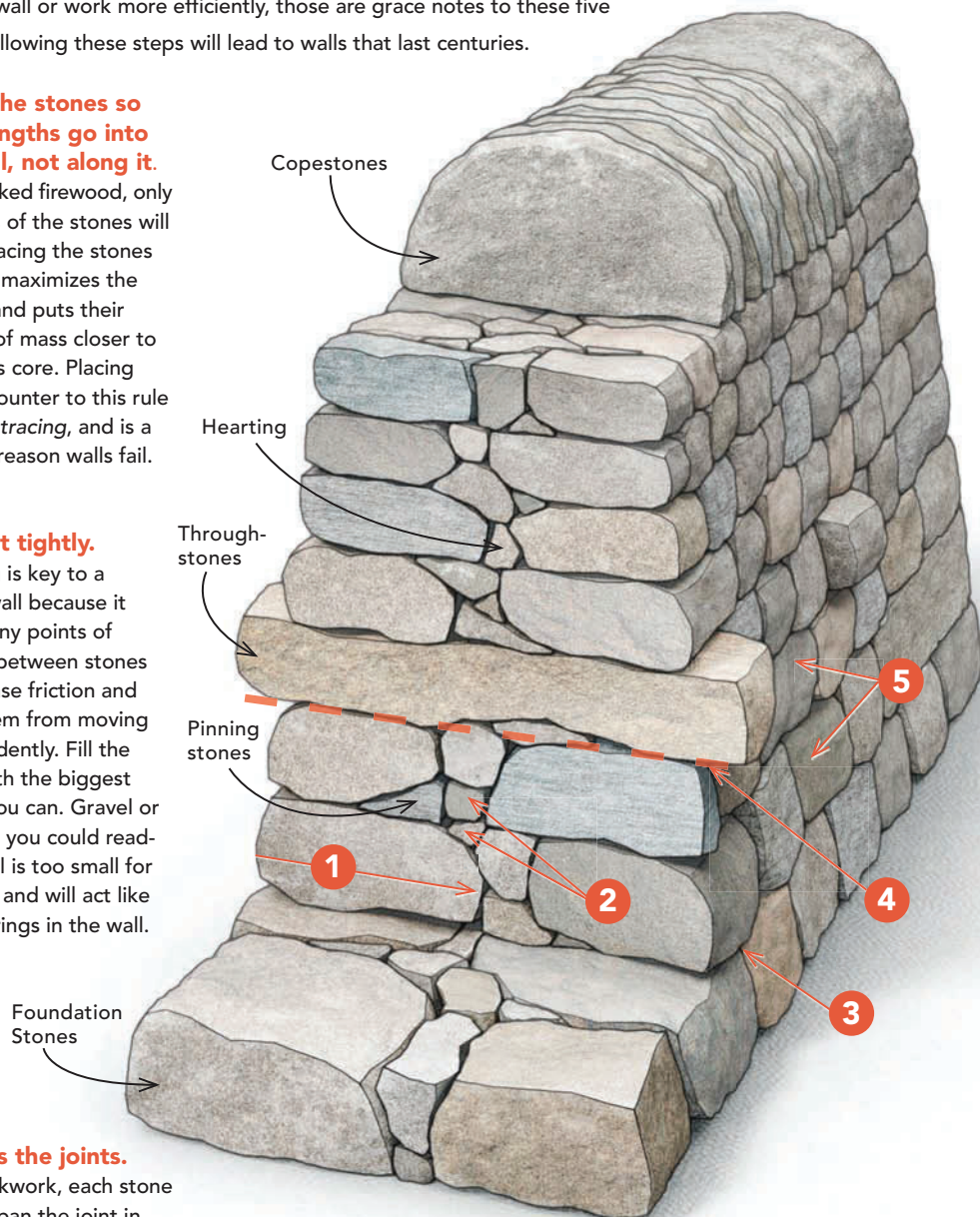
Like brickwork, each stone should span the joint in the course below and sit firmly on the two stones on either side of that joint. Vertical joints that break this rule and run through multiple courses are called *running joints*.

4. Set stones level.

Each stone needs to be able to support the stones above. The simplest way to achieve this is to set each stone so its top is level.

5. Build with the wall's plane.

Set stones so their faces line up on the outside face of the wall to create a smooth, even plane without hollows or overhangs, which can cause stones to tip.



Essential tools

- Braided mason's string
- Batter frames, made from wood or rebar
- Shovel
- Tape measure
- 2-ft. level
- 6-ft. pry bar
- 22-oz. brick or mason's hammer
- 3-lb. hammer
- 6-lb. to 10-lb. sledgehammer

Batter frames shape the wall. This frame for a 1:6 batter is being set with a level and an angled wedge. A rotary hammer with an electrician's ground-rod driver pounds rebar several feet deep to ensure stability.



level steps like stairs. Otherwise, the stones will gradually slide downhill and cause the wall to fail.

For stability, walls should be wider at the bottom than at the top. This taper is called batter. Expressed as a ratio of run to rise, batter typically ranges from 1:6 to 1:10. A 1:6 batter means that for every 6 in. of height, the wall narrows 1 in. on each side. So, a 3-ft.-tall wall with a batter of 1:6 would be 12 in. narrower (6 in. on each side) at its top. With flatter stones, a steeper batter like 1:10 may be appropriate, while a batter of 1:6 makes a wider base that's better for more irregular stone.

The width of a wall's base depends on its height, the width of the top, and the batter. Walls lower than 3 ft. lack enough area for the unevenness of individual stones to blend visually into a smooth face. Narrower walls use less stone, while wider walls make it easier to use larger stone and tend to be sturdier. With these factors in mind, the top is typically 14 in. to 18 in. wide.

With smaller stone or flatter stone, you can make the wall closer to 14 in. at the top. With larger or rounder stones, make the wall closer to 18 in. at the top. The size of available capstones may also influence the top's width.

Choosing the right stone

A 4-ft.-high wall takes about 1,000 lb. of stone per linear foot, and the options vary by region. First, look for stones of a size you can move, and keep in mind that those with one longer dimension work better. Flat stone doesn't necessarily equal good stone, and round or irregular stone doesn't equal bad stone. Flat stone can make working with

As you start out, aim to build 5 sq. ft. to 15 sq. ft. per day. If you're slower than that, you are likely being too fussy.

thickness variations between adjacent stones harder; plus, it's often thin, meaning lots of courses and slower building. Rounded stone makes it easier to work with thickness variations, and each course tends to be thicker, so building goes faster. With irregular stones, build a wall whose face stones fit more loosely. With flatter stones or ones that are easy to shape, build a tighter wall.

Stone from the ground right by the wall is the traditional material to use. Old piles that were collected but never built into walls and debris from construction sites can also be good sources. For reasons of historical preservation, even with permission, harvesting stone from old walls or structures is frowned upon and may be illegal. But taking stones from walls in poor condition that aren't visible from a road and don't mark property boundaries is more of an ethically gray area.

Crushed stone quarries often produce an 18-in. and smaller size (referred to as "18 minus") that can be used quite effec-

Tie strings to the frames. Set strings level with each other, just above course height. Sight between the string and batter frame to locate the edges.

tively. Gravel-pit leftovers or tailings can also work well. Stone from these sources may include a lot of unusable shapes, but it is often available for as little as \$20 per ton. Another option is palletized stone from landscape yards, but it often costs over \$200 per ton. Usually meant for use as veneer, it tends to have either long side faces or large flat surfaces rather than the end faces best for dry-laid walls.

People worry too much about the foundation

With well-drained soil, foundation preparation can be as simple as removing the topsoil and compacting the grade below. If the soil is prone to settling or holding water—for example, clay or silt—put in a foundation of $\frac{3}{4}$ in. to 2½ in. of clean, crushed stone. The smaller stone shovels more easily, but larger stone tends to be more stable. Crushed stone has sharp, angular shapes that knit together and work much better than rounded gravel. A 6-in. to 18-in. foundation about a foot wider than the wall is typical, with dense clay and other poorly drained soils at the upper end of that range. Water that collects in the crushed stone needs a 4-in. perforated pipe pitched to daylight for drainage. Otherwise, you’ve just made a pond under your wall.

Compact the foundation using a jumping-jack compactor or by driving back and forth a few times with a loaded pickup truck or tractor. A walk-behind vibratory plate compactor does virtually nothing and is not worth using.

Before starting to lay stone, get organized. Walls should be built with larger stones at the base, graduating to courses of smaller stones near the top. Sorting the stone by thickness beforehand will increase your speed and help to

If you’re faster than that,
you’re likely not being
careful enough.

ensure that each stone is used to its maximum benefit. Sort the stones into big, medium, and small sizes. Place an equal amount of stone on each side of the wall, leaving 18 in. of clear walking space, with the thickest stones near the foundation and smaller stones farther out.

Set pieces of the size and shape needed for through-stones and cap- or copestones aside, as well as any stones that have even a possibility of being useful in a wall end. Ends are tricky, and a large selection of stone is important. Pile hearting near the wall every 6 ft. or so, moving it around in 5-gal. buckets.

Although professional wallers can usually build 20 sq. ft. or more per day, as you start out, aim to build 5 sq. ft. to 15 sq. ft. per day. If you’re slower than that, you are likely being too fussy. If you’re faster than that, you’re likely not being careful enough.

Completing shorter sections of wall at a time is more efficient. Step back the ends of each section so the next section of wall ties into the area you’ve just finished. Define these sections by setting up sturdy batter frames 5 ft. to 20 ft. apart. String is used as a guide to keep walls straight and level or parallel to the ground. Tie strings to the inside edge of the batter frames on



Start big. Roll foundation stones into place and level their tops by digging into the soil or gravel below.



There will be voids. Face stones don’t have to meet tightly inside the wall. Just pack the spaces full of hearting stones.



Pin from within. Pinning stones shim the face stones level and solidify their placement. Never pin from the face of the wall because it will just fall out over time.



Tie the sides together. It's typical to let through-stones extend 1½ in. past the wall face to allow for flexibility in their length and for the wall to settle without slipping off them.

each side of the wall, level with each other and just higher than the course you're laying.

Set foundation stones so that the top edges of their faces align with the string (bumps may protrude past the string on this course). When sighting stones, line the string up to the inside edge of the batter frame, or use two string lines on each side of the wall, one about 8 in. higher than the other, and sight down between the two. It's usually easier to place the foundation stones along one side at a time, and quicker to set stones from one end to the other rather than working in from two ends and filling the middle with stone of an exact width. It's best to place stones so any sloped faces match the batter. A stone face that angles down will cast shadows that make the wall look rougher.

Try to find stones whose faces mate with their neighbors, but don't be too fussy. Large stones tend to meet with larger gaps, and when looking at a finished wall your eye will focus on its top half, which will be built with smaller stones that tend to fit more tightly.

Thicker foundation stones can be dug into the foundation so that they sit securely. Eyeball the stones so their tops are as level as possible, and keep the tops of adjacent stones even. If the top of a stone must slope, slope it toward a neighboring

A mouse might be able to work its way through a well-hearted wall, but a squirrel will definitely not.

stone. Sloping it toward the face will cause stones placed atop it to slide out, and sloping it toward the core will push the wall apart over time. Stabilize stones as needed with wedge-shaped pinning stones placed from within the wall, leaving no large voids.

Don't worry too much about how the stones fit inside the wall, just pack voids tightly with hearting. Stones that wobble are not properly hearted. A mouse might be able to work its way through a well-hearted wall, but a squirrel will definitely not.

Building upward, course by course

After finishing one course, move the strings up by the thickness of the next. Ensure each stone meets the five rules of walling, keeping the points of contact near the stone's face. If a stone tips when you push down near its face, the contact points are too far back. Focus more on following the five rules than fitting the stones' faces like puzzle pieces. A strong wall will look good, but an incorrectly built wall, no matter how tight-looking it starts out, will fall down. Experience will develop your ability to fit the stones tightly while still following the rules.

Once you've placed a few feet of stones on both sides of a course, fill any voids between them up to the top of the stones. Set hearting so it won't move when the next course's weight is added.

Unlike the foundation course, only the farthest point of each stone from the second course to the top of the

wall should align with the string. Keep the strings just above the course you are working on so stones won't push on the string. When working with smaller stones, set a few on the wall and move them until you find a place for each rather than looking for stones to fit specific spots.

There is an exception to the rule about every stone sitting on the two below: A smaller stone may sit entirely on a larger one. You may have situations where two stones are needed to equal the thickness of a neighbor. This is also acceptable, and creates a way of changing thicknesses within a course.

The faces need a strong connection

It's vital to a wall's structure to tie its sides together with through-stones placed at mid-height. Arrange through-stones no more than 3 ft. apart along the length of the wall and in good contact with the stones below, being careful not to create running joints. Heart under each through-stone so no daylight comes through or they may break from weight placed above. Walls over 5 ft. tall require additional rows of through-stones spaced no more than 2 ft. apart vertically.

Ends must tie the two sides together and tie back into the wall (corners are built much the same way). Ends are traditionally plumb to meet a gatepost, but a slight batter such as 1:48 on the end face will increase the strength.

The best stones for ends are long and large with flat and parallel top and bottom surfaces. Cube-shaped stones won't tie back and will force the creation of a running joint in at least one direction on the next course. The contact points below each stone should be close to the outside corners. You will likely need to shape stones used in wall ends and corners, so plan to spend time on these features.

The top stones help hold the wall together

Walls are topped with either capstones or coping to give it a finished look, to knit the sides together, and to protect the stones below. Thick and flat, capstones are laid across the width of the wall. Coping consists of flat stones set on edge like books on a shelf and is structurally the best way to top a wall. Coping provides the equivalent weight of very thick capstones without the hassle of lifting massive stones to the wall top. They provide many points of contact with the last course, anchoring it with lots of weight and friction. And because of their height, copestones can substitute for one or more upper courses.

Keep copestones as vertical as you can, make the end pieces as big as possible so they won't be pushed off, and make sure they don't rock. For a refined finish, shape them uniformly before setting them on the wall. To get the tops even, tie a string at the top height of the copes on either side of the wall. Tighten the coping by hammering small wedges of stone between the copestones at the top, and hammer pinning stones into any large gaps at the bottom corners. This will build up a tremendous amount of friction between the copestones. When finished, they shouldn't wiggle at all. □

Landscape architect Brian Post is a DSWA-GB certified Master Craftsman and executive director of The Stone Trust in Dummerston, Vt. Photos by Andy Engel.



Build ends and corners like log cabins. Shaping is often needed to fit end stones. Alternate stones that span the wall width with long stones that tie back into each course.



Copestones protect the wall top. Placed on end like books on a shelf, copestones add height and weight to the wall and tie the top together.

Better-Built Wood Railings

Elegant, site-built, rot-resistant railings don't have to break the bank

BY AARON ROSBURG

When I started out on my own about 15 years ago, I was doing mostly repair work, and many of those repairs were focused on rot. Fixing wooden deck and porch railings always seems to be on the to-do list, particularly the traditional-style railings in which the balusters land on a flat bottom rail or subrail. Water pools near this susceptible joint and then is drawn into the

thirsty end grain of the balusters where it rots the wood and corrodes the fasteners, and eventually the railing falls apart.

On a recent job, I was asked to rebuild a two-story porch on a historic 1800s brick building in my neighborhood. While I was researching some period-appropriate railing designs, I stumbled across an old illustration that detailed what I quickly realized was a better way to build a wooden railing.

