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Mastering stair balusters

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Weaving corner shingles

Get more from your foam gun

NEW THIS ISSUE

Marianne Cusato's design column **p. 90**

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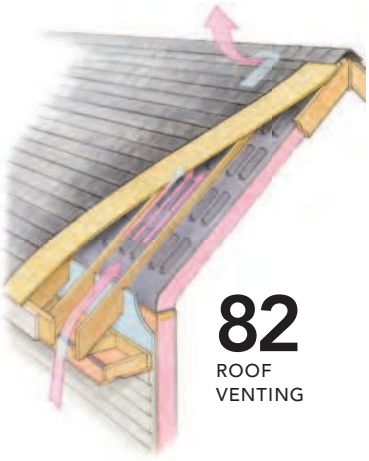

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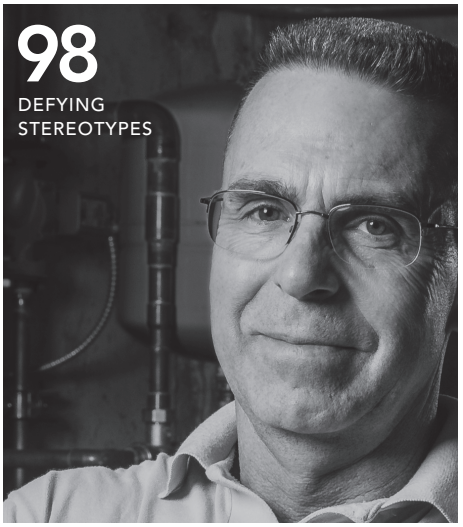

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The Taunton Press
Inspiration for hands-on living®

ON THE COVER *Fine Homebuilding* editor Justin Fink adds new trim to a porch addition. See how he seamlessly connects the new with the old on pp. 36-41. Photo by Rodney Diaz.

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New video series: Tool Tech

Join tool editor Patrick McCombe in his shop, where he evaluates the newest and most noteworthy tools and materials.

Outside skirt returns

Andy Moore shares a trick for getting stair stringers in plane across the riser.

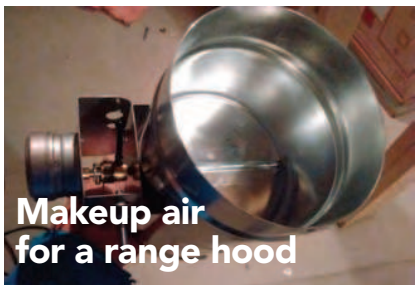
FHB
The Fine Homebuilding Podcast

How to spend $2,500 on tools

In Episode 55, the guys go all out in this heated debate: If you had $2,500, what tools would you spend it on?

Cleaner jobsite—better jobsite

Jason Mollak says the impression people get when they walk onto your job site is a reflection on you and your company.



Makeup air for a range hood

Editorial adviser Mike Guertin explains his solution for makeup air in a tight house.

Victorian vision

This Queen Anne–style home features stained-glass windows, floral wallpaper, and details in oak and cherry.

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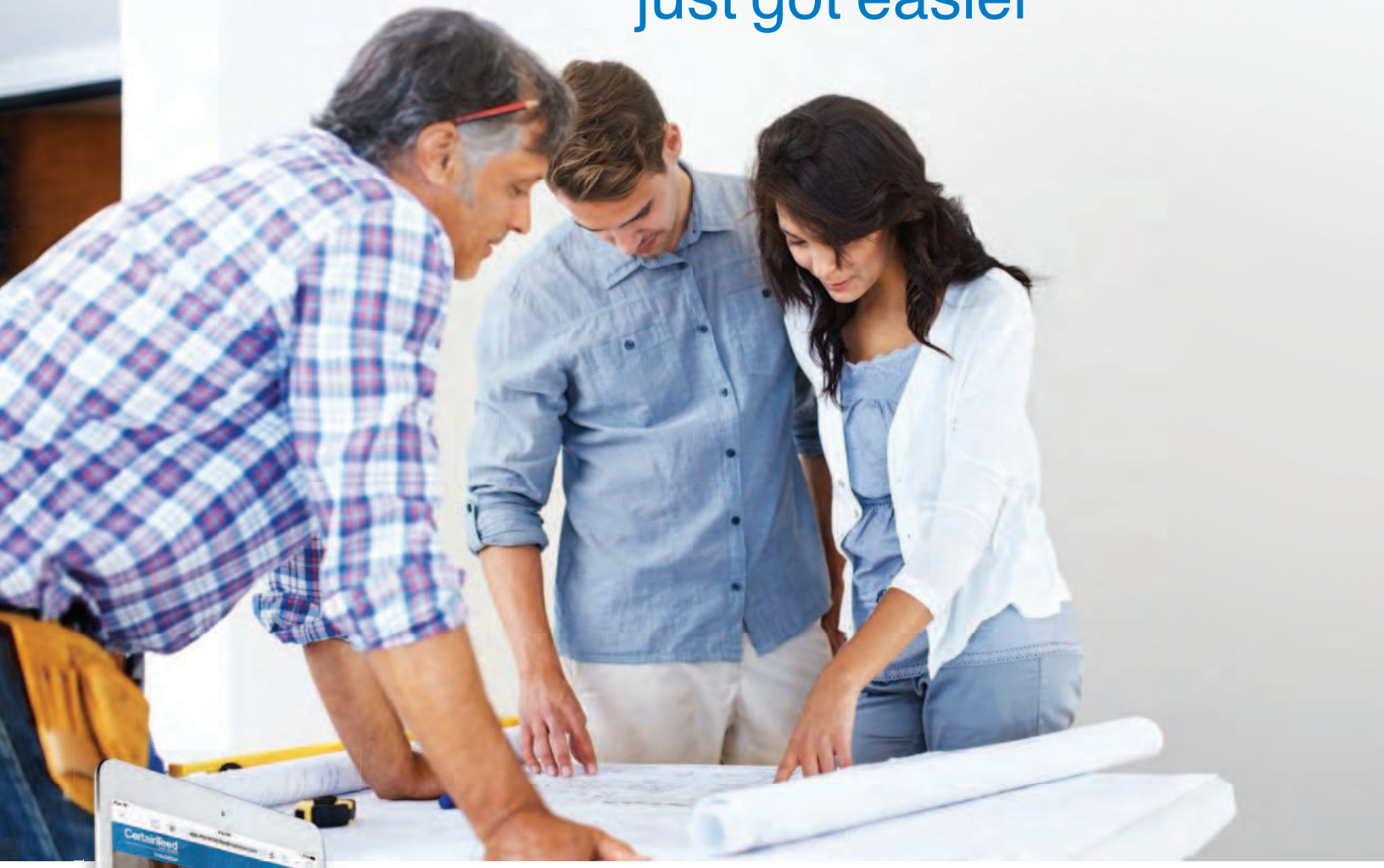
Talking Insulation
just got easier



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contributors

THE VOICES OF EXPERIENCE

DAVID CROSBY ("Guide to Low-Slope Roofing," pp. 66-71) is a construction design development and training consultant. He has worked as a laborer, carpenter, roofer, mechanic, foreman, and owner of a construction company specializing in excavation, demolition, and green building. He most recently spent seven years as a project manager in the public sector, responsible for the management of over 2.5 million square feet of low-slope roof.

JAMES SHULL ("Mastering Balusters," pp. 42-47), took up woodworking in a junior-high shop class, landing his first job at a stair company through a high-school co-op program. In 1996, he began installing railings as a subcontractor, and then started building stairs, working out of his garage. Today, he designs, builds, and installs all kinds of wooden stairs, specializing in circular stairs and traditional compound-curved rails, some with hand-carved fittings.

Associate editor **PATRICK McCOMBE** has been testing tools for national publications since 2001. He got his first power tool from his uncle at age 10, a vintage Rockwell electric drill with a mangled cord. He bought his first foam gun in 1996 to improve the efficiency of the homes he was building for Pittsburgh Habitat for Humanity. It quit working a few days later. In this issue, he writes about how to make your foam gun last (pp. 62-65).

ANDREW YOUNG ("A Workaround Approach to Knee-Wall Built-ins," pp. 56-61) is the co-owner of Young & Son Woodworks in Portland, Ore., with his recently retired father. After starting the business in 2005 as a full-service remodeling firm, they transitioned to finish carpentry during the recession. Andrew's father retired in 2014, and now Andrew focuses on four areas: stairs, cabinetry, built-ins, and interior finish work.

write an article

Fine Homebuilding welcomes articles from our readers. We'll acknowledge all proposals and return any we can't use, and we'll pay for any articles we publish. For details, check our website at FineHomebuilding.com.

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Fine Homebuilding: (ISSN: 1096-360X) is published bimonthly, with a special 7th issue in the spring and a special 8th issue in the fall, by The Taunton Press, Inc., Newtown, CT 06470-5506. Telephone: 203-426-8171. Periodicals postage paid at Newtown, CT 06470 and at additional mailing offices. GST paid registration #123210981.

Subscription Rates: U.S., $37.95 for one year, $65.95 for two years, $93.95 for three years. Canada, $40.95 for one year, $71.95 for two years, $102.95 for three years (GST included, payable in U.S. funds). Outside the U.S./Canada: $55 for one year, $98 for two years, $141 for three years (payable in U.S. funds). Single copy U.S., $7.99. Single copy Canada, $8.99.

Postmaster: Send all UAA to CFS. (See DMM 707.4.12.5)

Non-postal and Military Facilities: Send address corrections to Fine Homebuilding, PO Box 37610, Boone, IA 50037-0610

Canada Post: Return undeliverable Canadian addresses to Fine Homebuilding c/o Worldwide Mailers, Inc., 2835 Kew Drive, Windsor, ON N8T 3B7.

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Photos: Crosby and Young, courtesy of the contributors; McCombe, Rodney Diaz; Young, Nina Johnson

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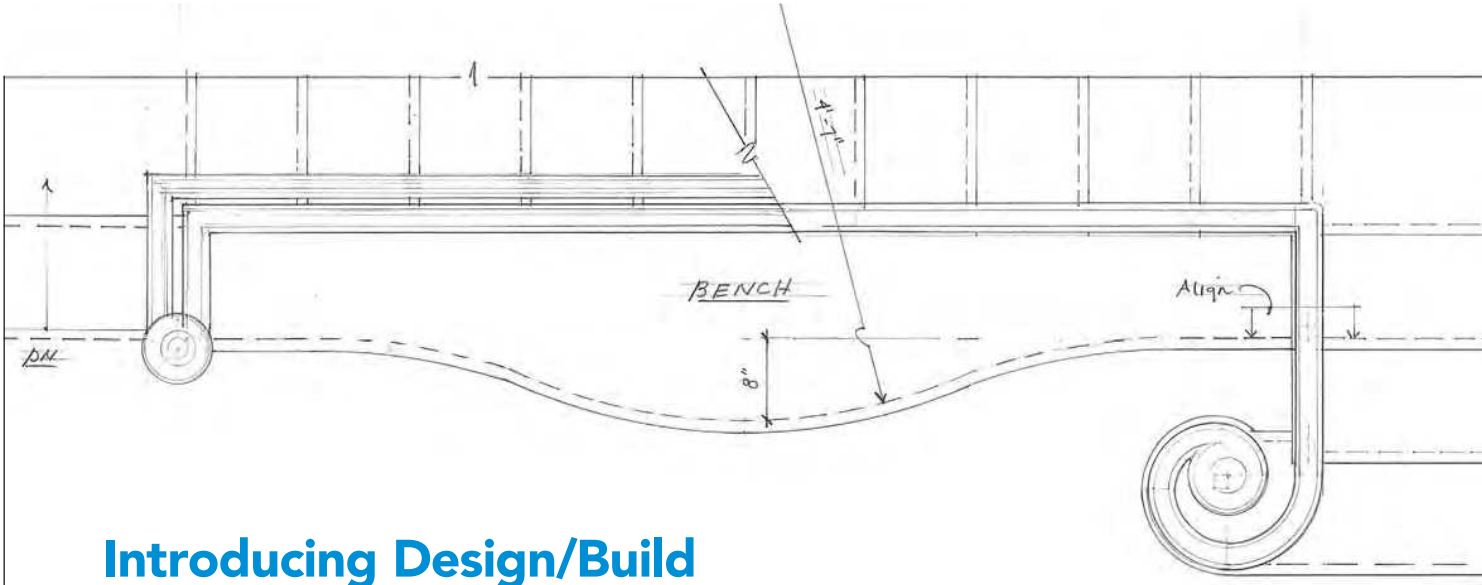

Introducing Design/Build

Our goal at *Fine Homebuilding* is to serve you equal parts inspiration and information. We want you to pick up each issue and be sucked in by a useful project or beautiful detail. Then we fan the flames of that inspiration by offering all the information you need to bring those projects to life. If you were to reduce this concept to its purest form, you'd have our new column, Design/Build. In two pages, now part of every issue, we will take an inspiring example of architectural design and break it down, explaining why it works and what details and proportions to use and avoid as you build it yourself.