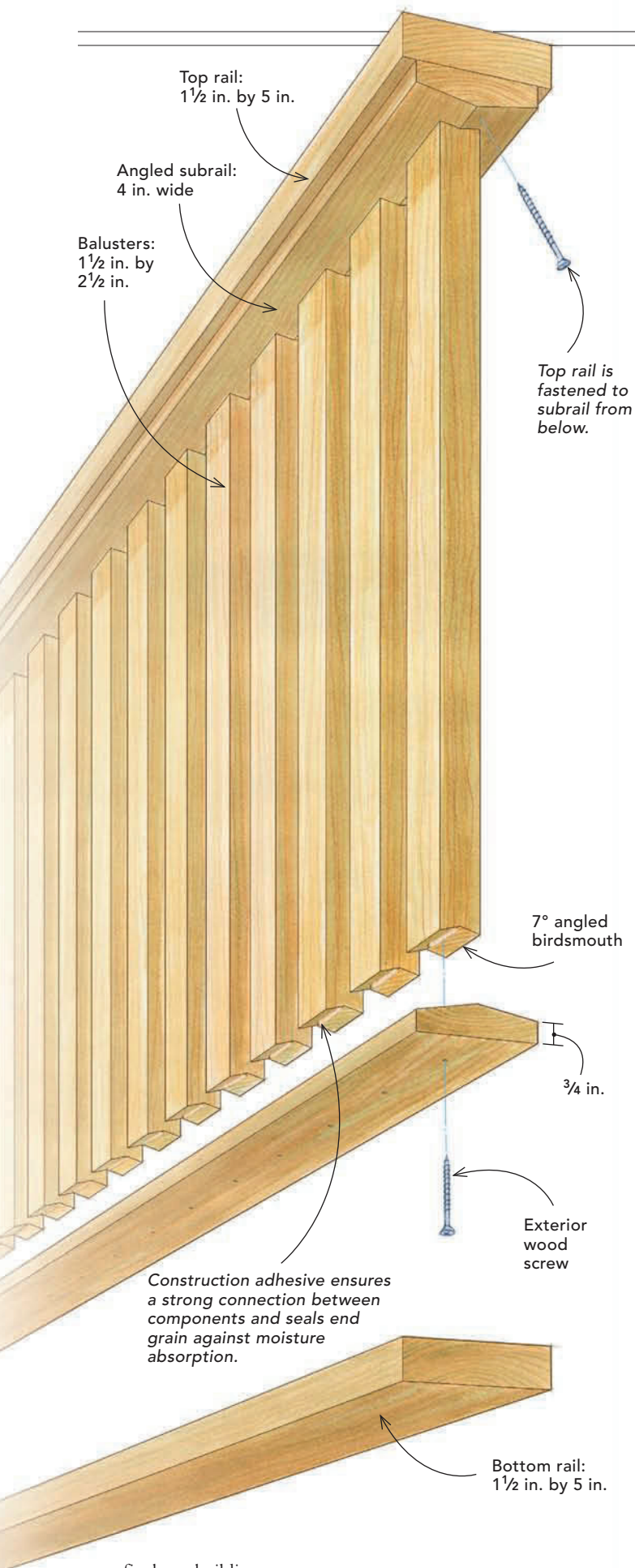
The illustration showed balusters with a birdsmouth cut at each end that mate with angled subrails to create a water-shedding joint. Eliminating standing water in this critical spot gives the balustrade a significant advantage over just about every other wooden railing I've seen and repaired over the years, but there are some perks beyond that, too. The angled connection allows balusters to be attached with a single fastener on the top and bottom—the preferred method if you want to avoid splitting the stock—yet they aren't prone to spinning like most wooden balusters are.

For our paint-grade version of these better-built railings, we use premium KDAT (kiln-dried after treatment) yellow pine. Compared to typical pressure-treated lumber, the KDAT stock is really straight and true and doesn't twist and move much, even when ripped down into balusters.

I can only guess why all historic railings don't follow the design I saw in that old illustration; perhaps it's due to the labor involved with cutting the more complex joints with hand tools. Luckily, the same durable design can easily be cut with common power tools and is only slightly more time consuming than the rot-prone railings we've all been assembling for years, but with a far longer expected lifespan. □

Aaron Rosburg owns AACraftsman, Inc. in Nashville, Tenn. Photos by the author.





FITTING BIRDSMOUTH BALUSTERS



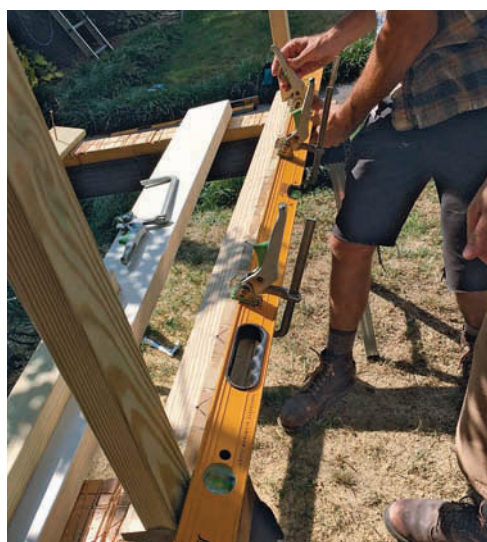
Birdsmouth bevels.

The angled baluster ends look tricky, but are easy to cut on a sliding miter saw. Use a stop to ensure that each baluster is the same length, set the saw to a 7° bevel angle, and set the saw's cutting-depth stop to limit the blade depth to half the thickness of the stock. The birdsmouth is then made in two cuts that meet in the middle.



Pilot holes are a must.

KDAT lumber is dry and prone to splitting, so it's crucial to lay out and drill pieces before assembly. Exterior wood screws are driven from the flat side of the subrail, where they will later be concealed and protected from the weather by the top and bottom rails.



A level for alignment.

The birdsmouth joint between baluster and subrail helps with alignment, but doesn't guarantee it. Start each rail section by fastening the two outermost balusters, and then clamp a level against their faces to create a guide for the placement of each additional baluster.

A professional landscape designer offers advice for every phase of the process, from grading to lighting

The Groundwork of Landscape Design

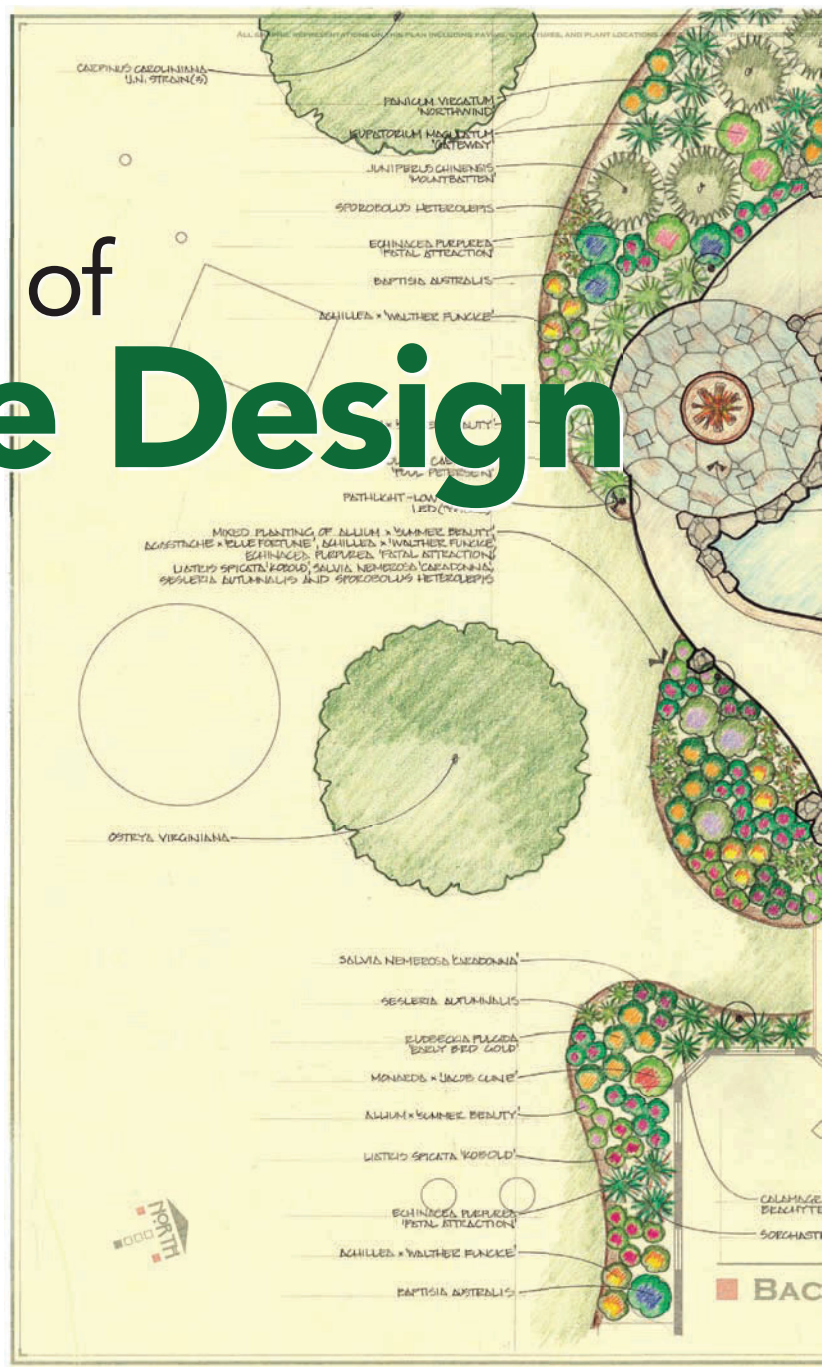
BY JAMES DRZEWIECKI

Gardening and landscaping have become popular hobbies for many homeowners—and for good reason. Not only do outdoor projects give us an opportunity to connect with the earth as we literally get our hands dirty, but outdoor spaces are a great way to extend the living area of our houses. So-called “outdoor rooms” have been a trend in home design for some time, and that’s a smart way to think of the landscape, because when we give it such purpose and design it with such intent, it truly becomes a functional extension of our homes. Having more living space and being able to vacation in our own backyards is an attractive idea and a sensible investment for both our properties and our lives.

While do-it-yourself TV programs, magazine articles, and any number of blogs tout the money you will save if you landscape your yard yourself—and there are certainly some aspects that you can tackle—many of these projects are more daunting than they seem. I may be biased, but I often tell my clients that it can cost more *not* to hire professional landscape designers and contractors.

Before attempting a “weekend project” in your yard, you should ask yourself a few questions to gauge your ability to pull it off: Have you done adequate research and planning? Do you have the right tools and equipment to do the work? How much time do you have to do the work, and what is your time worth? Will it take you double or triple the time it would take a professional? Mistakes can be costly, so consider hiring a professional for any landscape project that is realistically beyond your skill level. For those of you considering tackling this job for your home, I offer the following insight into the various elements of a landscape project. □

James Drzewiecki, associate AIA, is founder and design principal of Ginkgo Leaf Studio in Cedarburg, Wis. Photos by Westhauser Photography, courtesy of the author, except where noted. Drawings by the author.



IT'S NEVER TOO SOON TO

THE FIRST STEP in any landscape project is to create a thorough plan. Even if you can only afford to install certain aspects of the design at this point, it's a good idea to plan everything that you would like to eventually include right from the beginning.

If you're building a new home and plan to work with a landscape designer, don't wait until the house is built to bring one on board. If you're trying to coordinate the installation of the landscape so that it follows shortly after the completion of the home, keep in mind that designers and contractors often fill their schedules months in advance. The window of



Rain, rain, go away. Rain gardens can be used to collect and direct water away from the house. Here, a rain chain acts as a gutter downspout and the pervious rock bed is pitched away from the home's foundation.

GET THE GRADE RIGHT

TAKING ON MAJOR GRADING ISSUES is not typically wise for the amateur. Not only is heavy equipment often needed to do the work quickly, but special tools, and the skill to use them correctly, are necessary. Even landscape professionals may bring in a civil engineer if major grading of a property is needed.

No matter the extent of grading needed for a specific project, moving water away from a home's foundation is the number one goal. This is sometimes accomplished by just raising and pitching the soil around the foundation. However, such work might also mean adding window wells around basement windows, adding extensions to gutter downspouts, or connecting downspouts to underground drainage. Keep in mind that this is true where patios and walks meet the house, too. Improper grading can lead to costly home repairs.

Once you have directed water away from your home, remember it still needs to go somewhere on the site. For a new home, a grading plan should be created to ensure water will drain where the local municipality requires and won't create problems for neighboring properties. In any case, you can consider using rain gardens and dry streams to collect water from your downspouts and help prevent runoff and flooding in your neighborhood.



When to build a wall. A retaining wall creates a level area for the patio overlooking this steeply pitched lakeside landscape. Stairs wrap around the wall for access to the beach. Gardens surround the wall where the grade rolls away from the home.



CREATE PATHS AND PLACES

BY DEFINITION, HARDSCAPES INCLUDE paved patios and walks, but even if you are using a pervious material like compacted gravel for a patio or walk, you would design those aspects of the landscape now.

Walks and patios create both the circulation routes around the landscape and purposeful spaces within it. Consider the function of each space, and then choose the most appropriate location. As an example, a dining and grilling space should be near the home's closest entry to the kitchen. It will likely have a grill and dining furniture, at a minimum. Allowing room for circulation will eliminate space where furniture can be placed, so the patio needs an ample footprint of at least 400 sq. ft.

A patio may seem larger than you think it needs to be until you map out all the entry and exit points of the space. This includes circulation in and out of the house through doorways, plus access to the yard, usually at multiple locations.

Sometimes as much as 25% to 35% of the square footage of a patio may be lost to circulation. Also, allow extra room for chairs to be pulled out from a table or away from a fire pit.

One common hardscaping mistake happens when sidewalks are made too narrow. The ideal width for a walk is 5 ft. to allow two people to walk comfortably side by side.

The materials you choose will set the aesthetic tone for your landscape. Square-patterned stone may have a formal or contemporary flavor, while irregular flagstone imparts a more casual or rustic feel. Sometimes, budget is the determining factor in material selection. Here in the Midwest, concrete is



A concrete connection. With simple shapes and straight lines, this patio has a modern style. Runnels filled with decorative rocks add color to the taupe concrete. Adirondack chairs add a modern flair and have plenty of space to fit comfortably around the fire pit. Inset bluestone offers a path to the yard beyond.

WITH WALKS AND PATIOS

often chosen to stretch the budget. At about 15% of the cost of natural stone or brick, it's an attractive option, and it can be dressed up with a brick edge or stone inlays. Subdividing a space using contrasting materials can give a large patio the feeling of having separate rooms. An area-rug effect can be created, or borders of brick or stone can define spaces used for separate purposes within a large patio.



A walk of reflection. Like the home's rooflines and trim details, this walk's brick border creates interest with geometric shapes and also reflects the house's siding. Rectangular natural stone and flagstone in the circle add textures and connect to the home's natural stone piers.



Style and shade. This cedar pergola defines a restful space within the patio. With an additional layer of purlins, this pergola blocks more sun than a common pergola. Trellises will direct vines to the top of the structure to eventually shade the patio even more.

AN ADDITIONAL DIMENSION

OUTDOOR STRUCTURES CAN INCLUDE a wide range of built items including pergolas, arbors, fences, and seat walls. These structures can be functional or decorative and all of them bring an additional dimension that is often only created with plants and trees.

Pergolas are useful for creating an outdoor room. Often placed to define a dining area, they can provide shade and a sense of enclosure overhead. Arbors are good for definitively marking an entrance into a patio or garden.

Fences, of course, help to mark outer boundaries of a property or space and can be used to create privacy. Though homeowners sometimes ask for fences to contain their pets, more and more often the municipalities in our area are limiting or simply not allowing fences around property lines. So, most of the work that we do with fences is to use small, decorative sections to add privacy where needed. Extensive fencing will quickly eat up the budget, so we use it sparingly.

Shorter than fences, seat walls—as their name implies—are meant to be built at a comfortable sitting height, usually between 18 in. and 22 in. high. While great for subdividing a patio into smaller rooms and providing the benefit of extra seating, seat walls can be expensive if built out of wet-set masonry. In cold climates, best practice is a full frost-depth footing, making the seat wall very expensive per linear foot. There are many dry-set options that may not require a footing, and material choices can range from natural, dry-stacked stone to decorative concrete block.



Privacy at the entry. This arbor and fence are used to create a private courtyard garden. The gate marks your arrival and the arbor brings an Asian-influenced style to the home and its landscape.



A sweet fire pit. A 100-year-old sugarcane melting kettle serves as the wood-burning fire pit in this landscape. Uplights with yellow lenses illuminate the bowl even when a fire isn't lit.

ADD A FEATURE

FIRE PITS AND OUTDOOR FIREPLACES are great ways to create a gathering place and focal point. In colder climates, they offer an excellent return on investment by extending the seasons so you can use your outdoor spaces for more of the year. Fire pits and fireplaces can be permanent and made of brick or stone, or they can be portable (as in a metal bowl).