While I worked with design editor Brian Pontolilo to develop plans for the column and bat around ideas for the right author, it suddenly struck me that the perfect choice was hiding in plain sight. At the time, I was working on my back porch project (see "New Trim Fit for an Old House," pp. 36) and frequently referencing details in Marianne Cusato's book, *Get Your House Right*, for guidance on proper molding profiles and their proportional arrangement, as well as countless common but crucial mistakes to avoid. With her knowledge of historical architecture, her authoritative stance on which details to use and which to discard, and her incredible talent with illustration, Marianne is the perfect choice for Design/Build. I'm thrilled she has agreed to join the extended *FHB* team as a contributing editor.

Marianne Cusato

If you haven't looked at Marianne's book, I can't urge you enough to order a copy. But in the meantime, her first Design/Build column, focused on stair newels (pp. 90), should hold you over.

—JUSTIN FINK
editor

Don't dismiss the efforts of architects

Regarding the Commentary in *FHB* #267, "Drawing is easy, building is hard": The article's pithy title is perfect for the authors' much-needed student boot camps. In the context of *FHB*'s *Houses* readership, however, it's misleading and comes off as dismissive of architects' effort, expertise, and scope of contribution. It's frustrating to see fellow architects espousing and lending credibility to a misperception we must often contend with. The us/them tone of the phrase is also not conducive to project-team building, in which we should encourage each member to be valued for his or her unique skills. Context is important. But it's just one of the many things conscientious architects wrestle with while doing those "easy" drawings. Please be more care-

Photo: courtesy of Marianne Cusato; drawing: Marianne Cusato

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ful with that broad brush; many of us out here have long been engaged in frequent, decidedly non-theoretical education.

—TIM WADE McKELVEY
via email

The added cost of efficiency

In "Why Don't We Build Better Houses?" (*FHB* #267), author Kevin Ireton quotes Gene Myers, who gives a loan payment estimation. Kevin, Myers told you a whopper. A $35,000 loan does not cost $100 per month, unless your mommy loans you the money.

—AJ SCHMITT
via email

Editor at large Kevin Ireton replies: I was an English major; math makes my head hurt. But I did contact a mortgage broker, who said that at today's rate, borrowing $35,000 would cost about $165 per month, not the $100 Gene originally claimed. (Keep in mind that this does not include taxes and insurance, because these are based on appraisals, and as Gene stated in the article, he rarely is appraised for his zero-energy add-ons.) But even if Gene's math is off, his central point is not. If the monthly payment were as much as $200 more, instead of $100, the homeowner would still come out ahead.

Steel is not infallible

I read the article in *FHB* #268 on curved-deck framing with light-gauge steel. This is the second *FHB* article in the past few years on steel deck framing, and they both cite the steel as rot-proof. I work for a general contractor specializing in multi-family housing rehab, and I've worked on a few projects that have a concrete structure with light-gauge steel wall framing (non-structural). I've seen multiple occasions where framing is rusted out (usually bottom tracks) and needs to be replaced on 40-year-old buildings. These are not exterior locations, though the most recent examples have been in bathrooms. My point is this material does have a limited life span. Also, steel requires a lot of energy to produce and mine, whereas lumber can at least potentially be harvested sustainably. I also wonder if such lousy PT lumber is a regional thing; here in the Bay Area, I haven't had a problem getting quality straight PT from reputable lumber yards.

—JACK
El Cerrito, Calif.

Rust is a reality. *Steel deck framing may not rot the way wood can, but it is susceptible to rust and must be coated for protection.*

Roof rafters

A few points about your Building Skills column, "Laying out and cutting common rafters" by Andy Engel, in the March issue, *FHB* #265:

Mr. Engel precuts his rafter tails. This may be fine in new construction if you are certain your walls are perfectly straight, but in a renovation where this may not be the case and can be difficult to rectify, another option is to leave the tails wild, mark the soffit projection on each end rafter, then snap a chalk line, plumb, and cut the tails to length. This will help ensure a straight fascia.

He also advises using straight lumber, which is of course the optimal choice, but in the case of less-than-perfect stock it should be noted to put all the rafters crowns up.

In addition to the construction calculator and framing-square tables, another helpful resource is a tiny book with invaluable information called *Full Length Roof Framer* by A.F.J. Reichers, out of Palo Alto, California. The book lists rafter lengths from ½-in-12 to 24-in-12 in an easy-to-understand format. This old-school carpenter enjoys your magazine for new-school products and techniques.

—DAN OLSCAMP
Kenora, Ont., Canada

Photo: Andy Engel

your safety

Home building is inherently dangerous. From accidents with power tools to falls from ladders, scaffolds, and roofs, builders risk serious injury and even death. We try to promote safe work habits through our articles. But what is safe for one person under certain circumstances may not be safe for you under different circumstances. So don't try anything you learn about here (or elsewhere) unless you're certain that it is safe for you. Please be careful.

—JUSTIN FINK
editor

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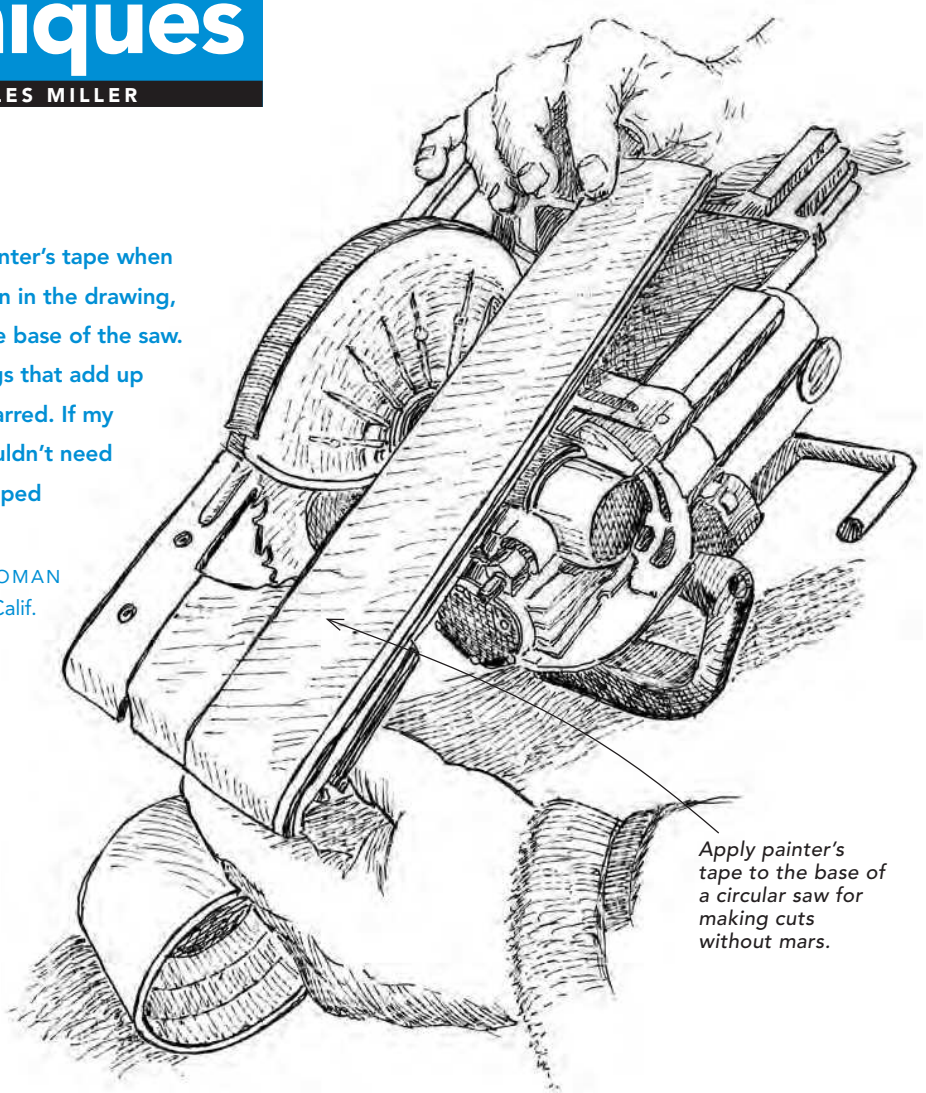
EDITED AND ILLUSTRATED BY CHARLES MILLER

No-mar circular saw

Once I saw an old-timer reach for a roll of painter's tape when he had to cut the bottom off a door. As shown in the drawing, he ran the tape lengthwise to cover the entire base of the saw. The tape covered the little scratches and dings that add up over time, protecting the door from being marred. If my saw were dedicated to rough carpentry, I wouldn't need this trick, but for finish carpentry work, the taped base works great.

—ROBERTO ROMAN
Gualala, Calif.



Apply painter's tape to the base of a circular saw for making cuts without mars.

submit a tip

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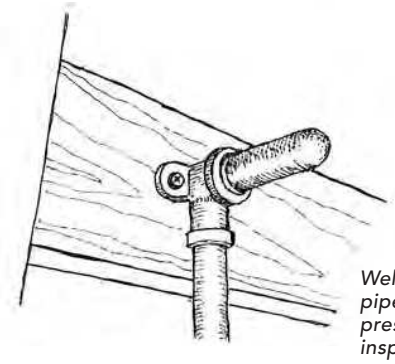
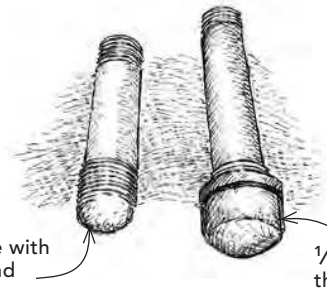


Welded pipe awaits pressured inspection.



Downsizing pressure stubs

When drywalling and tiling bathrooms, I like to install temporary ½-in. or ⅜-in. pipe stubs in all threaded drop-ear elbows so the supply lines can be pressurized. But I find that the normal threaded pipe caps are bulky and require a large hole. To stay on the small side, I take a 4-in. black pipe nipple and weld one end closed. Then I grind it smooth. This way, I only need to make a hole a little larger than the pipe's outside diameter. My tile guys particularly like this trick, as it can be difficult to make a hole large enough to clear a normal threaded pipe cap that will still be completely covered by the fixture escutcheon. As a note, I always use black pipe, as welding galvanized pipe will produce unhealthy fumes.

—DON MARTY
Verona, Wis.

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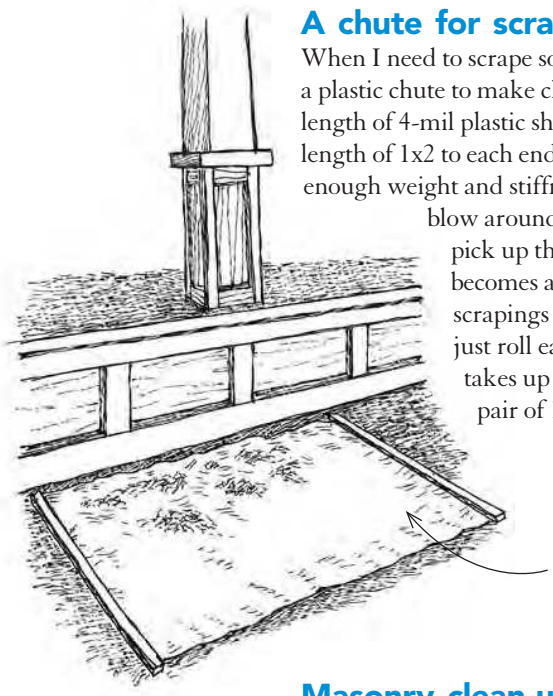
A chute for scraping paint

When I need to scrape some exterior paint, I create a plastic chute to make cleanup a breeze. I cut a 4-ft. length of 4-mil plastic sheeting and then staple a 4-ft. length of 1x2 to each end. The 1x2s give the rig just enough weight and stiffness so the sheeting doesn't blow around. When I'm done scraping, I pick up the 1x2s and my plastic sheeting becomes a chute for dumping the paint scrapings into the garbage. For storage, just roll each 1x2 toward the center. It takes up just a bit more space than a pair of 1x2s.

—JIM ARGEROPOULOS
Marquette, Mich.

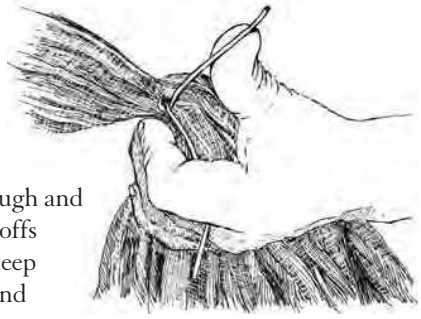


Masonry clean-up

One of my first (and toughest) jobs was as a mason's helper. He was from the old school and one of the best craftsmen I have ever known. I mixed lots of mortar and carried a lot of brick. After work, my hands were dry as a bone. He taught me to wash my hands with white vinegar so the dryness from the lime would go away. It seems that the newer generation of masons do not know this trick, but to this day, I still do this after every masonry job.

—JOE MARALDO
Sunapee, N.H.

Trash-bag wire ties



A 6-in. 12-ga. wire makes it easy to seal a big trash bag.

After my electricians are done working and before they clean up, I go through and glean any wire cutoffs over 6 in. or so. I keep these in a bucket and use them for all sorts of tasks, but mostly for tying up contractor trash bags. Once the bags are full, the twist ties supplied with the bags really can't hold 40-plus pounds of misshapen debris. The wire cutoffs work great, won't slip off the bag, and won't bust apart under pressure—plus, they make a great handle when trying to lift heavy bags that would normally slip through gloved hands, especially ones that have been out in the rain.