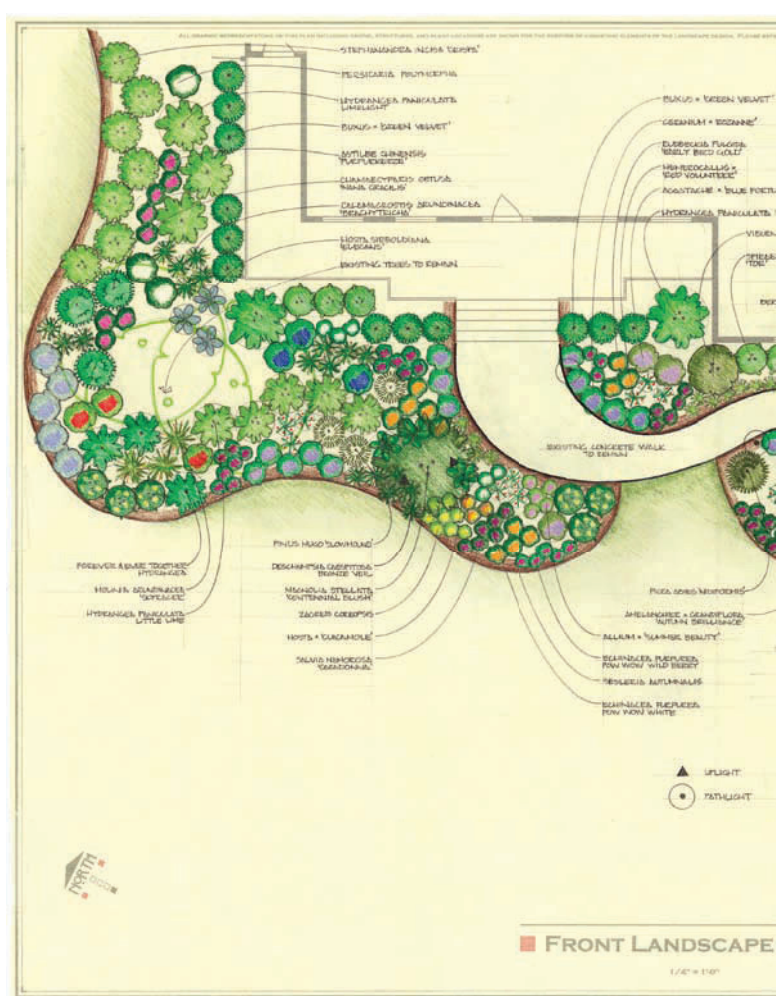
Be careful not to place a fire feature too close to your home. Most municipalities require a fire pit to be 15 ft. or 20 ft. from a flammable structure. Check with your local building inspector before incorporating fire in your landscape.

Another element that can add interest is a water feature. Many people imagine a pond or stream with waterfalls, but the scale, cost, and maintenance of such a feature is often prohibitive. For this reason, pondless water features have become extremely popular. *Pondless* means there is no open water visible—just the water flowing over a fountain, for example. The water disappears into a hidden basin and recirculates via a pump within. Many homeowners appreciate the soothing sound of a water feature, even on a small scale.

Outdoor kitchens were once a hot trend, but many clients now back away from them. One common reason is cost, but another is the realization that they will have two kitchens to clean and maintain. For clients who still want their grilling area to look attractive, we suggest adding a simple island or “grill garage” of stone or brick, designed to enclose a standalone grill or accommodate a drop-in grill. It's important that these elements be considered during the design phase—you likely won't have enough space to comfortably add them to an existing patio.

Evoking an Asian tradition.

This recirculating water feature is reminiscent of Japanese homes, which traditionally offer a place for guests to wash.



RIGHT PLANT, RIGHT PLACE

MANY FACTORS GO INTO CHOOSING the plants for a garden. We strive for multiseason interest and continuous color and bloom. Because there is no such thing as no maintenance—unless you want silk or plastic plants—consider native plants whenever possible as they are acclimated to your weather and soil conditions and will therefore require less upkeep. Stay away from exotic plants and the local honeybees and hummingbirds will thank you.

We live by the mantra, “right plant, right place.” When designing a garden, we consider flower and foliage color, foliage texture, bloom period, mature height and width of the plant, and whether it will grow in sun or shade. Planning combinations based on all of these characteristics can be a fun art form to practice and experiment with. Always start by locating trees and shrubs first, because they are the bones of the garden. When placing these plants, consider views you may want to block or highlight and potentially place a specimen plant like a flowering tree or evergreen as a focal point. The latter option can also keep cold-climate landscapes from looking dead and barren during the long winter months.

Once you've determined the location of the woody plant material, perennials and ornamental grasses can be used to fill in and accent the garden. Homeowners will sometimes shop



for plants without a plan, just buying what catches their eye. Then they get home and have to figure out where everything goes. Or, they'll buy only the plants that are blooming. Placing all those plants together looks great for a few weeks, but they will become a sea of green for the rest of the season. Plan your garden on paper before heading to the nursery.



Casual and continuous. This cottage garden is designed with perennial flowers that will bloom all summer long. Native grasses bring the state's natural prairies to this residential landscape.

FINISHING TOUCHES

CONSIDER ADDING one of the following as a finishing touch to your landscape.

Low-voltage landscape lighting can transform your garden, making it attractive even after the sun goes down. While halogen bulbs are still strong sellers, the current trend is toward LED systems. The benefits of LEDs are many, including extremely long bulb life and less electricity use. We steer our clients away from the lighting sold in big box stores and specify professional-grade lighting. It costs more up front, but the investment is well worth it.

Furniture should not be an afterthought. In fact, patio spaces should be designed with specific furniture arrangements in mind. This can even impact the size of a dining pergola, for example, if it's meant to cover a table that seats six or eight. At the end of a project, we often help our clients choose the style and brand of furniture that will fit the overall theme of their landscape. Although traditional, sustainably grown teak furniture remains popular, the all-weather wicker options are almost endless and seem to be a trend in patio furniture today.

Lastly, garden art is a great way to personalize your landscape. Again, the possibilities are almost endless, from whimsical to formal styles, cast-stone to metal materials, and everything in between. Because of the personal nature of garden art, we often only design a space for it to occupy, rather than choosing it for our clients.



Fitting furniture. The clean lines of this modern version of a picnic table mimic the style of the patio itself. The right furniture not only adds function, it ties together the landscape's style.



THREE WAYS TO ILLUMINATE THE LANDSCAPE

Using more than one type of lighting will add depth and dimension to your yard at night.

- 1 Path and patio lighting creates ambience and safe passage to the house.
- 2 Lighting walls emphasizes their texture. You can also shine lighting on the house in this way.
- 3 Uplighting brings the vertical elements, including structures and trees, into the evening landscape.

Tool Test Cordless Sliders

BY MARK CLEMENT

As a remodeler, I build everything from finished basements to business offices. Given the decent availability of power at my job sites, the latest offshoot of cordless technology that's been applied to miter saws struck me as a rather expensive option I could do without. Even so, I understand the need. Someone has to build malls and office buildings where the nearest working outlet might be a hundred feet away. There are also carpenters who have to trim out tract homes where several trades spend their workdays fighting over one or two outlets. Plus, everyone wants to spend less time setting up, and eliminating cords is a big help.

Even though I'll admit to being skeptical initially, I've had a few months to use the half-dozen cordless sliders—some full-size 10-in. and 12-in. models, some smaller 7¼-in. and 7½-in. models—currently on the market. Consider me a convert. I found the smaller sliders useful as a superportable second saw, and the larger ones could even replace your corded slider. □

Mark Clement is a remodeling carpenter and tradeshow presenter in Ambler, Pa. (MyFixitUpLife.com). Andy Doyle and Craig Ostrander, remodelers and Bucks-Mont, Pa. NARI members, participated in this review. Photos by Patrick McCombe.



Meet the new class of miter saws.
From big to little, we tested them all.



BIG SAWS, BIG CAPACITY

The 10-in. Milwaukee and the 12-in. DeWalt saws have all the features common to corded sliders, including tall fences and large, easy-to-read bevel and miter scales. Both saws have the power and cut capacity to replace your corded saw, but they're far from equal.



DeWalt DHS790AT2 (12 in.)

This big DeWalt uses a completely new battery technology. It accepts a pair of dual-voltage (18v and 56v) batteries that also work on DeWalt's 20v MAX tools. The big battery packs detect the tool they're being used in and supply the correct voltage automatically. The kit even includes an AC adapter, so you can plug the saw in when you have access to power. Combined with rock-solid features borrowed from its corded brother (DWS780), this tool offers both performance and value. The saw is big enough for cross-cutting 14.-in.-wide 2x stock and for cutting up to 7½-in.-wide nested crown. It's well designed, powerful, accurate, and even comes with a decent blade. The louvered guard prevents dust buildup and the slide mechanism is smooth and flex-free. Miter and bevel adjustments are intuitive and hold securely while visibility of the cutline is excellent. This is the tool to beat.

Price:	Weight:	Bevel:	Miter:	Battery:
\$799*	56 lb.	49° left / 49° right	50° left / 60° right	Two 56v
* with two batteries and an AC adapter				

CLOSER LOOK

DeWalt's big cordless sliding miter saw is virtually identical to the company's corded 12-in. slider, and its two big batteries give the saw as much power as its corded brother. When power is available, the saw's two 56v battery packs can be swapped for an AC adapter that's included in the \$799 kit, providing the best of both worlds: corded-saw ability with cordless convenience.





Milwaukee 2734-21HD (10 in.)

Unfortunately, this saw is a disappointment. For starters, there's movement in the saw head because the slide tubes can flex when they're extended halfway or more, particularly when the saw head is set for steep bevel cuts. Milwaukee claims their saw isn't any worse than other sliders and at first we didn't think the movement was affecting our cuts, but we later realized we sometimes had gaps in mitered outside corners and compound cuts. Other problems include having to remove the upper sliding fences when making steep bevel and compound cuts. Even the dust collection seems like an afterthought. The chute moves with the rails, so it shifts farther away from the dust source as you make the cut. The result is very little dust in the bag at the end of the day. It's too bad that Milwaukee didn't perfect the design before launching the saw, because this tool is not up to snuff.

Price:	Weight:	Bevel:	Miter:	Battery:
\$599*	45 lb.	48° left / 48° right	50° left / 60° right	One 18v
* without battery				

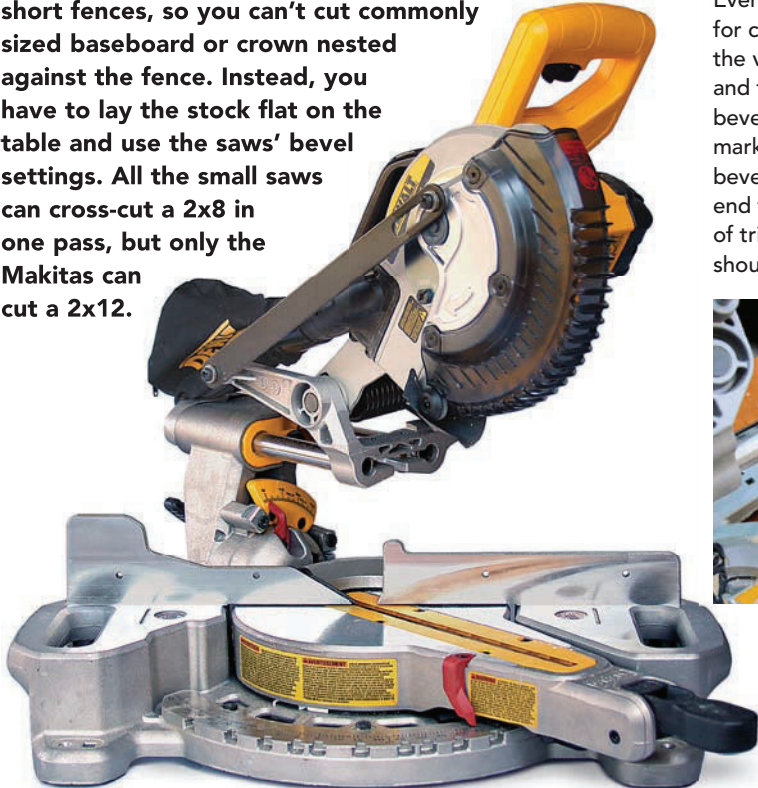
CLOSER LOOK

The Milwaukee slider has a 10-in. blade, allowing it to cross-cut a 2x12 and cut up to 5¼-in.-wide crown nested against the fence. The saw's vertical motor allows it to bevel 48° in both directions. The bevel lock is mounted on top of the saw and the lever's intermediate position engages one of the saw's nine bevel detents.



GO SMALL, GO FAST

Although they're light and easy to handle, the 7¼-in. and 7½-in. saws have tiny tables and short fences, so you can't cut commonly sized baseboard or crown nested against the fence. Instead, you have to lay the stock flat on the table and use the saws' bevel settings. All the small saws can cross-cut a 2x8 in one pass, but only the Makitas can cut a 2x12.



DeWalt DCS361M1 (7¼ in.)

Even with a single battery and no bevel stop at 33.9° (a common setting for cutting crown), this tool performed accurately and smoothly. We liked the visibility provided by the louvered blade guard and LED worklight and the saw has a good-sized fence and an easy-to-read miter scale. The bevel scale isn't as hard to read as those on the Makita saws, but the small markings are a little tough to see. The only real downside is that the saw bevels in only one direction. While you can always flip the stock end over end to make a cut with a single-bevel saw, swinging around long lengths of trim can be a problem in tight spaces, which is where these small saws should have an advantage, not a drawback.



CLOSER LOOK

The small DeWalt can cut 3⅝-in. crown nested against the fence. Like the Makitas, this saw only bevels to the left, which means flipping stock end over end. Bevel settings are changed by loosening a star-shaped handle at the back of the saw. Miter settings are held with a quick-adjusting lever-type lock.

Price:	Weight:	Bevel:	Miter:	Battery:
\$399*	32 lb.	48° left / 3° right	48° left / 48° right	One 18v
* with one battery				

Ridgid 48607K (7¼ in.)

This is the most versatile small saw in the group and it did everything we asked of it with no drama. The slide/plunge action is not as smooth as the Makitas', but it has big-saw features, including an easy-to-read bevel scale, an adjustable miter scale, solid detents, and a reasonably-sized fence. Despite an abrupt blade brake that jerks the saw head slightly when it activates and somewhat stiff movement in the bevel lock, it's a good saw. It's the same price as the little DeWalt, but it bevels in both directions. Compared to the twin-battery Makita XSL02 (\$567 without batteries), it's a bargain. The Ridgid is easily our favorite among the small saws.

CLOSER LOOK

Perfect for small jobs and quick setups, the Ridgid can cut 3½-in. baseboard upright against the fence and 3½-in. crown in a nested position. The action is smooth enough to pass muster, and the motor has plenty of power even though it sports a single battery.



Price:	Weight:	Bevel:	Miter:	Battery:
\$399*	24 lb.	48° left / 48° right	48° left / 48° right	One 18v
* with one battery				



Makita XSL01 (7½ in.)

While there are some things to like about this saw that can also be found on its two-battery counterpart, like its comfortable handle and trigger and smooth slide/plunge mechanism, this unit is underpowered for cutting anything but narrow trim and strip flooring. Cutting framing lumber took far too long to be practical, and the saw even labored while cutting a cedar 2x6. The fence is too short and we found the blade guard frustrating, as it's nearly impossible to see through when you're lining up a cut. Compound cuts were also a challenge because the saw doesn't have bevel stops and the bevel scales are so small they're hard to read.



Price:	Weight:	Bevel:	Miter:	Battery:
\$530*	27 lb.	45° left / 5° right	47° left / 57° right	One 18v

* without battery

Makita XSL02 (7½ in.)

Every power-tool designer should check out this machine for its supersmooth slide rails and head-plunge mechanisms. This saw shares the comfortable handle and trigger of its one-battery counterpart, but unlike its underpowered sibling, it has ample power provided by two 18v batteries. Unfortunately, it also shares the short fence and barely-readable bevel scale, plus the blue-tinted guard makes it hard to see a pencil line. Once again, there are no detents for common bevel cuts, and, like its sibling, it only bevels 5° to the right, which means a lot of flipping stock.



Price:	Weight:	Bevel:	Miter:	Battery:
\$567*	29 lb.	45° left / 5° right	47° left / 57° right	Two 18v

* without batteries



CLOSER LOOK

Unlike all the other cordless sliders, which have two, the Makitas have four slide tubes, giving the saws a surprisingly small footprint and an extra 4 in. of cross-cut capacity with 2x stock (12 in.). The newer model (XSL02) accepts two 18v battery packs and has a brushless motor, giving the saw noticeably more power than its single-pack sibling. Both saws are easy to carry because of their small size and comfortable handles and they have silky smooth slide rails and an easy-to-use bevel adjustment.



Passive House



Photos this page and facing page top: Amadeus Leitner;
facing page bottom: Andrew Michler

Meets

Pueblo

Three projects by a Santa Fe architect demonstrate how well this performance standard and the Southwest style work together

BY ANDREW MICHLER

The Balance Project

Northern New Mexico has one of the oldest design traditions in the United States. A mix of cultures intersecting for the past 500 years has led to distinctive architecture that speaks as much to the arid Southwest region as it does the people who live there. The oldest building still inhabited in the United States is the Taos Pueblo (taospueblo.com), built with a stepped, boxy form and massive adobe-brick walls. When the Spanish entered the region, they brought the hacienda with its long front portals, tall windows, and intricate woodwork. The railroad brought manufactured materials like corrugated steel and standardized lumber and trim, leading to the Territorial style. Many new buildings in the region are a mash-up of these influences.