—PAUL JOHNSON
Portland, Ore.

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TIP FROM THE ARCHIVES

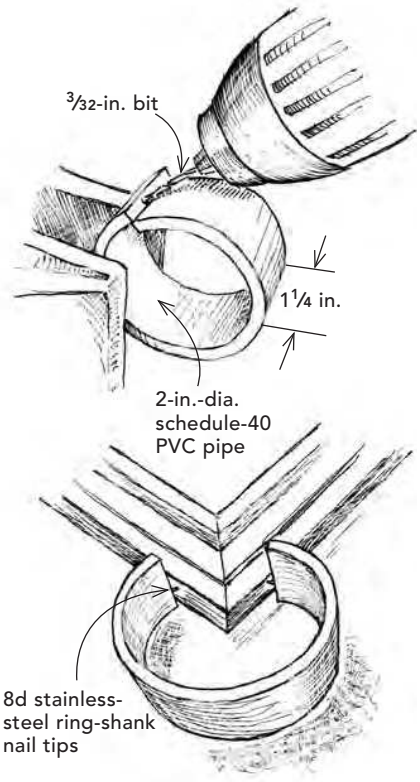
Miter clamps made with pipe

As the son of the second-cheapest guy in the world, I find it painful to spend hard-earned cash on specialty tools without pondering the possibilities of making them myself. At $12 for a four-pack (plus $15 for the pliers), spring miter clamps offer a great opportunity for a cheapskate replacement. My variation, the cut-ring PVC clamp, works as well as the expensive version.

Start by cutting 2-in.-dia. schedule-40 PVC pipe into 1¼-in.-long rings. Slice open the ring, and drill opposing 3⁄32-in. holes, ½ in. deep, into the edges of the sliced section, as shown. Next, cut ¾ in. off the tips of two 8d stainless-steel ring-shank siding nails, and insert the tips into the holes with a pair of pliers. (I use ring-shank nails, which will stay put when releasing the clamp.)

To use the miter clamp, spread the ring open with your fingers, and position it so that the nail tips grip the opposing mitered pieces, thus clamping the mitered joint. You can vary the width and diameter of the rings and the position of the nail tips to suit many situations.

—BEN KING
Natick, Mass.



Abraham Shetler helps stain one of the 20+ wood colors of Aeris windows at our Sugarcreek facility.

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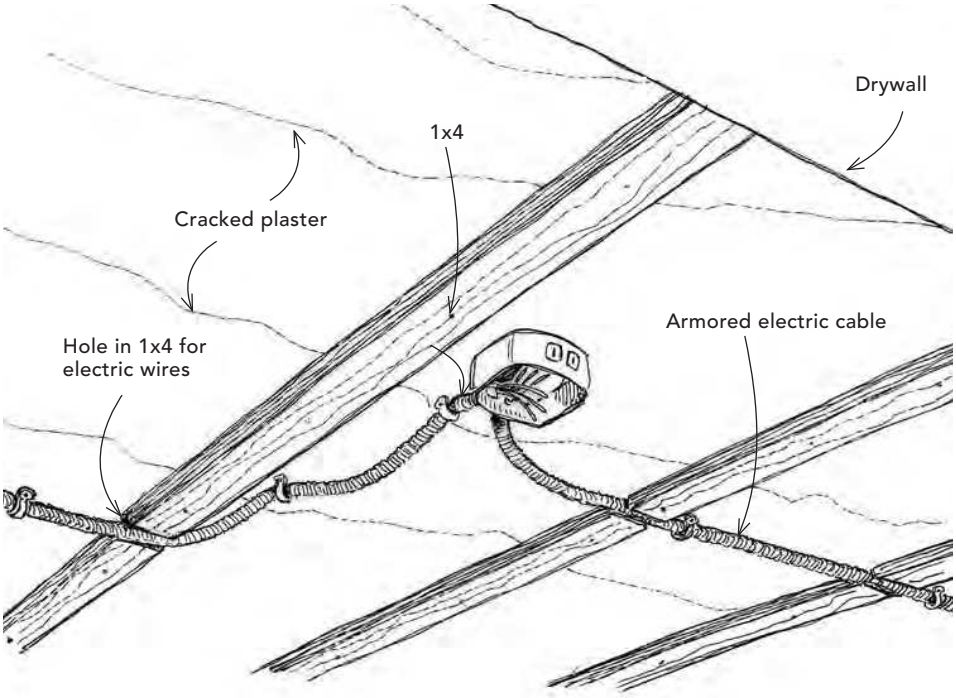
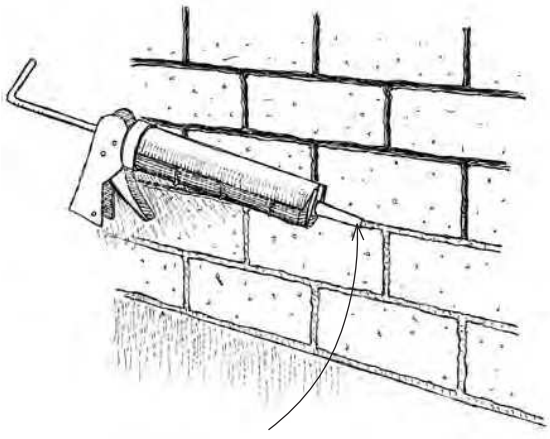


Drywall-over-plaster ceiling repair

I often repair badly cracked plaster ceilings by covering them with a layer of ½-in. drywall. Fastening the drywall to ¾-in.-thick furring strips enables wiring and ceiling boxes for light fixtures to be mounted beneath the plaster. In this situation, the wiring is close to the surface of the drywall, so I use conduit or armored cable, rather than Romex.

—TOM O'BRIEN
New Milford, Conn.

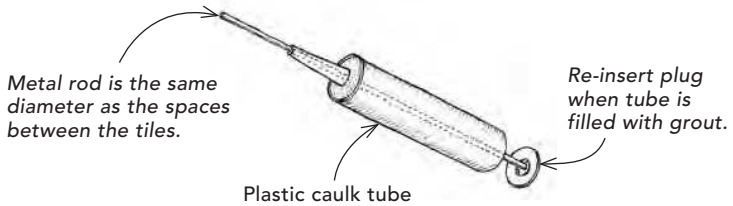


By grouting with a caulk tube, craters and holes in the tile are left untouched.

Caulk-tube grout

We are redoing our backsplash and using travertine tiles. Because of the finish, we did not want to fill all the contours in the tiles with grout. To avoid this, we started with a plastic caulk tube. We checked on the grout width—3⁄16 in.—and cut the nozzle to match that dimension. Then we got a 3⁄16-in.-dia. metal rod and inserted it through the nozzle tip to remove the circular plug at the bottom of the caulk tube. Once the tube was cleaned, we loaded the grout into the tube and reinstalled the plug, making our own custom grout gun.

—NEIL ROKOS
Cochrane, Alta., Canada



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BEST-EVER FRAMING HAMMERS

Martinez M1

Titanium handle, steel head framing hammer

Price: $225

Weight: 15 oz.

Mark Martinez, who created the highly regarded Stiletto titanium hammers back in the late 1990s, is back with his second generation of framing hammers. The titanium-handled M1 and the wood-handled steel head are both fully made in America. The prices might scare off some, but for a professional who swings a hammer every day, I think either is a smart choice.

M1

The M1 is quite possibly one of the best looking and most functional hammers of all time. It may look similar to the Stiletto TiBone, but it's smaller, sleeker, and has a removable all-steel head, rather than just a replaceable steel face that can loosen over time. And because the M1's head, which is available with either a smooth or mill face, is heavier than the Stiletto and more forward-weighted, it delivers immense striking force with minimal recoil. A dovetail on the bottom of the head slides onto the handle and is secured with a bolt. The connection is super strong and field replacement takes seconds. The M1 is comfortable to use all day long, it has a magnetic nail starter, and the grip is replaceable ($30). All in all, the M1 is an incredible hammer.

Wood handle framing hammer

The steel-head, wood-handle hammer has a head similar to a conventional wood-handle hammer, but instead of wedges, it's attached with a long T-bolt that creates a very secure connection to the handle and simplifies field replacement. The claws are sleek and flat, making them great for driving into beams to manipulate them, but their shallow arc makes it a little harder to pull nails. The hammer also has a forward-weighted head and delivers the same punch as the more expensive M1. The handle is wrapped with a very tacky, replaceable clear tape, allowing you to maintain your grip even when your hands are sweaty.

Kiefer Limeback is an FHB *ambassador and a carpenter in Whitby, Ont.*

Martinez wood handle

Wood handle, steel head framing hammer

Price: $81

Weight: 19 oz.

Photos: Patrick McCombe

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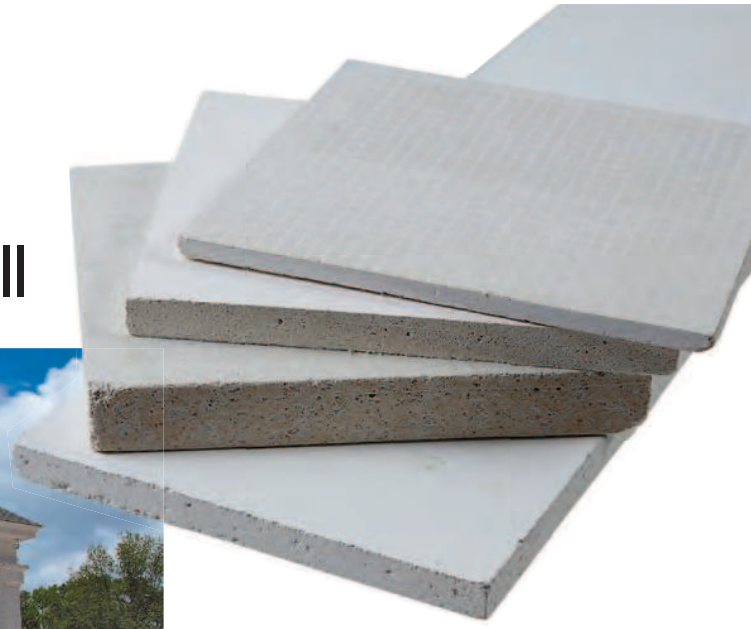
Magnesium oxide does it all



If you're not familiar with magnesium oxide (MgO) board, you're in good company, as it's only starting to make its way to this country from widespread use in Asia. Extreme Green's MgO board's impressive strength, as well as its fire, mold, and insect resistance, make it suitable for a wide range of applications, from tile backer and wall panels to exterior trim and lap siding.

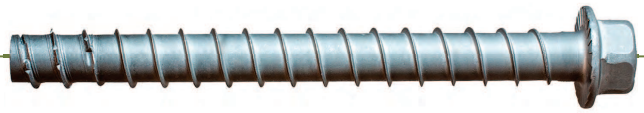
Bob Nilsen, a builder from Millbrook, N.Y., had to tackle the learning curve when MgO board was specified for ½-in. by 6-in. lap siding on a recent project. He told me that cuts are smooth and easy with conventional carbide-tipped circular saw blades and that ordinary bimetal jigsaw and multi-tool blades work fine for cutting around penetrations. His crew fastened the siding with pneumatic roof nailers, but, according to the maker, it can also be fastened with high-quality screws (conventional black drywall screws sometimes snap off), framing nails, and siding nails. Nilsen told me he liked working with the material better than fiber cement, because the dust wasn't as irritating and the composition is easier on cutting tools. He also told me that throwing the material in a bucket of water for two months had no effect.

Builders who work in multifamily and commercial projects might see MgO board sooner than residential builders, because the material's extreme fire resistance can eliminate the need for a second layer of drywall (and its associated material and labor costs) in many fire-rated assemblies.

Extreme Green MgO board is available through BlueLinx at local lumberyards. As of June 2017, distribution covers most of the United States, and nationwide availability is expected soon. In small quantities, ½-in. MgO board sells for $1.10 per sq. ft., ⅝-in. for $1.40 per sq. ft., and ¾-in. for $1.60 per sq. ft.

Patrick McCombe is an associate editor.

Outdoor anchor



Many people don't realize that Simpson's Titen HD concrete anchors, despite their zinc coating, are not approved for outdoor connections. The problem is the carbon steel they're made from expands when it rusts, cracking the concrete where it's embedded and ruining the anchor's lateral and uplift resistance. However, the company recently introduced a 316 stainless-steel version of their Titen HD screws (THDSS) for use outdoors and in corrosive environments. The stainless-steel Titen HD screws are available in ⅜ in. dia. in lengths from 3 in. to 6 in. and ½ in. dia. in lengths from 3 in. to 8 in. A 20-count box of ½ in. dia. by 5 in. sells on the web for $138.

P.M.

Photos: top left and bottom left, courtesy of the manufacturers; product photos, Patrick McCombe

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UV-resistant housewrap

Photo: courtesy of the manufacturer

"Open-joint cladding" describes siding installed on battens or furring strips with gaps between the boards. It's one of the newest fads in modern design. Although I'm still trying to make sense of the whole concept, the rationale is that the wide-open assembly allows any moisture to drain quickly, and it gives the house a contemporary look. In these assemblies, the water-resistive barrier can be seen behind the siding, so you have to install a WRB that looks good and can stand up to sunshine (UV) long term. Benjamin Obdyke's FlatWrap UV accommodates open-cladding systems with gaps up to 1 in. when the siding is installed on ¼-in.-thick furring. A 5-ft. by 100-ft. roll of FlatWrap UV sells for $112. A 4-in. by 75-ft. roll of compatible black flashing tape, HydroFlash, sells for $43. A 6-in. by 75-ft. roll is $62.

P.M.

Geberit Concealed Systems

GEBERIT

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.

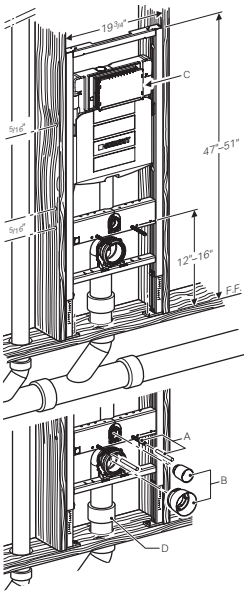
When the Houston chapter of the American Institute of Architects chose the Lyke residence as one of the stops on its home tour open to the public, Greg Swedberg, principal of 2Scale Architects, predicted that the Geberit Concealed Tank and Carrier System with wall-hung fixtures would be one of the most 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.

Hose-free connector nailer

I've been using Paslode's PF150S-PP metal-connector nailer for several years in our deck-building and remodeling business, and it has proven itself to be a trouble-free time saver. I especially like how the magazine holds two racks of nails, which means less time spent reloading. Perhaps the tool's only drawback is the air hose, which gets caught on any possible snag, so I was anxious to try the battery-powered DCN693M1 cordless metal-connector nailer from DeWalt. This nailer, which is part of DeWalt's 20v MAX line, has adjustable depth of drive, a rafter hook, and dry-fire lockout.

DCN693M1

Price: $370 (bare tool), $450 (1 battery and charger)

Weight: 8 lb.

Magazine capacity: 29 (1 rack + 7)

Fastener length: 1½ in., 2½ in.

I've been using this hose-free nailer for almost a year and I've found it to be a useful, reliable tool, and not having to drag around a hose is a huge plus. It doesn't seem to have as much power as the Paslode (it leaves a greater percentage of nails that must be finished with a hammer), but its minimal setup makes it my first choice when I have only a few connectors to install.

Joe Ciaraldi is a deck builder and remodeler in Salem, N.H.

Photo: courtesy of the manufacturer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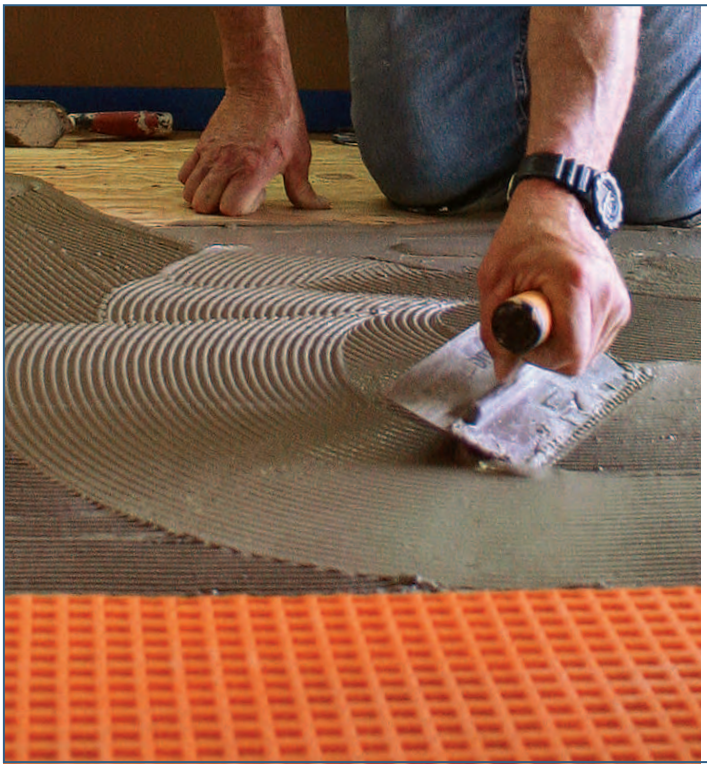

Schluter-made mortar

Schluter's waterproofing and uncoupling membranes are a popular choice for both occasional and professional tile setters. The assemblies are reliable, time-tested, and relatively easy to install. The only potential hangup is knowing what thinset to use. Now there's no guessing, as the company recently introduced its own line of thinset mortars specifically made for use with Schluter waterproofing and uncoupling membranes. The products include Schluter SET unmodified thin-set mortar ($24 white, $21 gray), Schluter ALL-SET modified thin-set mortar ($41 white, $38 gray), and Schluter FAST-SET rapid-setting modified thin-set mortar ($71 gray). The best part is that you can also call the company for advice on choosing the right thinset to use for any project.

P.M.

Photo: Andy Engel


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Good-looking porch ceiling

I recently had the chance to look at a porch ceiling finished with Versatex Canvas Series tongue-and-groove boards with a V-groove profile (WP4). The through-color cellular PVC stock comes in black cherry, macore, or walnut finishes and is available in 18-ft. lengths, so even long runs can remain seam-free. A 4-in. matching crown is also available. The stuff looks great and, owing to its PVC composition, should last a long time. Prices are said to be comparable to stain-grain hardwood lumber.

P.M.

Photos: courtesy of the manufacturer

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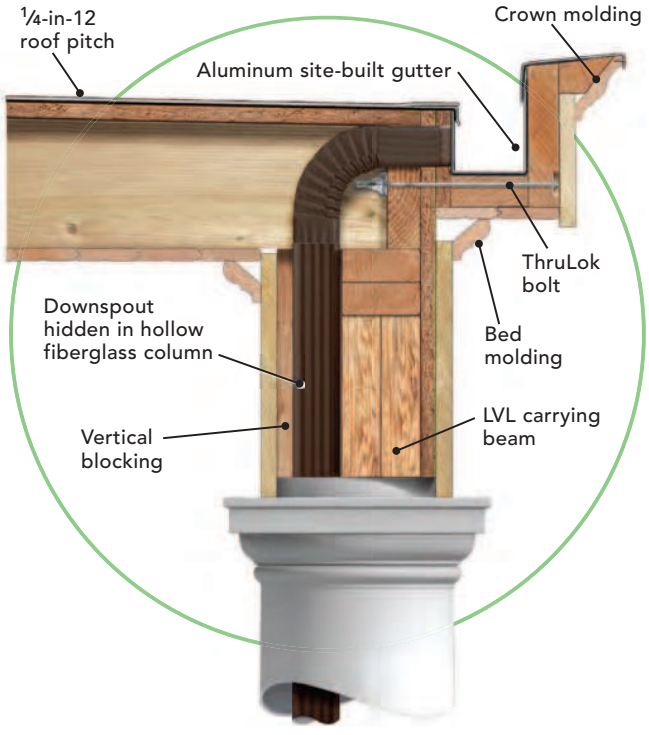
New Trim fit for an Old House

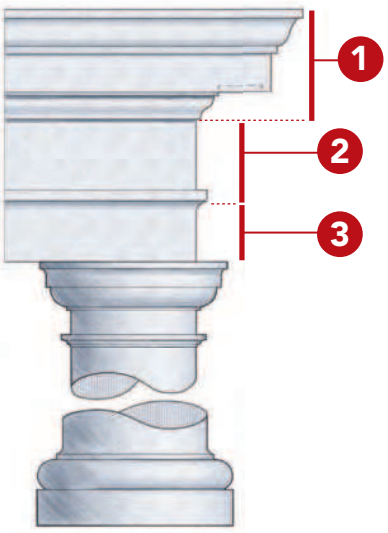
A traditional porch project offers lessons in style, proportions, and seamless transitions

BY JUSTIN FINK

When I bought my 1926 Sears kit house in 2011, I was mentally prepared for dealing with the perils and pitfalls that come with owning an old house, and confident in my ability to tackle any major challenges. What I didn't anticipate—and something that owners of newer houses don't usually understand—is the feeling of responsibility that came with every design decision I made. I was the new caretaker of a house that had been occupied by only one family since it was built 90 years earlier, and which had clearly been handled with extreme respect. So, when I decided to add a covered porch to the back, I wanted to make sure it would be a good fit for the house. Having seen a lot of bad entries, porches, and additions over the years, I was concerned about ending up with something that looked like a thoughtless bolt-on. I was determined

Drawings: Toby Welles





CRASH COURSE IN CLASSIC PROPORTIONS

Although often treated as pure aesthetics, exterior trim is actually meant to represent the structural and watershedding elements of ancient temples. I'm not suggesting that we should all be building faithful reproductions of Greek and Roman temples, just as I don't believe designers should feel pressure to recreate textbook versions of traditional American houses. I do, however, think it's important to understand the elements of construction—a study called "tectonics"—in order to make sense of the exterior trim we use today. According to Marianne Cusato, an expert in the field of architectural design and author of *Get Your House Right*, "Tectonics trains your eye to think about today's decorative elements from their original, structural point of view. It will help you avoid a lot of common mistakes." In short, knowing the origins of each piece can mean the difference between creating something that looks pleasing and something that feels aesthetically off.

Boiled down to its basic parts, the structure of a covered porch includes a classical entablature—the vertical assembly of elements that sits atop columns or a wall. Ordered from top down, the entablature is broken into three parts: the cornice, the frieze, and the architrave.

1 CORNICE

The cornice of an ancient temple is similar to a modern roof with overhangs. Water running down these ancient sloped roofs was collected by an S-shaped piece called a cyma, which is why most aluminum gutters are molded with the now ubiquitous S shape. Like modern roof overhangs, the roof rafters of these old temples were left long enough to overhang and protect the building from the elements, giving water a place to drip rather than running down the face of the building. This overhanging portion of ancient roofs, called the corona, was partially supported by a plate, which is the basis of today's bed molding and is the lowermost part of the cornice assembly.

2 FRIEZE

The frieze board to which the bed molding attaches is meant to mimic the covered ends of the joists. Typically not a functional part of the entablature, the frieze is often the place where designers showcase decorative elements like reliefs.

3 ARCHITRAVE

The frieze sits on a supporting beam, known in traditional architectural studies as an architrave. To provide sound structural support, the beam (and frieze above it) are traditionally aligned with the neck of the columns or outside face of the wall below.

DESIGNED FROM THE OUTSIDE IN

After studying architectural trim guidelines (p.37) and taking careful measurements of my existing trim package, I created a cross-section drawing of the entire porch roofline. This not only allowed me to lay out my trim proportions and figure out stock sizes, but also to make decisions about how the roof would be framed. In this case, it made sense to eliminate the rafter tails, stopping the roof structure directly above the outside face of the beam. This meant I could build a hidden gutter trough right into the trim assembly rather than covering my work with a fascia-mounted gutter.

Establish a datum line. *With the existing eave exposed, transfer a level line from the bottom edge of the rafter tails onto the face of the porch roof beam to create a reference line for locating all of the trim components to follow.*

to make the porch look like it had been there all along.

I knew the best way to tie the new porch into the old house would be to make it match. By simply extending each element of the existing trim package to include the porch (or extending them onto the porch), it would appear as if everything were built at the same time. But if additions were that simple, we'd have fewer ugly additions in the country. The truth is that blending the new with the old is a balancing act, and there are a lot of aspects to consider.

If you have any hope of blending new with old, you first need to understand the architectural roots, proper usage, and ideal proportions of each element. Then, you have to be willing to compare this idealized version with the often less-than-ideally designed trim of your house, and deal with the hard decisions about which architectural rules you're willing to break in the name of honoring the original design. Of course, on top of all these aesthetic and proportional considerations are the pesky realities of structural needs and material transitions, which are really what the trim is covering in the first place.

I believe that the easiest way to make sure the overall aesthetics of any addition look right is to work from the outside in, by first deciding on the finishes and then thinking about how to hide the structure within those

Make a mockup. *Using a full-scale cross-section drawing as a template, build a mockup of the bare-bones cornice assembly, being sure to include enough of the trim to get an idea of how the new will tie into the old.*

Reality check. *Align the cornice mockup so that the bottom edge of the corona framing is set on the datum line to double check that the intended assembly will meet the existing trim. If any components aren't aligned, now is the time to make final changes and compromises.*

A clever corona. *After cutting, assembling, and waterproofing the gutter trough, set it atop temporary brackets aligned to the datum line, freeing your hands for final positioning and stress-free fastening.*

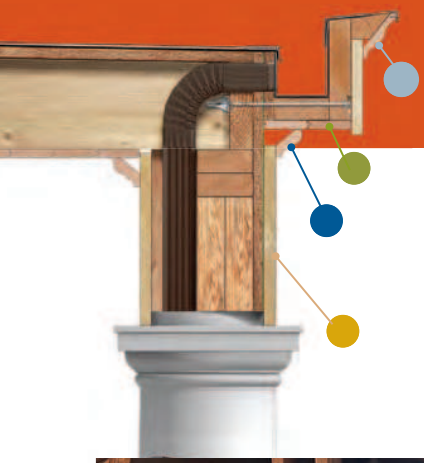
finishes. So that's where I started with my porch design.

Learn the rules, but be ready to compromise

The good news is that there is no shortage of credible information on architectural details, and whether you're following traditional details or working on a more contemporary style, the basic tenets still apply. Most elements of a building are rooted in structural necessity. Building materials have changed and advanced, but the purpose of those original elements is usually still sound (see "crash course," p.37).