It is in this rich backdrop that NEEDBASED, Inc.—a design firm where I work under my colleague, architect Jonah Stanford—built three certified Passive Houses: the Balance Project, the Taos House, and the Olsen House. For these projects, we were looking for a robust, energy-efficient system for building homes that would also be affordable. We prefer a contemporary design approach that draws on traditional qualities like the parapet roof, natural materials, and, of course, the thick walls that are ubiquitous in the Southwest. We have found that we can design Pas-



The Taos House



The Olsen House



sive Houses at market prices that use a fraction of the energy of a code-built home. We've built these houses for as little as \$175 per sq. ft. and feel that \$300 per sq. ft. is a budget that we can regularly hit. When this cost increases, it is commonly due to challenges with the building site.

Not passive solar, Passive House

There has long been a lively passive-solar design movement in New Mexico due to the 300 days of sun a year and the thermal mass inherent in adobe buildings. In our experience, though, we have found that passive-solar design has been inadequate for comfort and predictability. It is also too site specific, making it hard to scale or adapt to different conditions. Without significant owner interaction, these homes tend to overheat, even in the winter, but especially in spring and fall. Yet because these homes are so reliant on the sun, a few cloudy days or cold nights will still require large heating systems.

We have worked with the LEED for Homes certification program and the National Association of Home Builder's Green Building program, too, but found the design processes to be very generalized and prescriptive, lacking any opportunity for solutions based on actual local conditions. While working on an affordable housing development, for instance, we could not justify a \$5,000 increase in mechanical equipment simply to move from an 85% to a 90%-efficient boiler,

which would provide so little return for our clients. It was during this time that we heard about the Passive House system and its focus on energy conservation as a cost-effective approach to efficiency. We could take that same money to greatly increase the home's insulation levels and address air-sealing, yielding significant reductions in energy use and utility expenses. This focus on the envelope—a “fabric first” approach—is now the core of our design process.

The Passive House standard was developed 25 years ago in Germany and employs a strict performance metric to achieve a comfortable interior without using significant energy resources. With a very tight, superinsulated envelope that is properly energy-modeled and free of thermal bridges, this type of building works equally well during both heating and cooling periods with very small mechanical systems. The Southern Rockies is a very desirable environment for designing a Passive House, as the elevation of over 7,000 ft. above sea level brings cold winter nights while consistent sun provides for relatively warmer daytime temperatures. A Passive House-certified project can use no more than 4.75 kBtu per sq. ft. per year in heating and cooling energy and 38 kBtu per sq. ft. per year in other energy usage—or roughly 80% less than most code-built buildings.

With an additional focus on comfort, a Passive House stands out compared to other approaches. Most buildings rely principally on

THE BALANCE PROJECT A MODERN HOME OFFICE

The Balance Project is a home and office in the Railyard District of Santa Fe and the first certified Passive House in New Mexico. It has a modern design, but it fits in neatly with the age-old Pueblo-style buildings surrounding it. It has a solar-thermal domestic water heater with a radiant slab that supplies 100% of the heating and 96% of the hot water. The wall system is constructed of 2x6 framing with a taped plywood air barrier, off of which are hung Larsen trusses filled with cellulose insulation. Furring strips for the fiber-cement siding create a rain-screen cavity that helps the wall dry quickly.

Envelope Specs

SLAB R-26 EPS rigid foam

WALLS R-58 dense-pack cellulose

ROOF R-98 loose-fill cellulose

AIR BARRIER Poly sheeting under slab; plywood sheathing (seams taped with Isocell airstop tape) on walls and roof

WINDOWS Optiwin tilt-turn (U-0.137/R-7.2/SHGC 0.60)

BLOWER-DOOR TEST RESULTS 0.47 ACH50

System Specs

VENTILATION Zehnder 350 and 200 ERV

HEATING In-floor hydronic radiant

HOT WATER Solar-tank heat exchanger

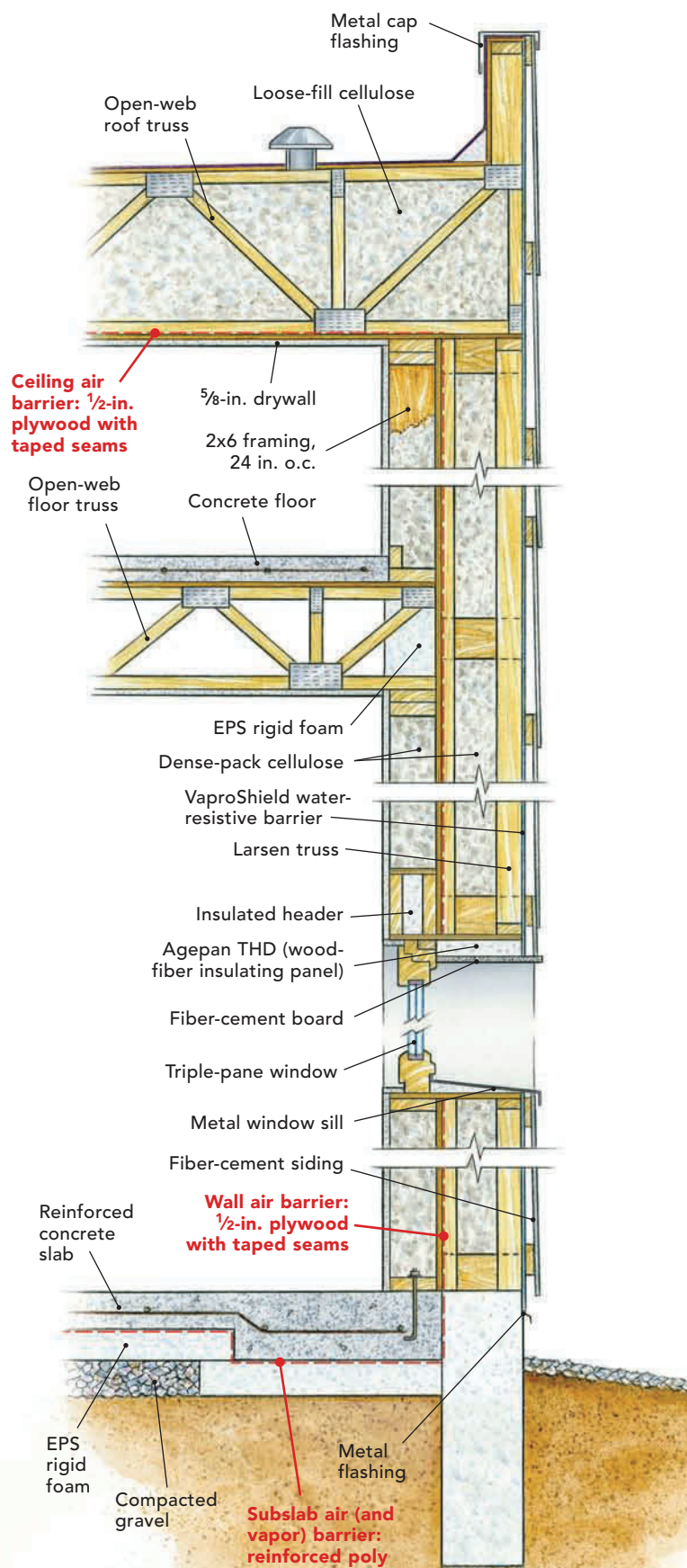
COOLING Passive shading and night-sky cooling via ventilation system

Measured Building Performance

HEATED SQ. FT. 3,452

AVERAGE ENERGY INTENSITY 1.82kwh per sq. ft. per year

AVERAGE TOTAL ENERGY USE 6,314kwh per year





convection through heating and cooling equipment to maintain air temperature. But comfort is also subject to radiation—we feel the radiant temperatures of cold windows and hot ceilings, and often find the difference between surfaces and interior air temperature uncomfortable. A Passive House will have only a slight contrast in temperature between the ambient air and interior surfaces, providing thermal stability and comfort. This is one of the most talked-about benefits by occupants and is rarely experienced in average homes.

We have learned how to optimize widow-to-wall ratios and massing, and the Passive House Planning Package design and verification software is very good at predicting heating needs as well as overheating potential. That was one of our first lessons with the Balance Project: for a few reasons, we added more glass than the energy model called for. Indeed, the home was overheating and we had to add sun-shading devices.

In this climate, a smaller Passive House will have about R-60 walls, R-100 roofs, and R-30 insulation beneath the slab. This allows us to eliminate the need for pricey heating and cooling systems and use those savings to upgrade the envelope. We have successfully been able to meet nearly 100% of heating and hot water needs with small solar-thermal systems. With proper shading, operable windows for ventilation, and the ability to flush the indoor air at night with the

energy-recovery ventilators (ERVs), the homes require little, if any, air conditioning, even during 90°F days. Dramatically reducing this demand not only simplifies energy systems, but also lowers costs and improves the resilience of the house. And best of all, insulation doesn't have any operating costs and doesn't break down after a few years like complex mechanical equipment, making it a lifelong investment.

Embracing thick walls

Massive walls have been part of the local vernacular since the first days of adobe-brick-building. In our contemporary designs, the thickened walls can enhance the occupant's experience. Not only do they create a sense of stability and scale, but thick walls also provide the opportunity to create alcoves, shelves, and informal sitting nooks.

Airtightness is as important to energy loss as insulation. We have found the Passive House airtightness standard is very achievable and all our projects test close to half of the 0.60 ACH50 threshold while under construction. Moreover, it's important that the house remain airtight over time, so we use quality materials and make sure they are well protected in the building assembly.

The key is to design a dedicated air-barrier system that properly connects the floors to the walls and the walls to the roof. Most of our assemblies use a combination of tapes and either a solid substrate like

THE TAOS HOUSE REMINISCENT OF A HISTORIC NEIGHBOR

With the Taos House, we again incorporated simple forms and emphasized the relationship with its surroundings, including the historic Taos Pueblo only three miles away. Here, we used ZIP System sheathing as an air barrier. The house has 10 in. of exterior EPS rigid foam with a three-coat stucco system. A solar thermal system heats the domestic hot water and an electric on-demand water heater feeds the radiant slab. Energy usage is more than offset annually by a 2.75kw photovoltaic system.

Envelope Specs

SLAB R-30 EPS rigid foam

WALLS R-58 dense-pack cellulose and EPS rigid foam

ROOF R-104 dense-pack cellulose and EPS rigid foam

AIR BARRIER Poly sheeting under slab; taped ZIP System sheathing on walls and ceiling

WINDOWS Zola (U-0.123/R-8.1/SHGC 0.62)

BLOWER-DOOR TEST RESULTS 0.42 ACH50

System Specs

VENTILATION Zehnder 350 ERV

HEATING In-floor hydronic radiant with electric boiler

HOT WATER Solar thermal with 80-gal. storage tank and electric on-demand backup

COOLING Passive shading and night-sky cooling via ERV

ON-SITE ENERGY GENERATION 2.2kw photovoltaic system

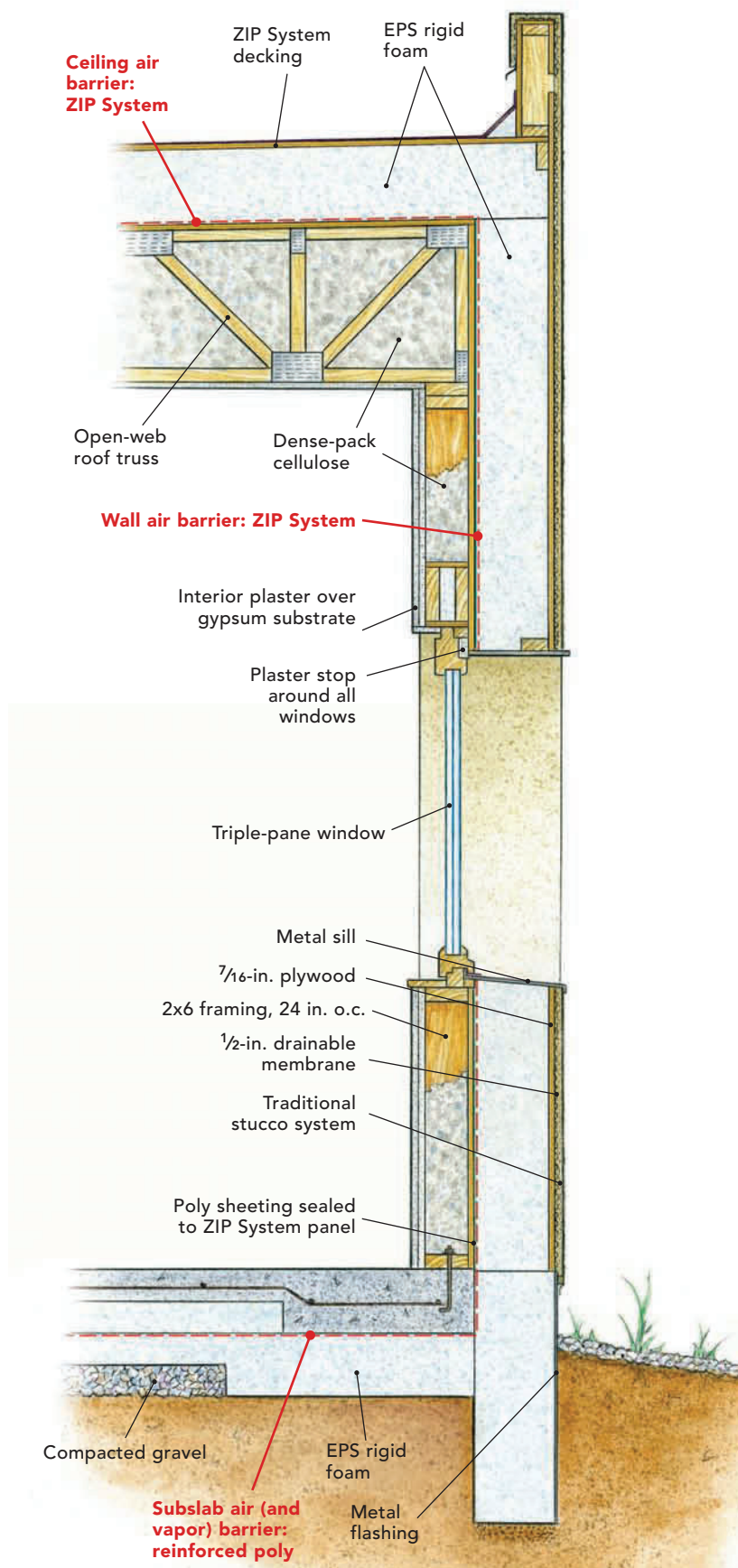
Measured Building Performance

HEATED SQ. FT. 1,620

AVERAGE ENERGY INTENSITY 2.11kwh per sq. ft. per year

AVERAGE TOTAL ENERGY USE 3,417kwh per year

AVERAGE TOTAL ENERGY GENERATION 3.532kwh per year





plywood or ZIP System sheathing in addition to smart membranes, which also provide vapor control. We work very closely with the contractors to ensure the whole team is aware of the importance of airtightness. A blower-door test is done before covering the air barrier's components and again after installing the majority of finishes. Interestingly, the homes test leakier when finished, so it is critical to be very diligent with the air barrier during construction.

With such a tight envelope, a balanced air-exchange system is a critical component of a Passive House. We now spec professionally commissioned Zehnder ERVs in all of our projects to exchange indoor air. We found lower-cost brands can perform poorly, leading the occupants to turn them off if they haven't broken down altogether—and neither is good for indoor air quality or comfort. The Passive House Institute (PHI) certifies components like ERVs, and will discount the labeled efficiency automatically if they are not independently tested.

One of the weakest links in a home's thermal envelope is the window frame. All of our projects have large triple-pane windows, which minimize the frame-to-glass ratio and are also certified by PHI. We can improve window performance by insulating over the frame from the exterior as well.

One of the most important lessons we learned when designing a Passive House envelope is that it is crucial to make sure every single

building component is chosen for a specific task. There are dozens of ways to build a high-quality, high-performance wall. Each is based on a systems approach that is airtight, thermal-bridge free, and vapor controlled while still providing room for mechanical services, structure, and cladding. If you try to force components to perform multiple tasks at the same time, they can fail in performance or durability. For instance, using spray-foam insulation as an air-seal will not provide an airtight envelope; similarly, installing an air barrier in the wrong place could lead to condensation and complicate mechanical penetrations. This will lead to expensive repairs and unsatisfactory performance results in addition to unhappy contractors and owners.