Armed with information on these architectural details—in my case, the name, function, and order of each roof trim element—you then have to decide on the relative proportions of each piece. For instance, generally speaking, the amount that the cornice projects beyond the face of the frieze and architrave should be about the same as the diameter of the column that the entire entablature rests on. The frieze and architrave should each be about one-half or three-quarters as tall as the column is wide. But if you're working with an existing house and tying into an existing trim package, you have to strike a balance between textbook and reality.

On my house, the exterior trim has somewhat exaggerated proportions, with a



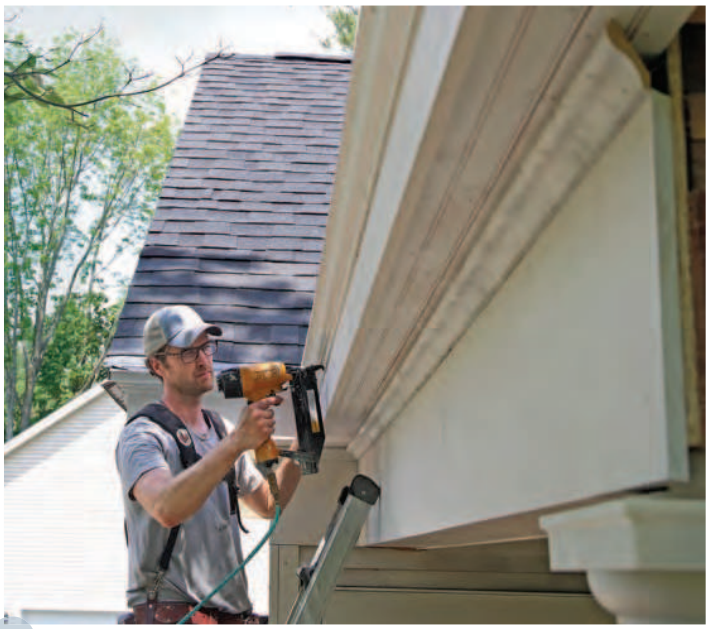
TRIM IT ONE FACE AT A TIME

Marrying new trim to existing assemblies takes some patience and creativity. There are a lot of intersecting faces and horizontal and vertical lines to manage. New molding profiles rarely match seamlessly with the old ones, and surfaces are rarely plumb, level, or square with one another. My advice: Stop frequently to stand back and look at your work. Often something that looks imperfect up close at the top of a ladder will look fine from the ground, and vice versa. To this end, I like to tack all exterior trim pieces into place with galvanized finish nails, then permanently secure them with trim-head screws after I'm sure everything is lining up and fitting the way it should.

Pay attention to alignment. *Set the frieze/architrave atop temporary brackets, and double check the bottom edge for alignment with the top of the existing trim before tacking it in place with galvanized finish nails.*

Know when to start fresh. *In some situations—as with this boxed eave, where the existing crown and bed molding were installed upside down—it's faster and easier to strip and retrim. Slight differences in profiles from one eave to the next won't be noticeable, but a mismatch from one side of a miter to the next certainly will.*

Preassembly has merits. *When dealing with out-of-square corners or irregular planes, it often makes sense to preassemble sections of trim and fit them as one piece spanning over minor gaps.*



Aim for continuous runs. *Whenever possible, limit fussing over joints to the places where the new trim connects to the old, rather than interrupting the new trim with unnecessary joints along its length.*

wide frieze/architrave and deep overhangs. Although the frieze is typically separated from the architrave below by a strip of molding known as a taenia, my house didn't have this separating detail, so I decided to omit it from the porch trim as well.

I also decided to reduce the overhangs on the porch for a couple of reasons. First, I wanted the porch to look subordinate to the house, and one way to do that was to scale down some components. Reducing the overhang also allowed me to tie the porch roof trim into the sides of the boxed eaves rather than trying to build it in perfect alignment with their faces. Jogs and reveals are where a carpenter can hide the realities of trim work.

The house does have the traditional crown molding along the roof edges and bed molding under the beadboard-clad soffits, but whether because of personal preference or architectural ignorance, both profiles were installed upside down. I decided to replace these two pieces of trim, along with the fascia and soffit on the boxed eave overhang, eliminating the need for the new crown molding, bed molding, and beadboard to exactly match the old. A minor variation in a trim profile from one side of the house to the other would be inconspicuous, but even a slight variation stands out if you join the pieces together.

Work your way in

After deciding on these compromises and drawing the assembly in section view (see drawing p. 37), I was able to determine how much room was left for the structural components, such as the rafters and beams.

Adding together the vertical height of the frieze and cornice gave me roughly 20 in. of space to work with—more than enough to conceal appropriately sized rafters and a carrying beam to meet my structural span requirements. I also found an opportunity to add a cool traditional detail. After figuring out the overhang, I realized I had more than enough room to hide the roof gutter within the entablature. This wasn't something I had planned, and likely not something I would have thought to include if I were designing from the inside out.

Now when I stand back and look at my porch, I'm pleased with how the new structure blends right into the 91-year-old house it's connected to. It looks like it belongs. □

Justin Fink is editor of *FHB* and lives in Plainville, Conn. Photos by Rodney Diaz.

Site-built box gutters

Depending on the size of the roof overhang, you may have the opportunity to hide the gutter and downspout as was often done on historic houses, allowing your trim to be unobstructed. These built-in gutters were typically made from wood or wood lined with lead or copper. Wood alone is a hard choice to justify, but I did consider both lead and copper for this project. Ultimately, I decided on aluminum coil stock for its low cost and available wide widths. I have faith in modern sealants—especially when bends in the aluminum are also mechanically fastened with rivets—but I also understand why some people prefer the peace of mind provided by soldered copper or lead. To each their own, but keep in mind that the metal you choose is no more important than the waterproofing work you do to the trough it sits in. I tested the watertightness of the bent aluminum gutter after fabrication and sealing (with a combination of SeamerMate on the inside of joints and flashing tape on the outside) by filling it with water and letting it sit for 24 hours. But that didn't stop me from also fully waterproofing the trough that the gutter slides into, and then sealing it's connection to the downspout as well as to the roof on all sides with sealant, flexible membrane, and metal flashing for UV protection. Leaks are a whole lot easier to prevent than they are to fix.

Mastering Balusters

A stair pro shares his process for installing the three common types of stock balusters

BY JAMES SHULL

PIN-TOP balusters taper to a uniform diameter near the top, which fits into a hole drilled in the rail. Pins on the baluster bottoms glue into holes drilled in the treads. You'll need to trim them to length, but I buy 34-in. balusters for the front, 39-inchers for the back, and, if there are three per tread, 36-inchers for the middle.

SQUARE-TOP balusters also come in various heights, and their doweled bottoms glue into the treads. The tops are cut on site to the angle of the stair, and are nailed into a rabbet plowed into the bottom of the rail. Fillet strips reinforce the connection, ensure consistent spacing, and fill the rabbet for aesthetics.

METAL balusters have gained popularity in the last decade. While they can have a variety of decorative elements, the basic stock is usually ½ in. square, with a short, round section that fits into a hole drilled in the underside of the rail. Simliarly, the square bottom section fits into a hole in the tread, and is then braced with a collar.

As a custom stair builder, I've installed miles of railing and balusters. Designs vary, but the style of balusters breaks down to three main types: pin top, square top, and metal. No matter what kind of baluster you're installing, the starting point is the same. You need to install the newels so they're plumb and centered where you want the balusters to fall on the stairs. To be code compliant, the rail has to be between 34 in. and 38 in. above the line of the tread nosings. Because a stair rail rises while the treads stay level, balusters are sold in several heights, with taller ones used at the back of the treads. In order to cut the balusters at consistent heights, the rail also needs to be parallel to the slope of the tread nosings. The space between balusters on stairs can't be more than 4⅜ in., and on level rails this is reduced to 4 in. For stairs with runs up to 10 in., the 4⅜-in. spacing requires two balusters per tread. Deeper treads will call for more balusters.

Here, I focus on installing balusters on stairs, but the process doesn't differ much when working with level rails on balconies—and you're sure to find those installations easier in comparison. □

James Shull's company, James Shull Custom Stairs, LLC, in New Fairfield, Conn., does all kinds of stair work, but specializes in high-end, one-off installations. Photos by Andy Engel.

LAYOUT AND DRILLING ARE UNIVERSAL

Accurate baluster placement starts with a good layout on the treads and continues with the transfer of that layout to the bottom of the rail. You need to get this part right, because once drilling starts, you're committed. Most stair builders still rely on corded drills for this work; drilling a lot of relatively large holes in hardwood gives even the best cordless tools a workout. Always use new spade bits for each job—they're cheap, and hardwood dulls them quickly. Be sure to have spare ¾-in. bits on hand because you'll almost always dull at least one on tread-return nails. When finished drilling, take a random orbital sander to the bottom of the rail before moving on to baluster installation.

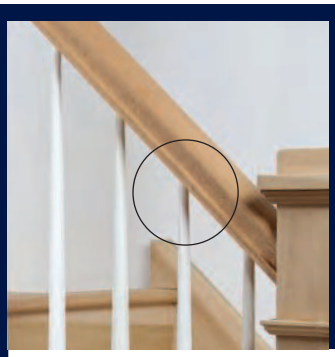
Set the spacing. *Locate the first baluster so that its face aligns vertically with the face of the riser below it. Set the second baluster half the distance of the stair run behind the first.*

Center the placement. *The vertical centers of the balusters should be aligned with the vertical centers of the newels, and are easy to locate consistently using a combination square referenced off the tread returns.*

Plumb up. *The fastest way to transfer the baluster locations to the rail is with a laser plumb bob, but you can also use a level and a combination square.*

Drill the treads first. *Most balusters call for a ¾-in.-dia. hole in the tread. Once you're finished drilling, use the air from the drill motor's fan to blow the chips out of the holes.*

Accurate angled drilling. *When drilling plumb holes in an angled rail, start with the bit square to the rail, then, once its point bites, swing the drill so the bit eyeballs plumb. Drill in about 2 in. (usually to the shoulder of the bit) to avoid drilling through the top of the rail.*



PIN-TOP BALUSTERS

Most pin-top balusters call for a 5⁄8-in.-dia. hole in the rail, but sometimes an 11⁄16-in.-dia. hole is needed if you've trimmed the tops of the balusters down to the tapered section. Yellow glue can be used for this connection, but it drips a lot, and if a baluster fits tightly the glue may flash-set before it's in its final position. PL Premium construction adhesive is a much more manageable product that also fills voids.

Mark the length. *Find the length of the balusters by placing their dowels in the treads and holding them against the rail. Allow for about 1 in. to penetrate into the rail.*

Glue the hole. *A shot of construction adhesive in the rail and in the tread secures the baluster. Use mineral spirits to clean off any adhesive squeeze-out before it sets.*

Push up, pull down. *With a twisting motion, push the baluster into the rail. When the dowel clears the tread, swing it into place and seat the baluster. Dowels aren't always centered, so check that each baluster aligns with the others, and twist it to a different face if needed.*

Pin the pin top. *To fix the baluster in place until the adhesive sets, shoot a 1¼-in. 18-ga. nail through the pin top and into the rail.*

SQUARE-TOP BALUSTERS

With square-top balusters, it's particularly important for the rail to be parallel to the slope of the stair nosings, as the relatively short upper blocks of square-top balusters can make even small height differences noticeable. You can buy a rail that's already plowed or plow your own. When I do it myself, I plow the rail to ⅜ in., and cut ¼-in.-thick fillets in order to leave a ⅛-in. reveal.

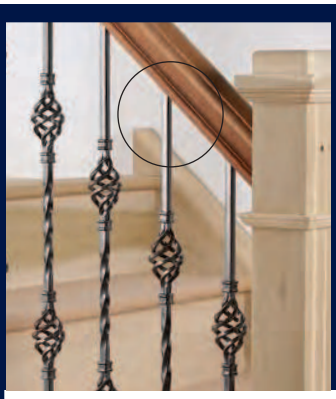
Check for parallel. *To make sure the rail is parallel to the stair, hold a framing square across the tread nosings and check the rail height at several spots.*

Plumb the first baluster. *Tape a 24-in. level to a board to bridge between the square parts of the baluster and mark its top edge on the rail.*

Mark the baluster. *With the baluster plumb, mark the spot where it meets the railing. Repeat this process on the longer, rear baluster(s).*

Mark the actual cut. *Add the depth of the plow to the mark on the baluster. Repeat this process for each baluster on the tread, and you'll have length templates for all the balusters on the stair.*

Nail 'em. *After gluing the tread holes and the baluster ends, fasten them to the rail with 1½-in. finish nails. Start at the bottom of the stair so there's room for the nailer, and keep an eye on spacing so the balusters don't wedge up the railing. Finish by pinning a fillet strip between each baluster.*



METAL BALUSTERS

The length of metal balusters must be precise because they bottom out both in the railing and the tread. Because of this—and as with square-top balusters—it's critical to get the railing parallel to the slope of the tread nosings. Unlike the other baluster types, when working with metal balusters, the rail is attached temporarily for layout and drilling, removed while the balusters are placed in the treads, and then reinstalled over the balusters.