Each project has its own distinctive assembly drawn from the specific needs of the homeowners and the site as well as our lessons learned on past projects. By incorporating the Passive House program into our practice we are confident that our buildings will provide many generations with comfortable, efficient, and affordable homes—even with unpredictable future climates. □

Andrew Michler is a Passive House consultant and the Social & Creative Instigator at NEEDBASED, Inc. He is the author of *[ours] Hyperlocalization of Architecture*. Photos courtesy of NEEDBASED, Inc.

THE OLSEN HOUSE TERRITORIAL WITH PITCHED ROOFS

Simple and discreet with pitched metal roofs, the Olsen House design borrows from the Territorial style. We sited the garage to avoid northwest-facing windows, which tend to overheat the interior. The double-stud walls are insulated with cellulose and are sheathed with ZIP System. The vaulted ceiling has an Intello smart vapor retarder and air barrier. We again utilized a combination solar thermal system that provides hydronic heating and domestic hot water. The owner opted for a 2.2kwh solar electric system, which is sized for a future plug-in car.

Envelope Specs

SLAB R-30 2-lb. EPS foam

WALLS R-56 dense-pack cellulose and fiberboard

ROOF R-98 dense-pack cellulose

AIR BARRIER Poly sheeting under slab; taped ZIP System sheathing on walls; Pro Clima Intello smart vapor-barrier ceiling

WINDOWS Zola (U-0.123/R-8.1/SHGC 0.62)

BLOWER-DOOR TEST RESULTS 0.43 ACH50

System Specs

VENTILATION Zehnder 350 ERV

HEATING Solar thermal in-floor hydronic radiant with electric boiler backup

HOT WATER Solar thermal with electric on-demand backup

COOLING Passive shading and night-sky cooling via ventilation system

GENERATION 2.5kw photovoltaic system (sized for future electric car)

Modeled Building Performance*

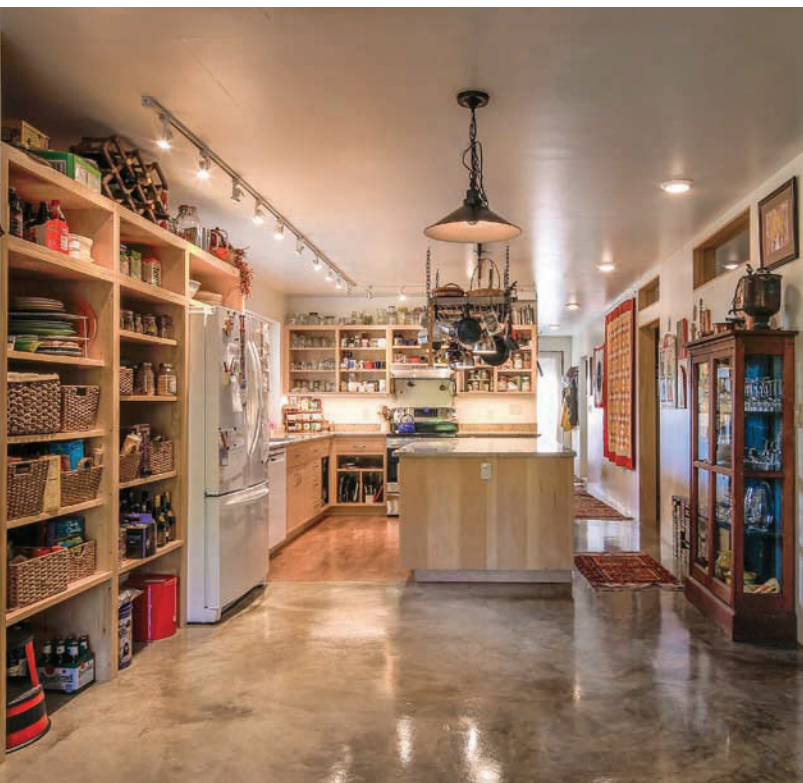
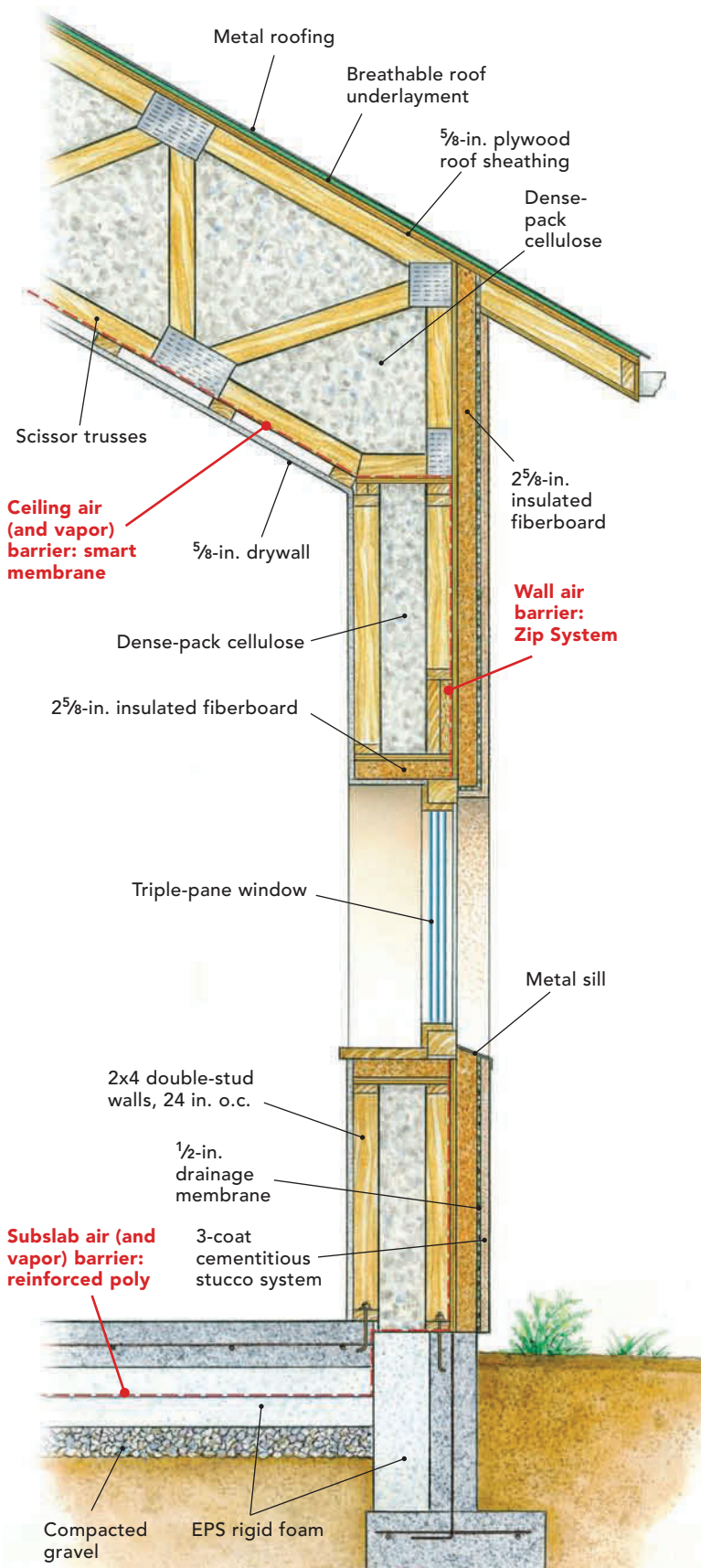
HEATED SQ. FT. 1,759

AVERAGE ENERGY INTENSITY 1.71kwh per sq. ft. per year

AVERAGE TOTAL ENERGY USE 3,015kwh per year

AVERAGE TOTAL ENERGY GENERATION 3.991kwh per year

*Actual energy use data is unavailable due to the project's recent completion



A Field Guide for **Prefab Railing**



Manufactured deck railings are fast to assemble and look great

BY JOE CIARALDI

My Salem, New Hampshire-based remodeling company builds a lot of decks. Given our harsh New England weather and insistence on high-quality products, we almost always install manufactured railing parts rather than using wood. We've used several brands over the years, and all have performed well. Generally speaking, the way the various manufactured railing systems are constructed is pretty similar, but we prefer the Trex Transcend line because of the wide range of available rail and baluster styles and colors. The top and bottom rails, post sleeves, and balusters are made from Fibrex, a fiber-composite material made by Andersen Windows (used on their patio door sills, among other products). The railing components come boxed and prefinished, and installation is straightforward. Best of all, our clients like the look of the finished railings, the maintenance-free system, and the option to integrate low-voltage lighting if desired.

A relatively simple white guardrail free of curves, angles, or sloping sections runs about \$175 per ft. in material costs. Colors cost more, as do more complicated layouts. The railings depend on 4x4 pressure-treated posts spaced every 6 ft. to 8 ft. The rail lengths are based on the on-center spacing, so they are actually 67½ in. and 91½ in. long, which is important to keep in mind when you're ordering components and installing the posts. Because Trex designed the rails to work with multiple baluster styles, you'll find that baluster kits include style-specific matched inserts that snap into the universal top and bottom rails to space the balusters. We're careful to accurately order all the parts plus one or two extras of each because it usually takes a few days for our local lumberyard to deliver an order. □

Joe Ciaraldi is an award-winning carpenter and deck builder with Professional Building Services in Salem, N.H. Photos by Patrick McCombe.

START WITH STURDY POSTS

Before installation, I run each post through the tablesaw to remove all four corners, making space to run low-voltage lighting cable. I fasten the structural posts to the joists and rim joist using self-drilling FastenMaster ThruLok fasteners. Then I reinforce the posts with blocking fastened to nearby joists with structural screws. Once the blocking is in place, I use additional ThruLok fasteners to connect the posts to the blocking. Fibrex sleeves make the pressure-treated posts maintenance-free.

Slide on the sleeves. The 4½-in.-square post sleeves are sold in 39-in. and 108-in. lengths. Cedar shims are used to plumb the sleeves once they're on the posts.



String the posts. Once the sleeves are on the posts, stretch a string across the posts to ensure they are in line. If one or more is out of line, remove the sleeve and use a flat bar to shove the post over. A plastic shim or two is sometimes needed to hold the post in place before reinstalling the sleeve.

Follow the template. With the four-sided base trim already slipped over the sleeve, use the included cardboard template to guide the placement of the plastic rail-support brackets. The rail-fastening kit includes zinc-coated, self-drilling screws.



FIT THE RAILS AND BALUSTERS

The rails, rail inserts, and balusters all work together to create a sturdy, code-compliant guardrail system. Once I've cut both rails, I fasten the bottom rail and place the top rail on support brackets, leaving it unfastened. I then install the balusters.

Cut the rails. Cut the top and bottom rails $\frac{3}{16}$ in. short to allow for the trim pieces at each end. It's best to cut the rail section inserts at the same time to ensure the parts are the same length. Removing equal amounts from both ends evens the baluster spacing.



Fasten the intermediate support.

To prevent the rail from sagging, fasten the intermediate support to the underside of the bottom rail. When the rail is in its installed position, extend the support's telescopic foot to the decking. A pair of set screws with matching caps hold the support in its extended position.



Connect the rails.

With the U-shaped trim placed halfway onto the rails, drive screws through the brackets into the bottom rail and then the top rail, securing them to the post. Once the screws are driven, push the trim fully onto the rails.



Install the insert.

Designed to accommodate both round and square baluster styles, the rail sections include PVC inserts to space and secure the balusters. After the top rail is secured to the bracket, snap the lower insert into the lower rail and place the upper insert on top of it to prep for the baluster installation.





Fit the balusters. The balusters are precut to make a 36-in.- or 42-in.-high code-compliant guardrail. Slip the balusters through both rail inserts and angle them to fit into the top rail's receiving channel.



Pull it tight. Top and bottom rails must be cut to an exact length to ensure the posts stand perfectly straight. If necessary, draw the posts together with a ratchet strap to tighten the fit before fastening the top railing.



Slide up the top insert. Once all the balusters are in place, slide the upper insert (which was placed on the lower rail) upward and snap it into the top rail. It's often necessary to move it gradually, switching from one end to the other.

Curves require a special setup

ONE OF THE ADVANTAGES OF FIBREX RAILING PARTS is that they can be heated to form curves. The ability to easily incorporate curves into our decks helps differentiate us from the competition, so five years ago we bought a CustomCurve heating oven from Trex. This \$10,000, 9-ft. long, propane-powered oven can hold two pieces of decking or railing on slide-out racks that make it easy to get the parts in and out.

Depending on the part, it can take anywhere from a few minutes (for inserts) to two hours (for deck boards) to get the material soft enough to bend. Before bending, we place 1x4 PVC stock on both sides of the piece to prevent scuffs and encourage a fair curve. We set up the clamping table for the specific curve using a paper template made by scribing the deck frame. The table—also part of Trex's CustomCurve system—has an aluminum top that accepts clamps to hold a curve while it cools. We've found the table can sometimes flex, throwing off the curve, so we added steel framing underneath to reinforce it.



WHAT ABOUT SLOPED RAILING?

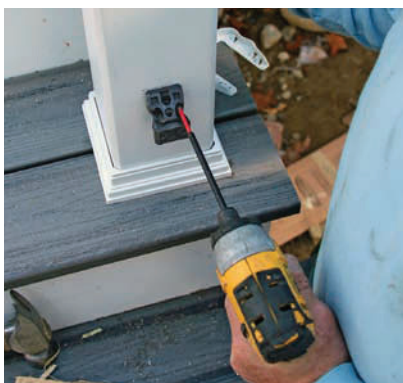
Although it's installed much like straight railing, sloped railing for stairways requires a different hardware kit. The stair hardware has longer trim pieces for rail ends and an intermediate support cut to match the rail's slope.



Scribe the fit. With the rail resting directly on the treads, scribe the rail length and the angle of the miter using the posts as a guide. Reduce this measurement by $\frac{3}{16}$ in. to account for the U-shaped trim that will be installed on both ends.



Mark the brackets. Place the bottom rail on a 2x4 and temporarily attach the bracket to the post sleeve with double-sided tape. Then remove the 2x4 and move the lower rail out of the way.



Fasten the brackets. With the bottom rail out of the way, you can now fasten the bracket to the post. The mounting bracket is sloped to match the rail (see below).



Pilot holes help. Although the screws are self-drilling, pilot holes are helpful to get the screws started, especially when you're fastening the top and bottom rails to the support bracket.

Rail brackets do double duty

High-strength plastic rail-support brackets connect the top and bottom rails to the structural post. They include corrosion-resistant self-drilling screws.



Sloping rails use the same bracket as straight rails, but you have to use two instead of one at every rail-to-post connection. The two brackets are joined by means of a sliding dovetail molded into the plastic.

TOOLBOX





Clip the long points. The sloped balusters have mitered ends and are meant to work with any code-compliant stair's rise and run. But clipping $\frac{3}{8}$ in. off both long points allows the baluster to sit deeper in the receiving channel for a sturdier connection.



Trim in place. We wait until the end of the railing install to trim the post sleeves. The easiest way to do this is with a cordless multitool equipped with a fine-toothed woodcutting blade. Any slight irregularities in the cut will be hidden by the post cap.



Cap it off. Post caps come in flat and pyramid styles (prices start at \$12). Both styles are designed to accept low-voltage lighting. Secure each cap with a bead of silicone where it meets the top of the post.

project gallery

HIGHLIGHTS FROM FINEHOMEBUILDING.COM



Backyard bliss

Whether you're joining friends for dinner on a warm spring evening, sipping a cool beverage on a hot summer day, or sitting beside a cozy fire on a chilly fall night, there's just something about doing these activities outdoors that makes them even more enjoyable. Of course, you don't need to have a fancy patio to do these things, but it sure is nice if you do. If your backyard renovation plans call for installing an outdoor entertaining area, here are a few great spaces to inspire you. —Maureen Friedman

Modern-day timber-frame pavilion

This living and dining pavilion and pergola near Portland, Oregon was added during the whole-house remodel of a timber-frame home. The pergola and pavilion were crafted with reclaimed industrial timbers salvaged by Pioneer Millworks. The 560-sq.-ft. pavilion includes an outdoor kitchen and dining space as well as a cozy seating area complete with Rumford fireplace. With additional bar seating and built-in benches, there's plenty of room for entertaining family and friends and enjoying the incredible views on all sides.