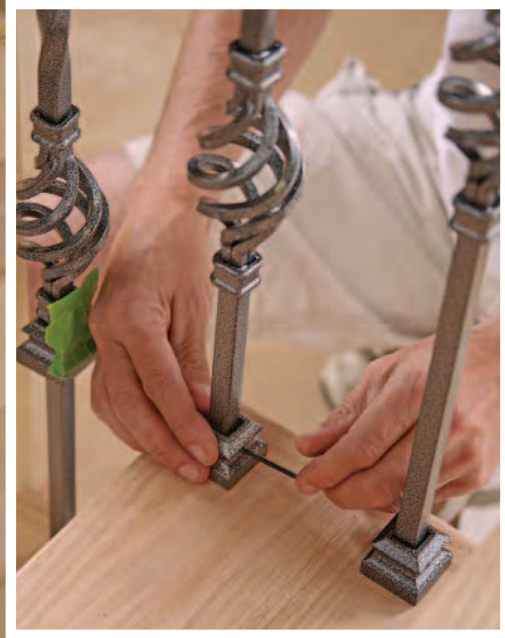
Measure carefully. *Metal balusters must be cut to exact lengths so they bottom out in the tread holes and their shoulder contacts the rail at the lower end of the hole. A folding rule is an excellent choice for getting the overall measurement right.*

Drill the treads precisely. *Use masking tape on your bit when drilling the treads to measure the depth of the holes, and make sure they're right with a depth gauge.*

Drill smaller. *With the rail installed temporarily, drill ½-in. holes for the balusters, located the same way as with pin-top balusters. You only need to go about 1 in. deep for most metal balusters. The railing will come off later to allow for baluster installation.*

An excuse to buy a tool. *Use a cutoff saw to cut metal balusters to length. If you don't do much stair work, a cheap version from a discount tool house will last through a few jobs.*

Assemble. *With a shot of construction adhesive in each tread and rail hole, the collars on the balusters (taped in place to keep them out of the way), and the balusters in the treads, place the rail over the balusters and screw it to the newels.*

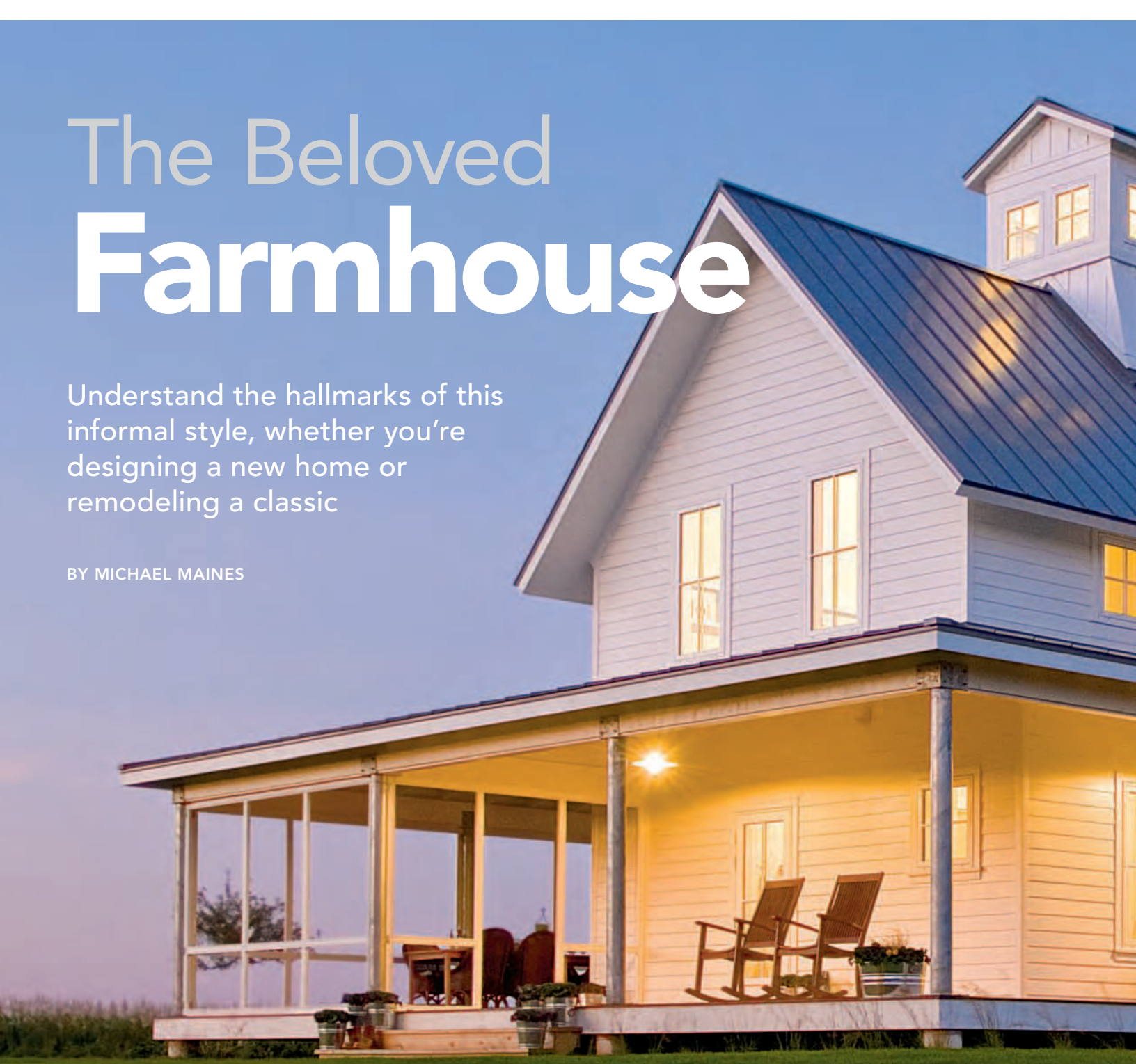


Tighten. *Slide the collars down to the treads and tighten the set screws. The collars can be loosened and moved by the floor finisher when sanding and coating the treads.*

The Beloved Farmhouse

Understand the hallmarks of this informal style, whether you're designing a new home or remodeling a classic

BY MICHAEL MAINES



The American farmhouse style combines comfort, elegance, and nostalgia, all without pretension. It is practical and hardworking. Pared down to the essentials, the farmhouse style is flexible enough to be adapted to a variety of family types and homeowner lifestyles.

New traditionally styled farmhouses tend to reflect homes built between 1820 and 1920, when farming was an inherent part of life for many families. Earlier, Georgian-era homes—typified by the New England Colonial and Federal styles and southern plantation homes—can also be farmhouses. Because the farmhouse is not specific to an era, the style lends itself well to modern interpretation.

Though regionally, the term "farmhouse" brings different images to mind, there are many common details found on most farmhouses. Because farmhouses don't have the strict design guidelines of other, more formal architectural styles, any of these elements may not appear—but here's a look at what you can expect to find on a typical farmhouse, or should consider when designing your own project.

Shaped over time

Even today, a farmhouse is ideally built in a rural location or a suburban area with a rural feel—or a long view. That's not to say that the farmhouse style is not comfortable in a village or urban setting, but

Photo: Rob Lagerstrom courtesy of *The Progressive Farmer*

for the full effect it should appear to be on what was once, if not currently, a farm. Even when the surrounding area has been developed, a farmhouse can retain its presence. A vegetable garden or other casual gardens with flowers and herbs sprinkled around the property can help cultivate the farmstead feel, though an overly stylized garden may look out of place in what is meant to be a hardworking setting. A pair of marriage trees in front of the house or an orchard in back create a sense of purpose, such as providing fruit, fenceposts, or support for a rope swing.

A farmhouse always starts with a basic rectangular form, often between 20 ft. by 30 ft. and 30 ft. by 44 ft. The roof is generally a simple gable. The one exception is the popular L-shaped plan, which features a projecting cross gable. But even on these homes, one of the volumes is usually dominant. Resecting portions of the main volume, which became popular in high-style architecture beginning in the Victorian era, was too frivolous for most historic farmhouses. Modern farmhouses often play with this detail, carving out a bit of the basic box to create a more dynamic form.

As needs changed over time, gabled or lean-to additions were added to the traditional farmhouse. The biggest box was not always the first shape; a smaller building may have served as a starting point, with a larger addition built when resources allowed. New farmhouses can

THE TRADITIONAL FARMHOUSE

Classic farmhouses can be found throughout the country. These two projects are excellent examples of new homes that have a traditional style. The simple shapes and exterior details reflect a farmer's practical attitude, while the porches emphasize a direct relationship with the landscape. The interiors are durable and hardworking.

Design Classic Home, classichomevt.com **Build** Classic Home, classichomevt.com **Location** Charlotte, Vt.

be designed to easily incorporate additions, or may even be built with the appearance of additions right from the start.

In New England, we have a tradition of connecting the main house to the barn through a series of supporting buildings, known as the "big house, little house, back house, barn" layout, named after a popular book on historic farmsteads. These days, homeowners tend to have garages for their iron horses, rather than barns for animals and fodder, but the organizing principles remain the same.

The life of a farmer is tied closely to the land, so it makes sense to have a close connection between indoors and out. Farmhouses often connect to the outdoors through a long, narrow porch, which sometimes wraps around a corner or two, known as a farmer's porch. Porches are a flexible indoor-outdoor space. Though they may be the first thing people think of when they hear "farmhouse," plenty of farmhouses don't have this feature, or have a porch that's been closed in to add interior living space. Porches are also not necessarily on the front side of the house—they can be on the side or back as well. Traditionally, porch ceilings are painted light blue to discourage visits from birds, bugs, and evil spirits, and floor boards often run in the short direction, pitched away from the house for drainage.

Most farms and farmhouses also have one or more outbuildings, dominated by the ubiquitous yet variable barn. Sometimes the barn

Photos: this page, Susan Teare; facing page, Jeff Lendrum

1 Most farmhouses begin with a basic rectangular shape. A gable roof and porches are common. Here, an entry porch provides shelter and a place to remove muddy boots. A screened porch is intended for relaxing in the shade at the end of the day. The materials used on the exterior are low maintenance, including wood lap siding, metal roofing, and metal-clad double-hung windows.

2 The kitchen sink is strategically located for views of farm activity. The countertop in this kitchen is highly durable recycled glass.

3 Farm kitchens are typically large and welcoming, with plenty of space in which to work. This one has a workhorse of an island instead of a traditional farm table. The cabinets are made of local maple, a Vermont tradition.

4 In keeping with the farmstead value of resourcefulness, this four-season porch is finished with reclaimed flooring and beams. The hearth and large farm table are hallmarks of a farmhouse interior.

5 Nestled among mature trees with views across a soy field, this farmhouse has found the perfect setting. The rebuilt home is all Midwest vernacular, including its reproduction beveled shiplap siding and steep gable dormer.

Design Craig Sachs, AIA **Build** Mark Stoltz, Stoltz Construction, Wausau, Wis. **Location** Waupaca, Wis.

is positioned near the house to create a working courtyard. On traditional farms, there may also be a chicken coop, a corn crib, one or more workshop outbuildings, and various sheds for storing materials, supplies, and firewood. Modern conveniences have rendered most of these outbuildings unnecessary, but to me it doesn't feel like a farmhouse without some supporting buildings scattered around the landscape.

Practical matters

Farmers are practical by necessity, and do not use flashy or unecessarily costly materials. They tend to stay put for generations, so it makes sense for them to invest in details that save money over the long term. Therefore, farmhouse materials are low maintenance and natural, often sourced locally if not from the building site itself. Natural stone, brick, and wood are commonly used on farmhouse exteriors. Farmhouse siding and trim tends to be simple and traditional. Clapboards installed 4 in. to the weather are typical in New England, but farmhouses around the country also feature shingles, vertical boards with or without battens, stone, brick, and stucco. Trim may be simple or elaborate, though rarely dressed up to the extent you would expect on a high-style city house.

Farmhouse roofs are pitched steeply enough to shed precipitation, usually with overhangs at the eaves and rakes. In some regions and

THE TRANSITIONAL FARMHOUSE

Built in all corners of the country for centuries, farmhouses can be a blend of traditional and modern styles and so are a natural fit for a transitional approach to design. By staying true to the farmer's ethos of simplicity and practicality, the new farmhouses shown here balance traditional form with materials and details that reflect contemporary materials and lifestyles.

Design Rehkamp Larson Architects, rehkamplarson.com **Build** Dovetail Renovation, Inc., dovetailrenovation.com **Location** Lake City, Minn.

for cost savings, rake overhangs may be omitted, and some modern farmhouses omit roof overhangs completely. Steel roofing of various types is popular for function and aesthetics on today's farmhouses. Wood shakes or shingles, natural slate, or clay tile may all be used, but asphalt shingles affordably imitate most of these materials and are much more common.

Before the late 1700s, many farmhouse exteriors weren't painted at all, or were painted only in muddy earth tones. Starting in the 1820s during the Greek Revival, off-white and light grays and tans imitating marble became popular; as the Victorian era progressed, earth tones in a wide range of mix-and-match shades gained prominence. The stark, chalky white of the titanium dioxide pigment we have today has only been available for the last 100 years, but has become a classic farmhouse look.