Intimate and inviting in town

What began as an addition to the main house and a garage replacement led to the total re-landscaping of this backyard. The sloping lot was graded and then finished with a retaining wall and pair of patios, all built using Vermont fieldstone. Because the house is nestled into the base of a small hill, the view from the neighbor's house is directly into this yard. To create a bit of privacy, the homeowner's architect brother-in-law designed the red-cedar and galvanized-steel pergola over the main patio. The addition of a children's play structure at the back of the yard completed the project.

Landscape design Cynthia Knauf, Cynthia Knauf Landscape Design, Burlington, Vt., cynthiaknauf.com

Hardscaping and installation Church Hill Landscapes, Charlotte, Vt., churchhilllandscapes.com

Pergola design Michael Willoughby and Associates, Birmingham, Mich., mwa-architects.com

Pergola construction Red House, Burlington, Vt., redhousebuilding.com

Photo Susan Teare, susanteare.com



Design Jonthan Orpin, Maxine Bromfield, and David Shirley, New Energy Works Timberframers, Portland, Ore., newenergyworks.com

Builder Kevin Reese, K. Reese Enterprises, Lake Oswego, Ore.

Photo Loren Nelson Photography, lorennelsonphotography.com, courtesy of New Energy Works Timberframers



Nighttime in New Hampshire

A screened porch and stone terrace were added to this home as part of a whole-house remodel. The porch features motorized retractable screens that open it up to the rest of the terrace. To add interest and functionality, the designer incorporated recessed areas into the terrace for gardens and a fire pit. From the fire pit area you can sit back and enjoy the view yet still stay warm on chilly New Hampshire nights.

Architect Richard G. Holt, Cormack Construction Management, Madison, N.H., cormackconstructionmanagement.com

Landscape design and installation R. Theresa Puza, Gardens to Imagine, LLC, Henniker, N.H., gtiarborists.com

Photo Cheryle St. Onge, cherylestonge.com

Sanctuary in the suburbs

The greatest challenge when incorporating dining, sitting, and play places in this long, narrow yard was the considerable grade change. The distance along the back of the house is approximately 55 ft. and the distance from the house to the retaining wall is only 15 ft. This area was excavated in order to install the cozy bluestone terrace. The retaining wall is a mixture of Oak Street veneer and Westchester granite. Set into the top of the wall is a custom-designed water feature lit with a string of LED lights. The water feature brings a gentle bubbling sound to the sitting area. A small stone path planted with blueberry bushes leads up into the garden. Next to the terrace is a fun play space for adventurous kids complete with a rope bridge leading to a playhouse.



Design Jana L. Bryan, Julie Moir Messervy Design Studio, Saxtons River, Vt., jmmnds.com

Construction Joe Arcidiacono, JMA Landscaping, Eastchester, N.Y., jmalandscaping.com

Photo Susan Teare, susanteare.com



California courtyard

The kitchen and master-bedroom wings of this home carved into a steep hillside in the Santa Ynez Valley in Southern California extend out to form protected courtyards. This outdoor dining room off the kitchen is sheltered from the strong breezes from the west. A wood-burning concrete fireplace adds warmth and ambiance. The room is covered by a metal trellis and planted with vines to offer shade from the midday sun. The flooring is integral-color concrete.

Design Fernau & Hartman Architects, Inc., Berkeley, Calif., fernauhartman.com

Construction Coastal Builders, Inc., Solvang, Calif.

Photo Marion Brenner Photography, marionbrenner.com



Bringing it all together

The main level of this bank barn is used as a gathering place for entertaining friends and family. A more recent addition, the 16-ft. by 24-ft. Pennsylvania bluestone terrace, was designed and built by Church Hill Landscapes. It gracefully connects the house and barn and provides an inviting outdoor area for cooking and dining, and with its dry-laid retaining walls of Adirondack fieldstone and radius bluestone steps custom-fabricated on site, the terrace appears as if it's always been a part of the bucolic Vermont landscape.

Design and construction Nate Carr, Church Hill Landscapes, Charlotte, Vt., churchhilllandscapes.com

Photo Susan Teare, susanteare.com

askthe experts

YOUR QUESTIONS—PRO ANSWERS

experts



Myron R. Ferguson
drywall specialist



Brian Wallo
electrician



Mike Guertin
editorial adviser

Need help?

Get answers you can trust from the experienced pros at FHB. Email your question to Experts@FineHomebuilding.com.

Horizontal vs. vertical drywall

Myron R. Ferguson's book, *Drywall: Professional Techniques for Great Results*, has many helpful ideas, but as a trim carpenter I was dismayed to see him promote hanging drywall horizontally. When the tapered bevel is placed on the floor, it makes fitting coped corners in baseboard much more difficult, as the baseboard is now "kicked in" at an angle. Also, when drywall is installed horizontally, you end up with an unsupported joint between each stud. If fastened vertically, every edge will land securely on a stud. I know it is easier for drywall installers to install and finish horizontally, but this method adds difficulty for trim carpenters, and I think adds weakness to the wall as well.

—DAVID FERRAND
via email

Myron R. Ferguson: As far as the tapered edge along the base goes, attaching a shim along the floor is really the answer. Changing the orientation of the drywall will just create poorer-quality finished walls.

Hanging drywall horizontally does, as you point out, place seams at a more convenient height for finishing, resulting in better work, but that's only part of the story. When the walls are 9 ft. high or less, attaching the drywall horizontally can reduce the lineal footage of seams by as much as 25% over vertical attachment. When combined with the longest sheets possible, butt seams are minimized, and those that do appear land



between studs where they can be back-blocked to make them easier to finish. The unsupported edges you mention aren't a problem and are actually less likely to crack than a joint that lands on a stud.

All of this adds up to a smoother wall. But the perks go beyond labor savings and quality of finish. Horizontal attachment actually increases the shear strength of the structure.

Proper drywall prep

Prior to priming, my husband wiped our newly taped drywall with a damp rag to remove the sanding dust. This messed up a near-perfect finish by making the joint compound somewhat wavy. What is the proper way to prep

the wall for priming? Should we just dust it with a dry cloth?

—CAROL HARLAND
via email

M.F.: I have been in the drywall business for over 30 years and I have never cleaned dust off drywall before priming. There is no need, and, as you discovered, dusting can damage the finish. I vacuum dust out of electrical boxes, around rough openings, and along the floor, but the best option for dealing with small specks of dust or whatever is creating a slightly rough surface is to prime first, and then lightly sand the wall with a pole sander (with 220 or finer grit paper attached). The primer protects the wall from over-sanding, and you create a smooth surface ready for the top coats of paint.

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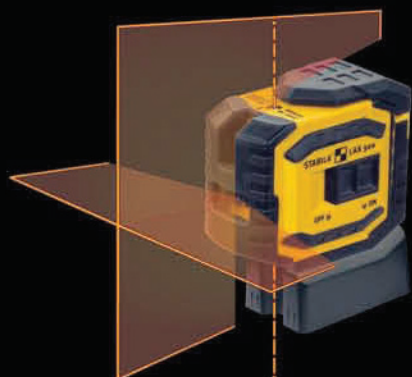


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Generator fix

I have an 11kw standby generator that is less than three years old with eight hours of runtime, yet the system just had its second controller fail. The manufacturer repaired it the first time, but has refused to replace the second controller under warranty. I don't want to spend over \$600 for yet a third controller that may also fail, so I tried to find a universal controller to replace the OEM controller. My search was unsuccessful. Can I tear out the electronics and just run this generator manually when I need to?

—RUIZ MANGO
via email



Although it may be tempting to bypass, the transfer switch on a standby generator is an essential safety item.

Brian Walo: When you lose the electronics, you lose the transfer switch, which is an important

and code-required part of any compliant generator installation. The main reason behind a transfer switch is to ensure the safe interconnection between commercial power sources (utility companies) and private power sources (your generator). The transfer switch not only ensures that both sources of power cannot power your home simultaneously, but also guarantees that you won't backfeed your local power grid and potentially electrocute local line workers who believe they're working on dead wiring. So, while the temptation to "run this generator manually" might be strong, there are a lot of very serious safety considerations and codes you'd be ignoring. Take another run at the manufacturer if it's still under warranty or get it professionally repaired.

Building soundproof walls

I'm remodeling two bedrooms that share a common wall. How can I make the wall more soundproof?

—ERIC LEWIS
Keene, N.H.

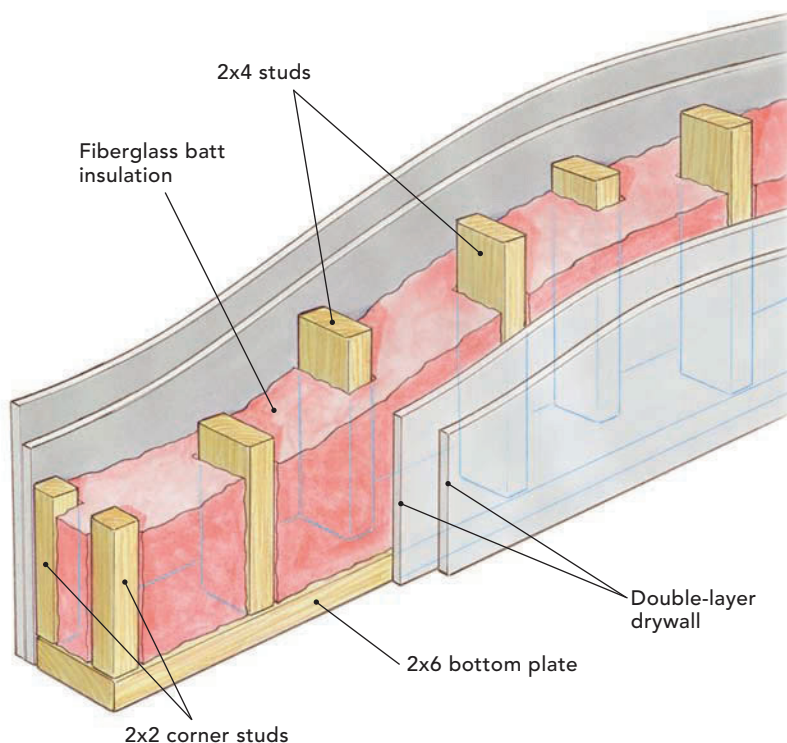
Mike Guertin: There are several ways to make walls more soundproof, and they can be combined to achieve the level of quietness desired. I prioritize my approaches based on bang for the buck.

First, minimize sound bridges. Sound travels through solid materials more readily than through air and soft materials. One approach is to reframe the wall with staggered studs, using 2x6 bottom and top plates and 2x4 studs set in an offset pattern. The studs supporting the drywall on one side of the wall are separate from the studs supporting the drywall on the other side. You can take this a

step further by replacing the top and bottom plates with steel track, which will help reduce the sound transfer between materials. If the wall is non-bearing, you may be able to use offset 2x3 studs and 2x4 plates and save two inches compared to the 2x6 and 2x4 combination of plates and studs. Sound bridges can also be minimized by adding horizontal metal-resilient channels across studs, which separate the drywall from the studs. These are a good option if you don't want to reframe the walls with offset studs.

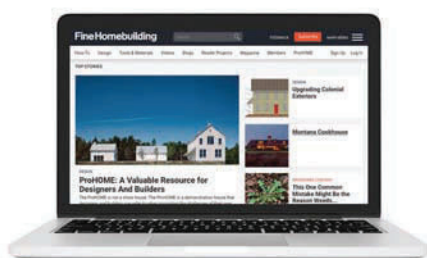
Next, seal penetrations. Back-to-back electrical outlets, switches, or any other wall penetration will let sound travel through a wall. Apply acoustical putty on the outside of any electrical boxes to minimize this sound transfer.

The next approach is to muffle the sound by filling wall cavities with acoustical insulation. Fiberglass batts, for example, are a



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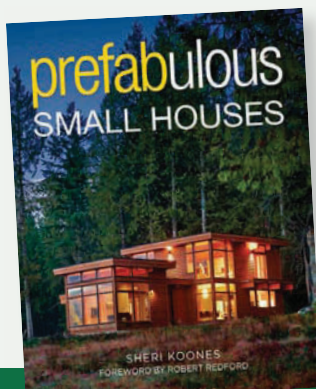
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cost-effective and commonly used material that will muffle sound.

You can create sound-deadening drywall by installing multiple layers on each side of the wall. Or, use noise-reducing drywall like

SilentFX or QuietRock.

These sheets incorporate a polymer core and are only ½ in. or ⅝ in. thick, but they have the sound-deadening performance of several layers of regular drywall. You could apply a sound-deadening membrane, called mass-loaded vinyl, over the studs before

hanging the drywall, but these sheets are costly.

Last, seal gaps and joints (like the bottom plate to the subfloor) with non-hardening acoustical sealant. This is an inexpensive measure, but it may not make the wall much quieter than the previous options unless there are large gaps that can be sealed.

Balloon-frame remodel

I'm in the process of renovating an early 1900s home that was constructed using the old balloon-frame method. There were no headers or jack, king, or cripple studs used. When I replace the windows and doors, is there a requirement to install headers and jack, king, or cripple studs, or should I match the methods used throughout the rest of the over 100-year-old house?

—GEORGE CARR
via email

M.G.: Balloon-framed walls are different than platform-framed walls; in balloon-framed walls, the studs are continuous from the mudsill

Rather than headers and jack studs, balloon-framed houses rely on let-in ledgers to support and transfer load paths to studs. When enlarging existing openings, conventional headers, jacks, and kings may be required.



all the way to the top plates on the uppermost floor where the rafters rest. Floor joists on the second and third floors are supported by let-in ledger boards, and the joists are usually nailed to the side of the studs. The ledgers essentially act as headers and the studs surrounding the doors and windows act as jack studs, transferring the loads around the openings. Openings on non-bearing exterior walls (walls running parallel to the floor joist system) often don't have a ledger.

Since your home is an existing structure, you may not have to

upgrade the framing unless the replacement windows and doors are larger than the existing wall openings. I've replaced windows in many balloon-framed homes and have not been required to reframe the rough openings. However, if you enlarge the opening size, the local official may require you to install platform-style framed headers, jacks, and kings.

To see the codes relevant to your situation, check sections "R102.7: Existing Structures" and "R102.7.1: Additions, Alterations or Repairs" in the 2015 IRC.

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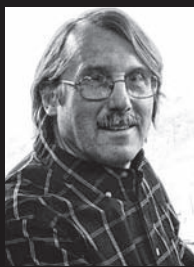
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"Musings of an Energy Nerd" showcases the best of Martin Holladay's weekly blog at GreenBuildingAdvisor.com, where he provides common-sense advice about energy issues to residential designers and builders. His conclusions usually fall between minimum code compliance and the Passive House standard, which often makes them controversial to both building-science geeks and everyday builders.

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Should I Replace My Old Windows?

If you're trying to lower your energy bills, you've probably plugged your home's air leaks and added insulation to your attic floor. Now you may be wondering, "What about my old windows?"

There is no clear answer to this question. Sometimes it makes sense to leave old windows alone. Sometimes it makes sense to repair the weatherstripping and add storm windows. And sometimes it makes sense to replace old windows with new energy-efficient ones.

Although new energy-efficient windows will reduce your energy bills, the payback period will be longer than the windows will last. When considering what to do with old windows, comfort, historical character, and the presence of lead paint may matter as much as cost and energy efficiency. Some homeowners decide to repair old windows because new windows may not last as long as restored historic ones, because they care more about their house's character than energy savings, or because of historic preservation commission requirements.

Plus, replacing windows doesn't always reduce costs. Michael Blasnik is an energy consultant with access to utility-bill data for millions of U.S. homes. "I've looked at a lot of window-replacement data," Blasnik explained at the Building Energy 12 conference in Boston. "I've heard window salespeople say that you can save 50% on your heating bills if you replace all your windows. In fact, the amount of



energy saved by replacing all of the windows in a home is generally 1% to 4% of the heating energy usage."

Exaggerated marketing claims by companies selling replacement windows have exasperated energy experts for decades. "Window replacement has a 200- to 300-year payback period," said Blasnik. "A Wisconsin study found that a lot of the expected energy savings is lost by the reduction of solar gain. Most replacement windows have low-solar-gain glazing, so maybe half the saved energy is gone due to the reduction in solar gain. I tell people, go ahead and replace your windows if you want, but don't expect significant energy savings."

In short, says Blasnik, "The measure is not cost effective."

The authors of a 1996 study ("Testing the Energy Performance of Wood Windows in Cold Climates") concluded, "Replacing a historic window does not necessarily result in greater energy savings

than upgrading that same window. The decision to renovate or replace a window should not be based solely on energy considerations, as the differences in estimated first-year savings between the upgrade options are small."

New replacement windows

Repairing an old window can cost as much as or more than replacing it. That's why it sometimes makes sense to install replacement windows—as long as you realize that you'll never see enough savings in your energy bills to justify the high cost of the work.