Windows are usually spaced uniformly across a farmhouse facade, but are sometimes combined in groups—for example, at a bay window or picture window. As a rule, they are simple, vertically oriented rectangles. Multipane windows in various patterns and proportions are common, but modern farmhouses often omit the muntins altogether; since the only purpose they serve today is aesthetic, it fits the practical farmhouse ethos to eliminate them. Windows are usually limited to just a few different sizes, though modern farm-

Photos: this page, Rob Lagerstrom courtesy of *The Progressive Farmer*; facing page, Whit Preston

1 This farmhouse is tall and proud, similar in style to a house just down the road. The gable roof, symmetrical window arrangement, and front porch are characteristics of Midwestern farmhouses from the early 1900s, but the porch columns are made of galvanized steel instead of wood.

2 The kitchen is designed with generous windows so the cook never need wonder who is coming up the drive or what weather is rolling in from the west. Hutchlike built-ins anchor the corners and the traditional farm table is replaced by a functioning island. Exposed timbers and industrial-steel light fixtures are inspired by the unadorned rural barn aesthetic.

3 Mixing traditional and modern features allows this kitchen to feel timeless and fresh. The home-office nook reflects modern life while the informality of a kitchen table in lieu of an island and the refrigerator tucked around the corner give the new farmhouse kitchen an old-time feel.

4 A wraparound porch takes advantage of different light and temperature conditions throughout the day and the seasons. This porch is detailed to allow unobstructed views. The metal posts and beams are a modern upgrade that set off the warm wood color of the decking and ceiling.

Design Eric and Rebekah Rauser, Rauser Design, rauserdesign.com **Build** Risinger & Co., risingerhomes.com **Location** Austin, Texas

houses often play with the scale while keeping the proportions of traditional windows.

Warm and hardworking interiors

Unpretentious and welcoming, farmhouse interiors have a sense of warmth and openness, with inspiration drawn from traditional details and natural materials. Historically, the front rooms in the house are the more formal, public spaces, and the back is more utilitarian, but in today's floor plans these rules are often broken.

Though the way we cook has changed dramatically over the last three centuries, farmhouse kitchens may still reflect some elements of their old-time counterparts. They usually include a place to eat, whether it be an island, peninsula, or small table—sometimes, the kitchen wraps around a large worktable. There may be a fancy dining table used on special occasions, but the everyday table should be a workhorse, as useful for breaking down an animal carcass as for dining.

Some details you might expect to find in a farmhouse kitchen include painted cabinets with a mix of paneled or glass doors, open shelving, and plenty of drawers. Sometimes simple Z-back doors are used, but this occurs more often in a pantry than a kitchen. Plate and pot racks keep everyday items on display and within reach. The cabinets have face frames, ideally with inset doors and drawer fronts,

THE MODERN FARMHOUSE

As seen in these two new homes, the essentials of modern architecture—including symmetry, clean lines, and ingenious details—are in keeping with the farmhouse spirit. Wood, stone, and metal are materials commonly used to create both modern and farmhouse styles, and even reused materials—part of farmstead culture—have a place in modern design.

Design TruexCullins Architecture + Interior Design, truexcullins.com **Build** O'Neill Builders, gogreenoneill.com **Location** Jericho, Vt.

and may have a furniture-like appearance. Durable stone, wood, tile, or metal countertops; glazed apron-front sinks or sinks with an integral drainboard; a range with the presence of a wood- or coal-fired cooking stove; and vintage-style, decorative lighting all have a place in today's farmhouse kitchens. Nothing is wasted on a well-run farm, so repurposed or somewhat worn items fit right into the farmhouse aesthetic. A generous but simple pantry is useful and appropriate.

There should be enough windows in the farmhouse to make the space light and bright, with available views of the farmstead. A true farmhouse also has a mudroom of some sort—an informal side or garage entry with heavy-duty surfaces and room to store outerwear and other essential items. Cubbies, a freestanding or built-in bench, and durable wood wainscoting on the walls all fit the farmhouse look.

Historically, many farmhouses had plastered walls and ceilings—but spaces were also often left unfinished in anticipation of renovations made regularly over time, so surfaces of all types are appropriate. Exposed beams and grooved boards on ceilings, simple wood wainscoting on walls, and painted or natural wood floors are all common—the more worn in, the better. Colors range from all white to rich, bright, or cool earth tones. Distressed wood, galvanized or pewter-finished metal, and classic lantern-style lighting are all appropriate touches. Modern farmhouses don't necessarily need to use period fixtures,

Photos: this page, Jim Westphalen; facing page, Whit Preston

1 This new home is a great example of how setting and form establish the farmhouse style. A simple rectangular main volume, a cross gable "addition," consistent window arrangements, lap siding, and an outbuilding keep the farmstead tradition in an otherwise supermodern home.

2 A hearth at the heart of the gathering space and simple, utilitarian bookshelves are true to the traditional farmhouse interior, even with this home's modern interior design and decor.

3 A salvaged window sash is repurposed in this staircase to soften the look of the hardworking wall of bookshelves. In the kitchen beyond, an industrial-style pendant light reflects both the minimalistic modern and utilitarian farmhouse aesthetics.

4 With open shelves, furniture-like cabinetry, and a casual kitchen table, the high-style urban interior design remains informal and functional.

5 This modern home stays true to the farmhouse style through the use of natural materials, including wood lap siding, a natural-stone masonry chimney, and architectural steel elements. Connected to the garage by a breezeway, the home creates the effect of an original main house with a series of additions.

Design Tim Cuppett Architects, cuppettarchitects.com **Build** Wilmington Gordon, wilmington-gordon.com **Location** Austin, Texas

though; farmers of old would have used the most practical fixtures available. Farmhouse doors are usually paneled, though the number and orientation of panels varies. Sliding barn doors are not historically accurate, but they pull a practical farm detail into the home in a whimsical manner.

Some old farmhouses still have an attached privy, but virtually all have upgraded to an indoor bathroom. Décor can vary, but a claw-foot tub and pedestal or console sink always look at home in a farmhouse. Painted wood or simple tile wainscoting on the walls, a furniture-like medicine cabinet or a simple wall-hung mirror, and vintage-looking light fixtures all work well. Bathroom floors may be painted planks, classic glazed or slate tile, or something more contemporary, like natural linoleum sheet flooring.

As you've seen here, farmhouses have been designed for centuries in all corners of the country. While one can be quite different than the next, each share traits that reflect the philosophy of American farmers—simplicity and practicality of form, resourcefulness and durability of materials and construction, and a strong work ethic. It is perhaps these characteristics, more than any particular architectural details, that define the farmhouse style. □

Michael Maines is a contributing editor.

A Workaround Approach to Knee-Wall Built-ins

Without modifying the framing, a carpenter tucks storage and style beneath the roof in a second-floor hallway

BY ANDREW YOUNG

This Cape Cod–style bungalow was built just before World War II (the war that would change everything, including the way houses are built). It's compact and efficient, with a steep roof made of intersecting gables and eaves with no overhangs. It has simple moldings and few extras. The house reflects its era—a time of great struggle—with a modest amount of comfort.

Though the current homeowners appreciate their home's history, they're a growing modern family and needed more storage. But adding built-ins that protrude into any of the home's small rooms would mean losing valuable floor space, which is at a premium in this house. So when I was hired for the project, I suggested we turn our attention to the narrow second-floor hallway at the top of the home's steep winder stairs. It's a spacious, light-filled area, and the 4-ft.-high knee wall under the sloped ceiling left us with an unclaimed triangle of attic space to work with—or, perhaps more accurately, to work around.

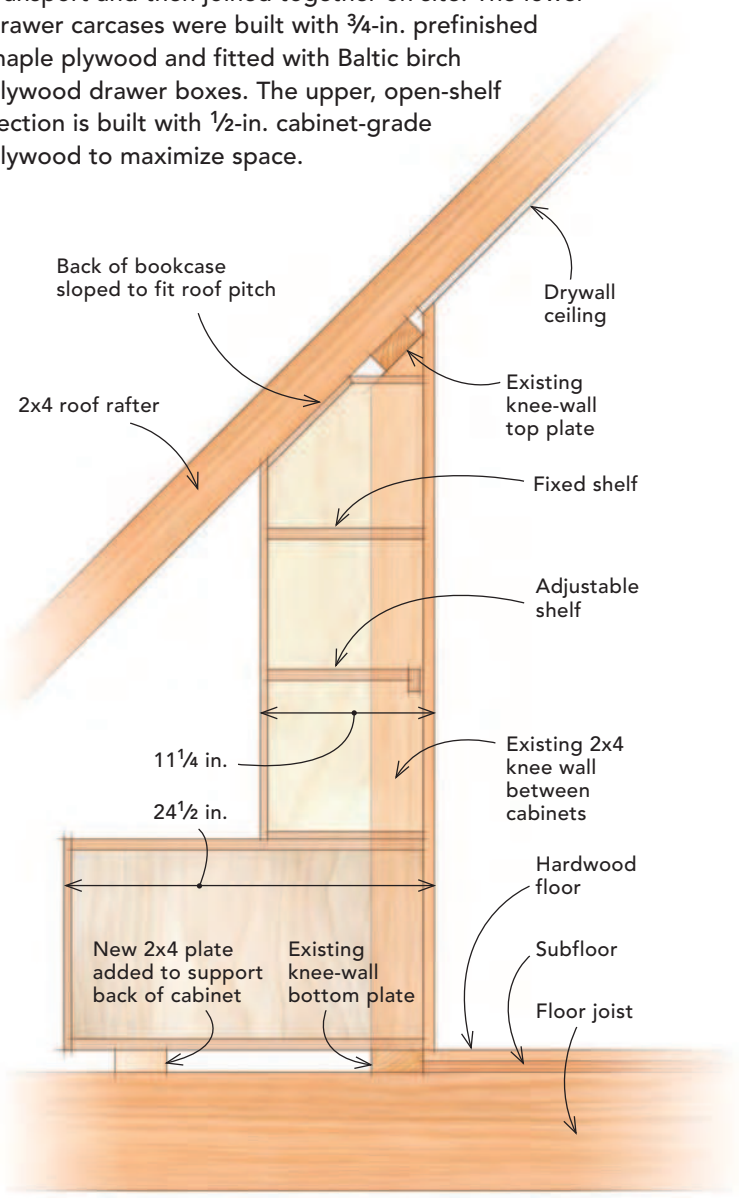
Designed to fit in

Like most roofs of its day, these 2x4 rafters were framed 24 in. on center, and the knee wall was framed to match with a stud aligned with each rafter. Though they are undersize according to modern building codes, these simple roof assemblies seem to stand the test of

Drawing: Trevor Johnston

TRIANGULATING A FIT

The carcases for each unit were built in two pieces for easy transport and then joined together on site. The lower-drawer carcases were built with ¾-in. prefinished maple plywood and fitted with Baltic birch plywood drawer boxes. The upper, open-shelf section is built with ½-in. cabinet-grade plywood to maximize space.



time in our climate and under our limited snow load. All the elements of the assembly are critical to its success—the rafters, collar ties, knee wall, exterior wall, and floor joists create strength through geometry. This means old roof frames such as this one are a lot like roofs framed with modern engineered trusses: You can't modify them in any way without creating a major weakness.

Not wanting to open a can of engineering worms, we decided to work around the existing framing to reclaim the attic space, setting a row of built-ins into the spaces between the studs. To avoid mistakes, we determined that it would be best to build the cabinet carcases in the shop, and then assemble the face frames on site after the carcases

IN PLANE IS EXTRA IMPORTANT

The installation started with the carcases temporarily set in place to check their fit and determine an appropriate height for the bottom of the units to sit above the finished floor. The chosen height was then set with a laser and the installation continued from the outside units toward the middle, with each carcase set plumb, level, square, and—most importantly—in plane with each other. This is critical for the continuous face frame to work across the independent carcases.

Blocking for height. *Ripped to the necessary dimensions, blocking is nailed to the front and back edges of the carcases' bottoms to set their heights above the finished floor.*

had been installed. The homeowners asked for a seamless look, and we felt that doing the face frames on site would offer flexibility in the process and allow us to fine-tune how everything would fit, making the new built-ins look like part of the original design.

The final plan uses five stud bays at the face of the knee wall—each approximately 22½ in. wide and 44 in. tall—for a run of bookcases. Each open-shelf bookcase is anchored with a deep bottom drawer, and the assembly is complemented by a linen closet set in the corner at the top of the stairs, which does not enter into the attic space. We replaced an existing linen cabinet with this larger unit, pulling the piece farther forward to create additional storage and make better use of the jogged hallway.

Because the stud spacing varied slightly, we chose to build the bookcases to the smallest dimension. This simpified the process so the caracases would fit in all the bays with enough space to shim them level and plumb. Making the most of the triangular space, the open bookshelves are only 11¼ in. deep, but the bottom drawers extend back 24½ in.

The built-ins are intended to look simple and clean. Because we were working around the knee-wall studs, we knew that the stiles between the units would be wider than usual, as would the top rail, which has to accommodate the knee-wall top plate. We opted for overlay drawer fronts to help de-emphasize the chunky face frame.