One fan of window replacement is GBA reader Keith Gustafson. "In my opinion, the only way to get an antique window to be at least partly airtight involves removing it from the building [for renovation]," Gustafson writes. "In doing so, you will doubtless find that some pieces are rotten and need extensive rebuilding." Because "wood moves," and

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because “those sashes were never intended to be airtight,” the windows “will continue to leak air ... and this will grow over time, especially if they are used regularly. There are good companies that make weatherstripping products, but they depend on the quality of install, and if you are paying for the labor it is going to add up.

“Once this is done, you have the honor of maintaining paint and putty on a regular and ongoing basis. I have watched panes fall out of their sashes behind storm windows. While storm windows are less expensive than new windows, they still cost money. A quick search finds a decent-looking triple-track with screen for \$150, while [home centers] have them for as low as \$60. None of these are airtight or low-e. [Home centers] will also sell you an Andersen 400 series [window] for less than \$400, or a vinyl window for less than \$200.

“It would surprise me if the bill for properly refitting antique windows and adding a good-quality storm window was significantly lower than the cost of installing a decent-quality replacement window. If you are doing the labor yourself, then it will be cheaper ... but people hereabouts who are worth hiring run \$25 to \$50 an hour.

“If you love the look of antique windows (which I actually happen to) or are legally required to save them, then repair sounds sensible. Take none of this to mean that you should buy a house full of windows from the guy with bad breath, a lime-green polyester sport jacket, and a magnetic sign on his truck. Restoring old windows is a labor of love, or the product of intense hatred of vinyl windows, but I think both long and short term it is not a big financial gain.”

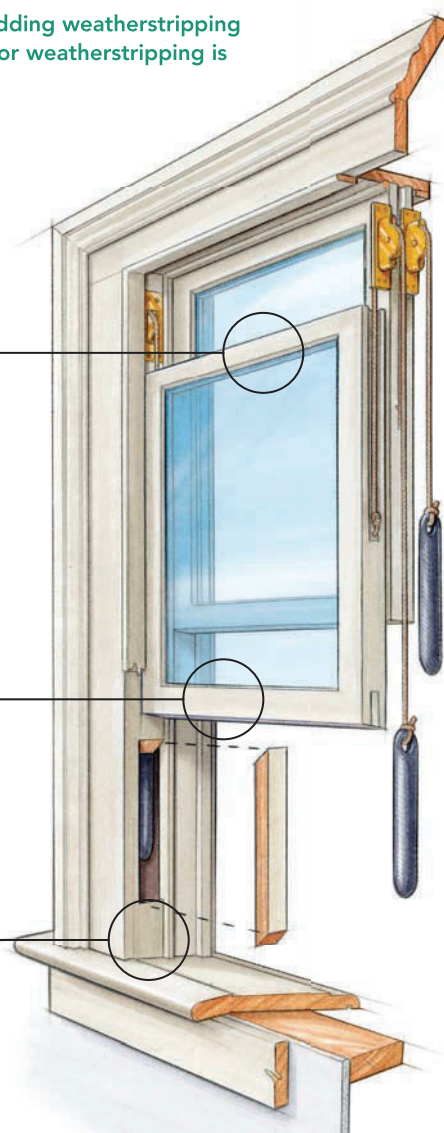
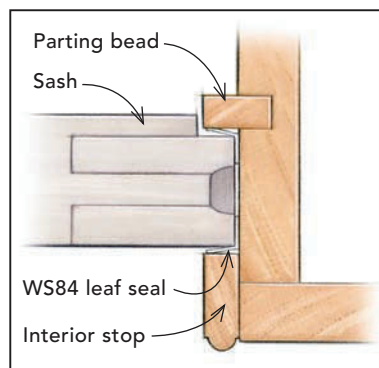
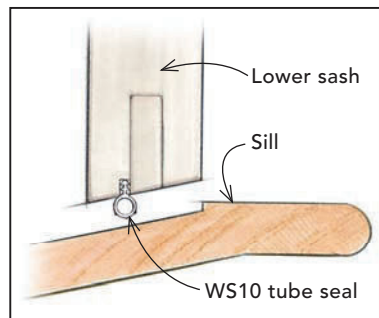
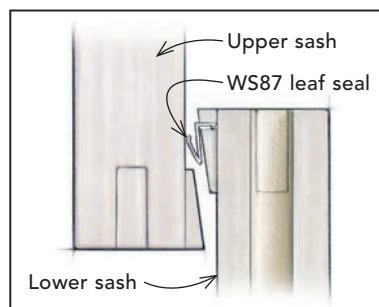
If you install replacement windows, you should have a good understanding of moisture management and flashing. Remember that building codes require every bedroom to have at least one window that is large enough to provide emergency egress. A bedroom window with a small rough opening may require a casement rather than a double-hung to meet egress requirements.

Storm windows can make a big difference

While many older homes still have their original single-glazed windows, almost

MAINTAINING CHARACTER AND ENERGY EFFICIENCY

Old windows can be made less drafty by adding weatherstripping in a few important places. A good source for weatherstripping is conservationtechnology.com.



all such homes (especially those in cold climates) have had triple-track storms installed by now. Single-glazed windows with triple-track storms don't perform quite as well as new double-glazed windows, but their performance is surprisingly close. The annual difference in energy bills may amount to just \$1 or \$2 per window.

If your single-pane windows have storm windows that are in good shape, it makes sense to keep what you have. Of course, storm windows are only effective if they are closed during the winter. (A surprisingly high percentage of triple-track storm windows are left open all winter long.)

If you live in a cold climate and your windows don't have storms, consider install-

ing low-e storm windows. Research has shown that an old single-glazed window fitted with a low-e storm window performs nearly as well as a new double-glazed low-e window. According to a 2007 Lawrence Berkeley National Labs/NAHB Research Center study by Craig Drumheller, the average payback period associated with the installation of new low-e storm windows on older homes in Chicago was 4.3 years.

There are two types of low-e coating: sputtered (called soft coat) and pyrolytic (called hard coat). Only pyrolytic coatings are durable enough for storm windows. When used on a storm window, the low-e coating faces the interior. Since most pyrolytic coatings have a higher solar-heat-gain

coefficient (meaning that they allow more solar gain) than most sputtered coatings, pyrolytic coatings are particularly appropriate for cold climates.

There is a caveat to low-e storm windows: they work well when installed over single-glazed windows, but should never be installed over newer double-glazed low-e windows. According to an article in *Environmental Building News*, "Modeling performed for Lawrence Berkeley National Labs by sustainability consultant Thomas Culp, Ph.D. has uncovered the potential for serious overheating problems when low-e storms are added to low-e windows: in hot weather, in direct sunlight, temperatures up to 185°F may be reached. That kind of heat can cause premature aging or failure of the insulated glazing unit's seals."

Old single-glazed windows are high-solar-gain windows. On a sunny winter day, that's good news. However, on a hot summer day, it's bad news, especially if the windows face west. If you live in a hot climate, you probably worry more about cooling costs than heating costs. Solar gain through windows is a major contributor to cooling loads, so it makes sense to address solar gain in rooms that overheat.

Solar gain can be addressed by shading with a trellis or awning or by installing solar-control window films. An effective but expensive option is to install replacement windows with low-solar-gain glazing.

Comfort is worth paying for

Before fixing or replacing your windows, ask yourself if the windows have storms, if they operate smoothly, and if the existing weatherstripping does an adequate job of keeping out drafts. If the answer to all three questions is yes, you may not need to do anything at all.

If you live in a cold climate and your house has older single-pane windows and no storms, invest in low-e storm windows. If you live in a hot climate, you may want to invest in window film to reduce solar gain.

It's hard to justify any other improvements to existing windows on the basis of energy savings. That said, if your windows are drafty, or if you feel cold when you sit beside a window on a winter night, you may be happy to spend \$400 or \$500 per window for improved comfort. And if lead paint is an issue, it's worth paying for lead abatement to protect your family's health.

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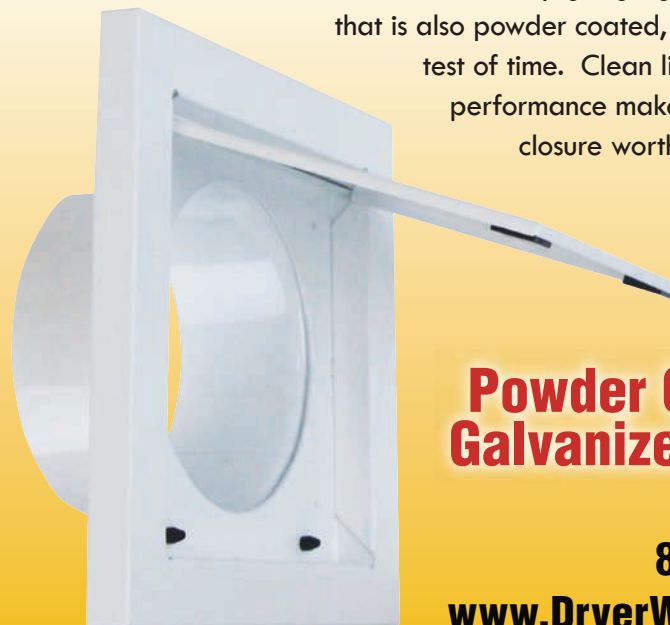
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Repairing rot with epoxy



STEP BY STEP

Wood rots—particularly wood that gets and stays wet. In many cases (for example, when considering a rotted piece of 1x trim) the fix is straightforward: Replace the decaying material and address the detail that failed and allowed in water. With historic houses, however, replacement isn't always simple. Stock replacements for historic elements may not exist, and having custom replications made can be pricey. Even if you can take one of these approaches, odds are the wood available today won't be as stable nor as rot resistant as the original, making the longevity of the repair questionable. In some cases, PVC or cement-based products can be used, but these may not lend themselves to being machined to replicate existing elements.

Another option is to repair the rotted area with epoxy. Epoxy repairs make a lot of sense with old moldings, columns, and windows

1 Remove the worst rot. Use a wire brush, scraper, or pick to get rid of anything that's loose or particularly wet—the material should feel dry to the touch.



2 Mix the liquid epoxy consolidant. Mix equal amounts of resin and hardener, then let it sit for about 10 minutes to be sure the components are well blended.



3 Make reservoirs for the consolidant. Bore holes every 1/4 in. or so into the semi-sound wood. Don't drill all the way through or the consolidant will leak out.



4 Fill the holes. Use a syringe to flood each drilled hole with consolidant, repeating this step several times until the holes are thoroughly soaked.



5 Brush epoxy onto the surface. Use a plumber's flux brush to paint the consolidant onto the surface until the wood stops sucking it in.

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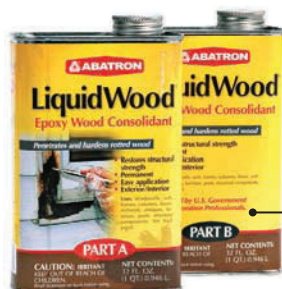
Special materials, simple tools

Sources for epoxy rot-repair products include Abatron, TotalBoat, and West System. A kit containing quart-sized tubs of consolidant and putty costs about \$130.

STEP BY STEP



Putty, parts A and B



Consolidant, parts A and B



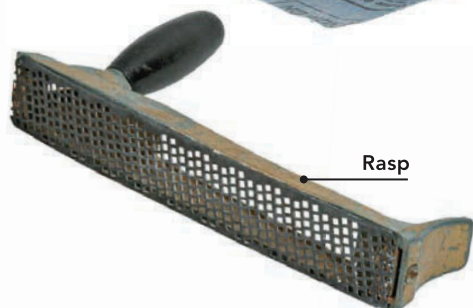
Glue or basting syringe



Flux brushes



Sanding block



Rasp



6 Mix the putty. Like the consolidant, epoxy putty consists of two roughly equal parts that are kneaded together. Wear gloves—once set, epoxy is essentially insoluble and impossible to remove.



8 Build up the surface. Form the putty roughly into the shape of the original element. Make it a little larger so it can be shaped once the putty has hardened, which takes about an hour.



7 Squish the putty into any voids. Be sure to completely fill any holes in the wood, working in the putty and trying to avoid capturing big air bubbles.



9 Remove the extra. Hardened epoxy can be shaped with standard woodworking tools, from routers to rasps and sandpaper.

where exact-match replacements can't be found. After fixing the issue that allowed the piece to stay wet in the first place, an epoxy repair is a four-step process that includes removing the loose decayed material; hardening the mostly sound remaining wood with thin, liquid epoxy (also called consolidant or rot stabilizer); filling the voids with epoxy putty; and, finally, shaping the hardened epoxy to match the original details. Once it has set, epoxy is as strong as the wood it's replacing.

One complication with epoxy is that the material and the ambient temperature generally need to be between 50°F and 90°F. If it's colder than 50°F, the epoxy won't set. Above 90°F, it can set too fast and become difficult to work with. You can use heat to

your advantage, however. Once you've finished applying the consolidant or putty, the setting time can be accelerated by using a heat gun or halogen lamp to warm the area.

Rot prevention is a battle

The organisms that cause rot need four things: food, water, air, and convivial temperatures. Eliminate one or more of these things and wood can't rot. Air and liveable temperatures are necessary for human life, so that leaves only deprivation of food or water as practical ways to thwart rot.

Rot-causing organisms eat wood itself. Nature has made some wood species highly rot resistant by loading them with chemicals called extractives that make the wood inedible (cedar and redwood are among

these species). Humans have mimicked nature's approach by introducing chemical preservatives ranging from creosote to a variety of compounds containing metals such as copper or chromium that make wood inedible. However, it's rare to find preservative-treated wood of trim quality.

In fact, a lot of wood used for exterior trim on houses incorporates no preservatives. Instead, builders try to prevent rot by keeping the wood dry using good installation details and paints. This approach can work if well executed and maintained, but rot is relentless and eventually something is likely to go south.

Old wood really is better

Wood used 50 or more years ago was more resistant to rot than most of what's available today, including species we don't think of as particularly rot resistant. This is because antique wood came primarily from large-diameter old-growth trees.

Trees grow outward from the center, adding layers each year. These layers are classified as either sapwood or heartwood. Sapwood consists of several annual layers of living cells just under the bark that carry water and nutrients between the leaves and the roots. Young trees are all sapwood, which is why they're called *saplings*. Once a tree is harvested, sapwood tends to be rot-prone, even in cedar and redwood.

As trees age, the cells in the innermost layers of sapwood die and become heartwood. Heartwood no longer transports anything between the roots and the crown of the tree and has a high concentration of extractives. Rot-resistant species have a high concentration of extractives already, but even rot-prone species generally have some level of extractives in their heartwood.

Because of their slow growth and large diameter, old-growth trees have a greater ratio of heartwood to sapwood than modern lumber, which tends to come from fast-growing trees harvested at much smaller diameters than would have been cut half-a-century ago. The lack of sapwood is what makes old-growth wood more rot resistant.

Senior editor Andy Engel once made his living fixing old houses. Photos by Rodney Diaz, except where noted.



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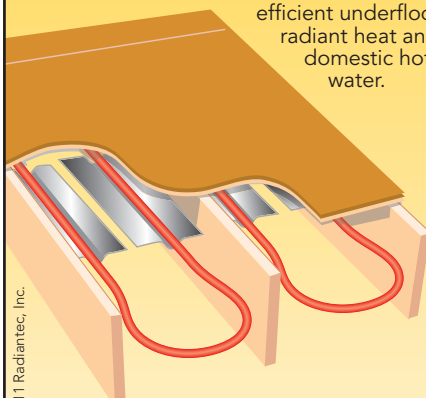
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Making a room under a deck

As an architect specializing in small-home design, I'm always looking to get the most out of the spaces people have available in and around their homes. With this in mind, I often see a great opportunity to gain outdoor space under raised decks. With a little thought and a little extra effort and material, this under-utilized area can add to the appearance, comfort, and value of your home.

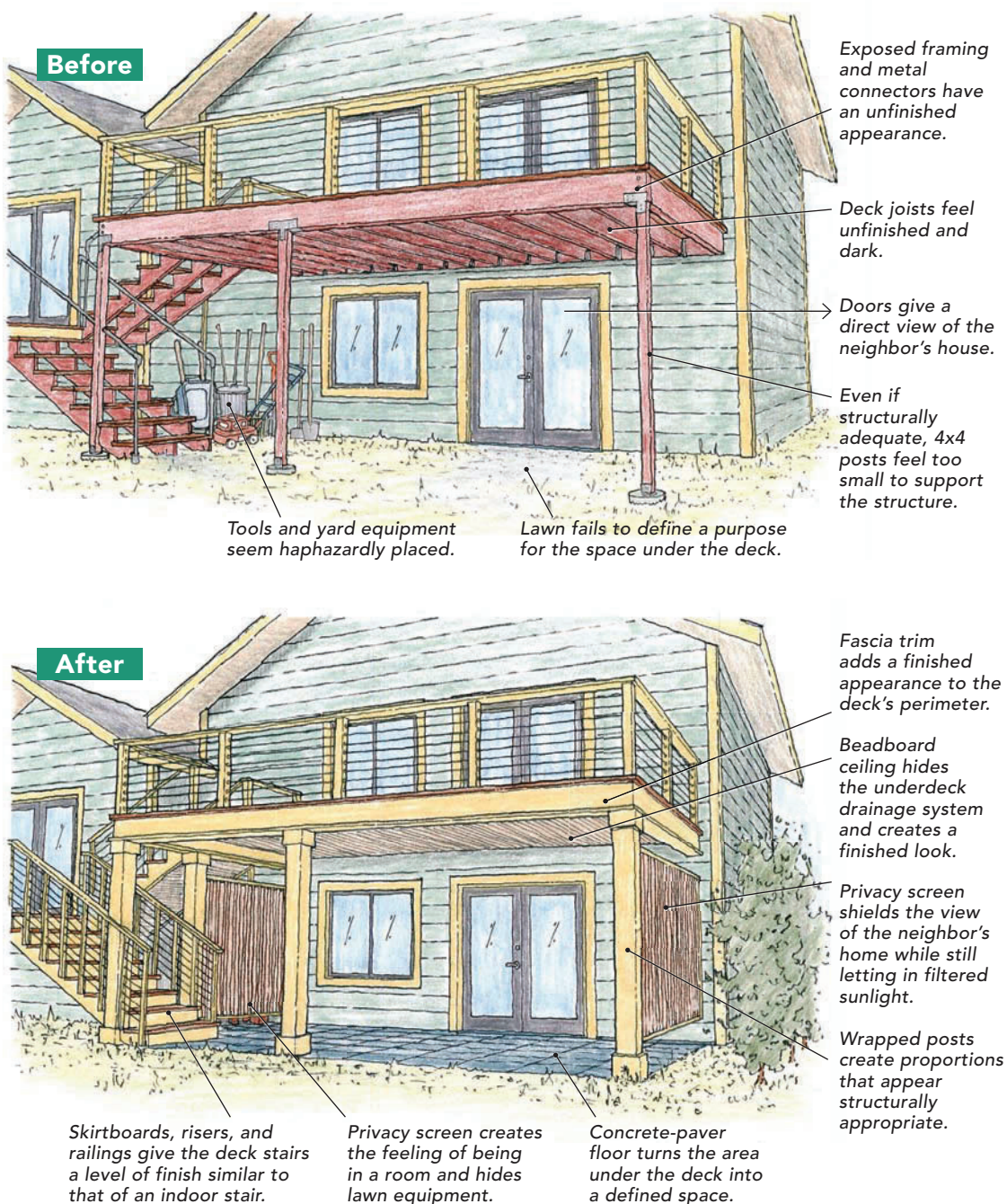
Not only is this a project for capturing additional outdoor living space, but defining the area under your deck will also add character. Let's face it—the spaces under most decks are less than attractive. If there are doors or windows looking out below the deck, this is true when viewed from the outside as well as from the inside. Creating another room outside the house allows us to perceive the house as larger.

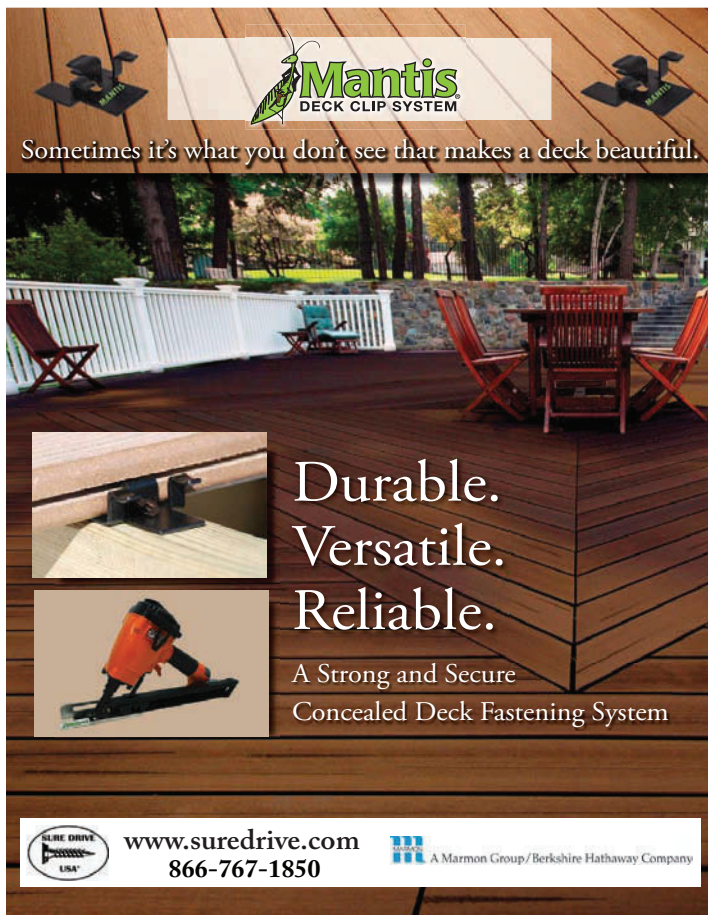
Before designing the space under a deck, be sure to address the challenge of waterproofing the underside of the deck with a manufactured or site-built drainage system. From a design point of view, it's also important to evaluate the space to be sure you are comfortable with its opportunities and limitations—specifically that headroom, access, orientation, drainage, utility runs, and so forth all work in your favor.

The key to making this all work is transforming the space under the deck so that it has

LOOKING IN: The whole house looks better

Not only did this remodel create an inviting, usable living space under the deck, but the details dress up the overall elevation of the house.







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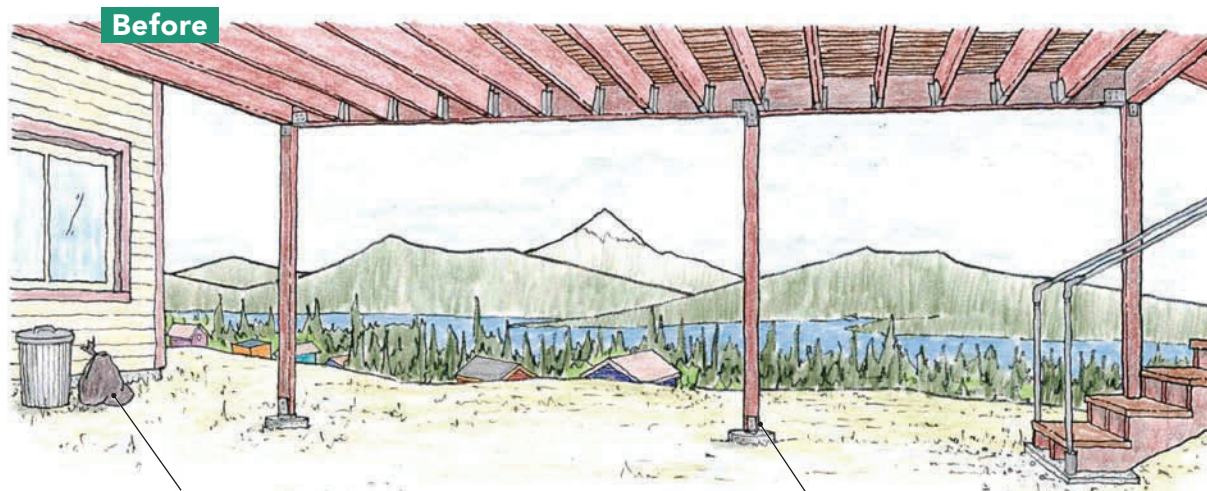
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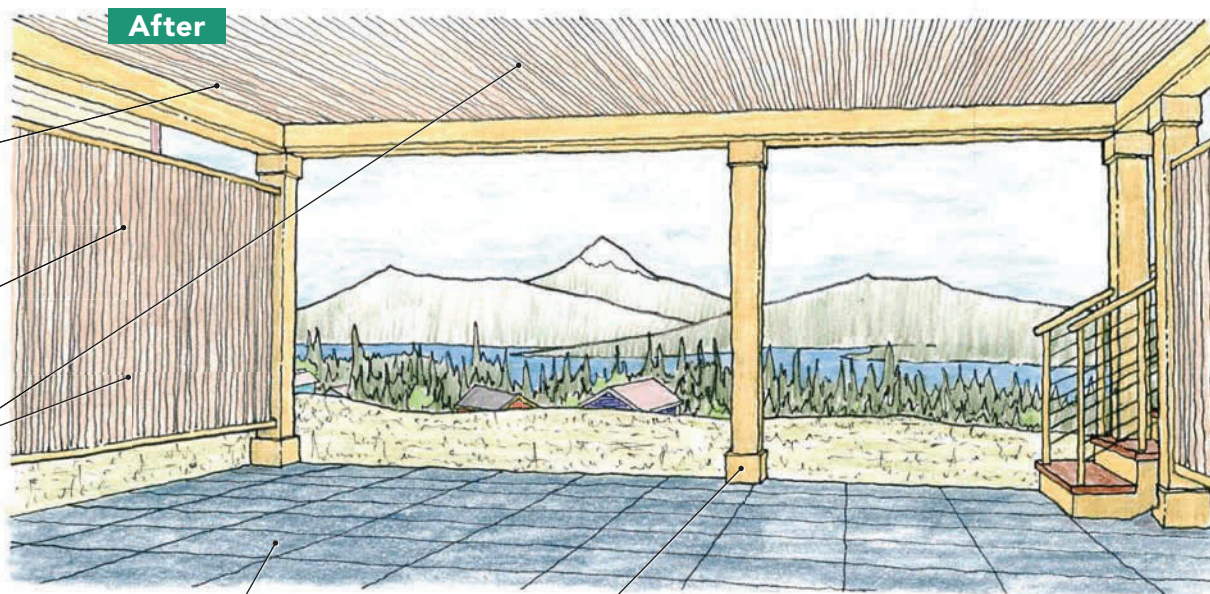
LOOKING OUT: The view comes into focus

Similar to using windows to frame particular views from inside the house, the details of the new deck hide storage, block the view of the neighbor's house, and direct your attention to the distant landscape beyond, extending the sense of spaciousness inside the house.



Open area gives an unsightly view of the neighbor's house and garbage.

Deck's structure has an unfinished appearance, similar to that of an unfinished basement.



Beadboard ceiling running perpendicular to the house directs your view to the mountains.

Privacy screens block unwanted views and suggest walls that define the space as an outdoor room.

Directional lights on the privacy screens and ceiling add interest at night.

Pavers create a defined footprint and mimic the tile flooring used inside the house.

Post bases and caps on wrapped posts add decorative elements to the space, suggesting a level of finish similar to that of indoor rooms.

a roomlike feel. This means creating and defining a floor area, adding the perception of walls, and designing an appealing ceiling plane. The same concepts can also be applied more broadly when adding any outdoor living area to the house.

Flooring defines the space

Ideally, the floor area has about the same footprint as the deck above and can be finished with gravel, poured concrete, concrete pavers, wood, or composite decking. For

gravel, a border edging to contain the stones and define the footprint is important. A concrete pad will be more interesting if it is scored with a pattern (perhaps mimicking tile), has a sanded finish, and/or has an integral or applied color added to it. Many concrete-paver choices are available, but I recommend keeping it simple by choosing materials that are already used in other parts of your property whenever possible. This will help tie the underdeck design to the rest of the house. Decking is also an

option, particularly duckboards, which are tile-like sections of decking installed on grade that are removable for cleaning.

With the flooring defining the space, the trick with privacy screening is to give the impression of walls without creating a dark and dreary area under the deck. Where you can, try to bring daylight into the space. This may not be as important in a hot climate where an oasis of shade is desirable, but in most areas you'll want the space to feel as light and cheery as you can make

it. You can use semitransparent privacy screens—angled slats, for example—to make the space feel contained and comfortable. In this way, you can hide undesirable views such as the neighbor's trash cans or your yard equipment, and block wind or harsh light while still keeping the space feeling open and bright. Plantings can also be used to accomplish this goal, as well as to help define the space.

Dressing up the deck posts and beams helps to make the space feel substantial and finished as well. A raised deck supported by 4x4s or steel posts may be structurally sound, but may make people feel uneasy about being under or near a structure that appears inadequately supported. By wrapping the columns and beams with trim, you can give perceived heft and strength to the structure. You can even go a step further and add a base to the posts and perhaps a cap piece to suggest a level of finish similar to that found inside the house.

A ceiling is the finishing touch

In some cases, the underside of the decking may be a perfectly suitable finished ceiling, but if you have created a true living space, you're likely looking at the drainage system and so will need to install a finished ceiling. Deck joists offer endless opportunities for attaching the ceiling material of your choice. Common options include tongue-and-groove beadboard, plywood with battens (to conceal seams), and corrugated metal. Here, too, take cues from other materials and finishes used on your house. If it is a directional material, I often like to install it perpendicular to the house. This draws the eye to distant views, further helping to expand the perceived size of the space.

Upgrading the lighting is also worth considering. Unless it is strictly used for utilitarian purposes, I would avoid simple overhead fixtures on the ceiling. These tend to create harsh and uncomfortable lighting conditions. Instead, think about lighting the surfaces using sconces or uplights shining toward the ceiling and then highlighting elements such as the posts, privacy screen, or plantings. Also consider low-voltage landscape lighting and its potential for inviting people to enter the space.

Russell Hamlet (studiohamlet.com) is an architect on Bainbridge Island, Wash. Drawings by the author.

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BRIAN POST,
WALLER

Historically, a mason is somebody who knows and works with mortar. Brian Post is not a mason, he's a waller. His specialty is dry-stacking stones, and aside from some simple hand tools, he does his job with the help of only friction and gravity. At age 32, Post is the youngest of seven DSWA-GB Master Craftsman-level wallers in North America, a certification earned through a traditional, years-long sequence of rigorous, time-consuming, and highly critical evaluations. Although

the Vermont-based Stone Trust where he earned his certification might, at first glance, be mistaken for a frivolous collection of hobbyists pursuing a skill with no modern utility, that couldn't be further from the truth. It's the mission of the Stone Trust to preserve and advance the art and craft of dry stonework not as some nostalgic indulgence, but because it outperforms modern methods in almost every way. This is how you build so it will last, because if built correctly, dry stone walls are more durable



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than their mortared and concrete-block descendants. This is how you build efficiently, because trained wallers build faster and are therefore less expensive than their popular veneered-block-wall-laying competitors.

As for Post, he says he will never get tired of stepping back at the end of the day and seeing his work, knowing it's going to outlive him. "It gives you a real sense of purpose and satisfaction in life. Much more so than working on a computer, or anything else, I think."

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Essence of the earth

For over thirty years, artist and mosaicist Andreas Kunert has worked with stone. In 2009, artist Naomi Zettl joined him. Partners in life and business, they collaborate to design and create unique artistic and functional works such as mosaic panels, garden features, fireplaces, and sculptural elements. Their creative inspiration flows directly from nature and they seldom work from a preconceived

design or drawing, preferring to let their pieces grow from the vision in their minds and the spirit of the stones and other materials that they use.

Pictured here is the wall they built on their Vancouver Island property. The approximately 250 tons of stone were individually selected and installed by the Kunerts. A 4-ton granite boulder the couple fell in love with in South

Dakota was trucked to their home, where it was split down the middle and used to flank the garden gate. Passionate about finding a way to use materials that would otherwise be discarded, they incorporated large columns of basalt—the cast-off material from windowsill production—into their design. The columns' natural hexagonal shape was formed from rapidly cooling lava flows. Colorful stone mosa-

ics are interspersed between the columns and boulders. The cedar garden gate was designed by the couple and custom-made by a woodworker neighbor. Its window is a recycled cog.

The project began November 2014 and was completed May 2015, in time to create a beautiful backdrop for the couple's August wedding at their home.

—Maureen Friedman

GATE DESIGN, WALL DESIGN AND CONSTRUCTION Naomi and Andreas Kunert, Ancient Art of Stone, Cowichan Bay, Vancouver Island; ancientartofstone.com
GATE CONSTRUCTION Jack Van Hell, Cowichan Bay, Vancouver Island **PHOTO** Courtesy of Ancient Art of Stone

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