An extra-careful install

We're used to working in older homes that present unique challenges, and this project was no different. The surrounding walls, floor, and ceiling were all out-of-level and out-of-plumb, ranging from mild to wild. The corner linen cabinet was straightforward to install and the first thing we tackled. Once that was in place, we began prepping the attic space to receive the built-in carcasses. After removing the drywall, the first step was to fasten a 2x4 (on the flat) over the floor joists

Laser level and plumb. *Set to the height of the cabinet's fixed shelves, a laser line is used to ensure each carcase is at a level height with the adjacent units. Young uses a level to check that each unit is installed plumb.*

Ready, set, shim. *Once each carcase is set plumb with shims beneath the back of the drawer boxes, more shims are used between the sides of the carcases and the studs to ensure they stay square.*

Nailed it. *After a straightedge is used to make sure each carcase is evenly projecting the appropriate distance from the knee wall and is in plane with adjacent carcases, they are fastened to the studs with finish nails.*

for the back of the carcases to rest on. The 2x4 brought the cabinets level with the hardwood floors on the finished side of the knee wall (¾-in. subfloor + ¾-in. hardwood floors = 1½ in.). Once we determined the height we wanted the cabinets to sit above the finished floor, we used blocking to lift and shims to level the individual units.

The key to a successful installation on this project was keeping all the carcases square and in plane with each other so that we could install the face frames as a (mostly) single unit, tying all five carcases together. Taking the time at this stage to get all the carcases in the correct position made the rest of the install much easier. We weren't concerned with getting the spacing between the units exactly uniform. As long as they were vertically parallel, the stiles would fit nicely, and we were happy to rip each stile to a custom width. Because the stiles are wider than usual to begin with, the differences in spacing aren't noticeable.

Using a laser level to set the elevation, we started by installing the end units and worked toward the middle. This allowed us to use a straightedge to check that we were keeping all the carcase fronts in plane with each other.

Finely tuned face frame

With the carcases installed, we turned our attention to the face frame, starting with the stiles at the ends of the units and the top and bottom rails. First we fit the stiles on the left and right ends, scribing them to the walls and ceiling as needed while also setting the proper overlap over the sidewall of the carcases. A ⅛-in. overlap creates an inside corner between stile and carcase that can be caulked to hide any gaps that may show up once the cabinets are painted white. Once these stiles fit well, we temporarily screwed them in place to ensure they didn't move as we measured for the top and bottom rails and marked where they should attach to the stiles.

The bottom rail was fairly simple to fit as the floor is mostly level and we planned to add a base shoe to cover any slight gaps. The top

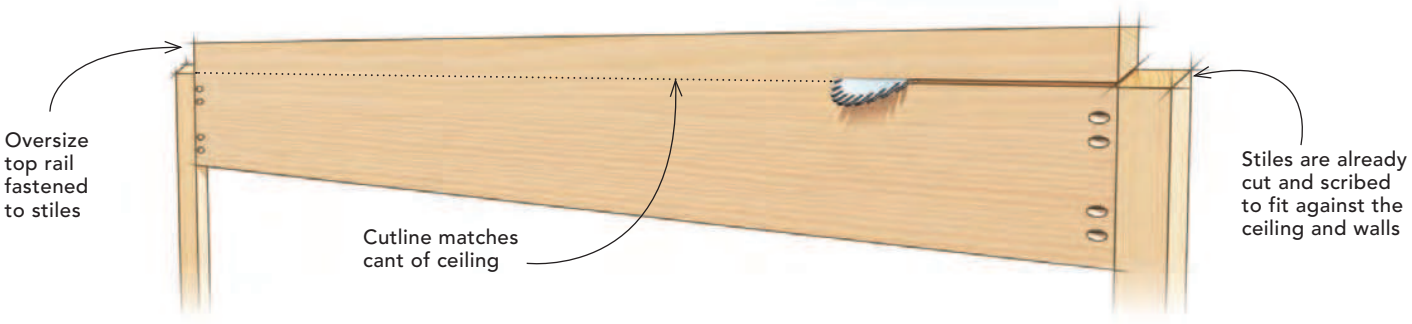
A HYBRID APPROACH TO THE FACE FRAME

Preassembled face frames have become the standard for cabinetry. But because this was a unique situation, a hybrid approach made sense. The assembly and installation included fabricating and fitting each individual component, starting with the stiles at each end of the built-in.

Measure for the rails. *With the end stiles cut to length, scribed to the walls, and temporarily tacked in place, Young measures for the top and bottom rails.*

Assemble with pocket screws. *The bottom and top rails are then fastened to the stiles with glue and pocket screws. The top rail is left wide to be scribed to the ceiling.*

Rip the bevel on the top rail. *Using the end stiles that are already fit to the ceiling as a reference, Young rips a bevel along the top rail with a track saw.*



Drawing: Trevor Johnston

Custom fit. *Because the spaces between the carcases are not consistent, each intermediate stile is measured and ripped to the appropriate width before being held in place to mark its location on the top and bottom rails.*

Easily fastened. *The stiles are then fastened to the face-frame assembly with glue and pocket screws.*

Quickly finished. *The intermediate rails at the fixed shelves are glued and nailed to the shelf edge for speed, completing the face frame.*

rail was another story—the sloped ceiling has a significant cant from left to right and is bowed in the middle. With both end-stiles fit from floor to ceiling, we realized that we could use the stiles themselves as reference points to rip the top rail, which we left extra wide and then cut after the face frame was assembled (drawing left). In this way, the beveled rip matches the cant of the ceiling from one end of the built-ins to the other.

Once we were happy with the fit of the perimeter frame, adding the intermediate stiles was a fairly straightforward process, as we had already done the work of ensuring that all components were square. We marked the position of the interior stiles, cut them each to the necessary width, and again removed the frame to install them using pocket screws.

Finally, we installed the assembled face frame using glue on the carcase edges and countersunk screws driven into the knee-wall framing (not the carcases, because the ½-in. plywood chosen for the carcase sides would have been a risky target for finish nails). The remaining shelf rails were glued and nailed in place before we spent a couple hours plugging the screw holes, filling the pinholes, and sanding everything to create a seamless frame. It's worth noting that this approach is best suited for a painted installation. It could be done on a stain-grade project, but you would be adding a complication when it comes time to hide all your fasteners.

We returned to complete the installation of the drawer boxes, fronts, and hardware after the painters had done their work. The final result is as functional as it is charming and adds a lot of visual interest in what would otherwise be a rather unremarkable hallway. And we did it all without disturbing the framing, which would have required an engineer, permits, additional trades, and a much larger budget. □

Andrew Young is co-owner of Young & Son Woodworks in Portland, Ore. Photos by Nina Johnson.

Make Your Foam Gun Last

The secrets to keeping this precision tool up and running

BY PATRICK McCOMBE

Photos: this page, Rodney Diaz; facing page, Patrick McCombe

The ease of application and huge yield from a single can of pro-style foam is reason enough to use a gun rather than a straw, but like many other carpenters, I've long been frustrated with the reliability of my foam guns. I've tried a lot of brands, and sometimes had them quit working after only a few weeks. But after several conversations with industry insiders, I learned that the problem wasn't the gun—it was me. With a better understanding of how the gun works, and what can cause it to fail, I've learned the secrets to keeping this tool working well for years.

Moisture is the key

The first step is to understand foam chemistry. Canned foam has three main ingredients: polyurethane resin, propellant, and fire retardant. Some foams have additional ingredients for specific purposes, like capsaicin for pest control or dye to differentiate the color of, say, foam construction adhesives vs. foam for filling holes. No matter what type of foam you're using, the chemistry behind how it works is the same.

The can keeps the propellant in a liquid state, but when you pull the gun's trigger, the pressurized propellant is released as a gas, pushing the liquid polyurethane resin ahead of it. The propellant (usually propane or butane) has a boiling point of about -10°F at normal atmospheric pressure, so in a 60°F room, it's 70° warmer than the propellant's boiling point, which creates a vigorous boil that fully froths the foam. The closer you are to -10°F, the less vigorous the reaction. The can will yield less, and what does come out will be dense, less resilient foam than if you were in a warmer space. This is why foam makers suggest that if the can is cold, you should warm it at room temperature for at least 24 hours before use. If you're in a rush, you can warm cold cans faster by placing them in a bucket of warm water.

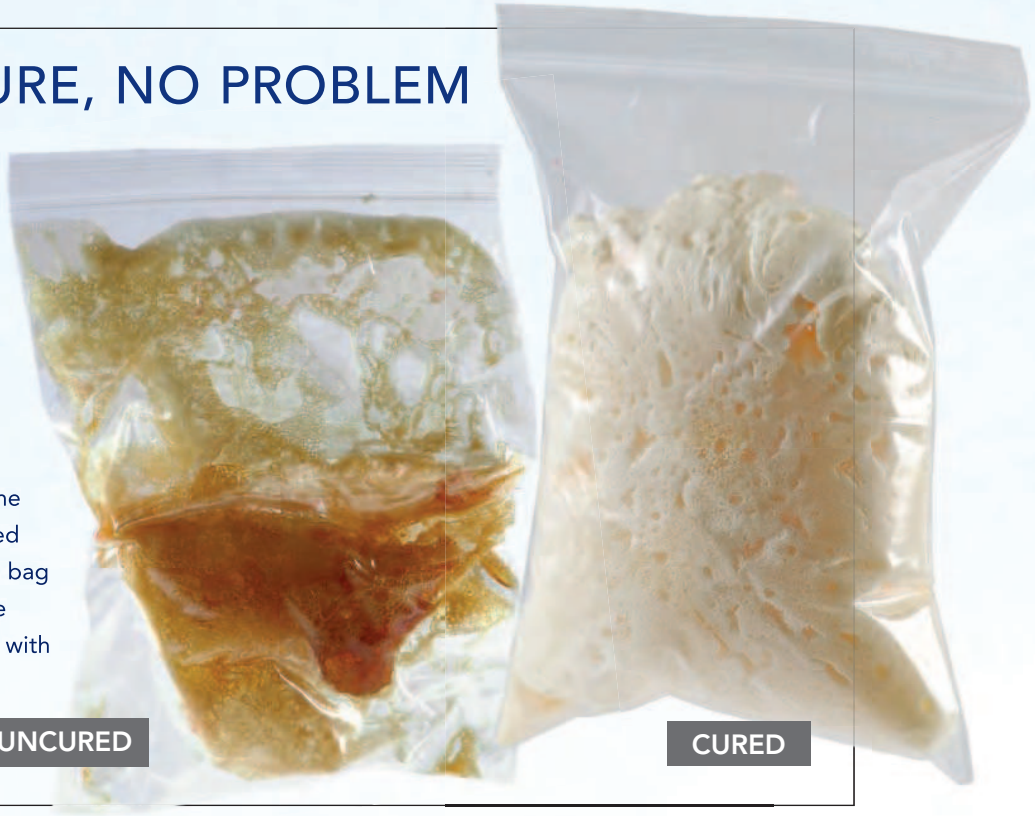
Once it's dispensed, the frothed foam immediately starts reacting with moisture in the air, which is necessary to make the resin cross-link and harden. Foam that is starved of moisture will look syrupy and dark brown, and will collapse after it's dispensed. A lack of moisture is seldom a problem, except in arid regions and during extreme cold when outdoor air holds little water vapor, but the solution is easy: use a spray bottle to lightly mist the substrate with water before foaming and mist any large fills as you dispense the foam to ensure a full cure (see "You Don't Know Foam," *FHB* #241).

If you keep in mind that the foam will not cure without moisture, you're well on your way to keeping your foam gun working for a long time. The idea is to keep moisture-filled

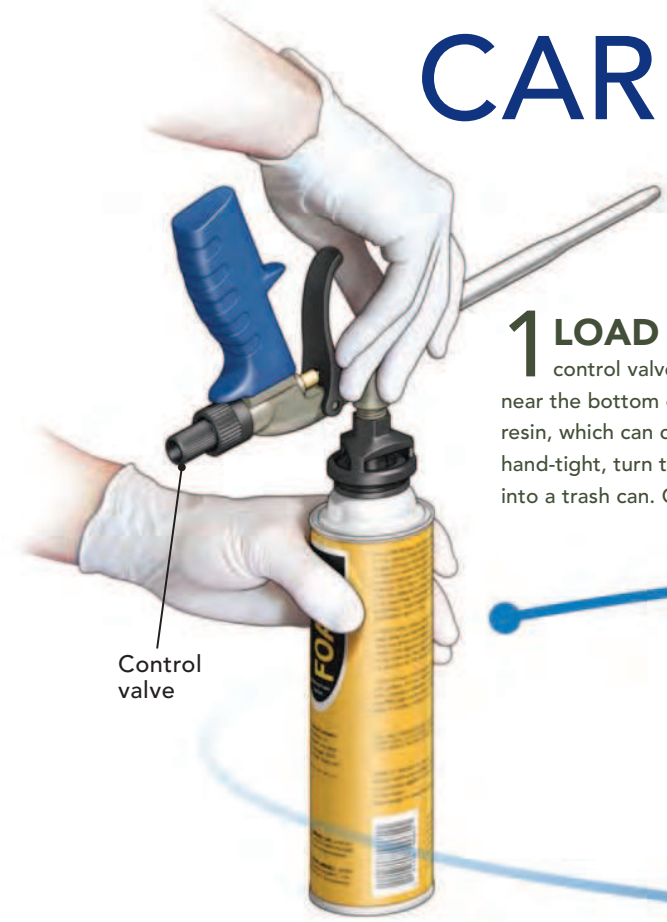
INSIDE THE GUN

NO MOISTURE, NO PROBLEM

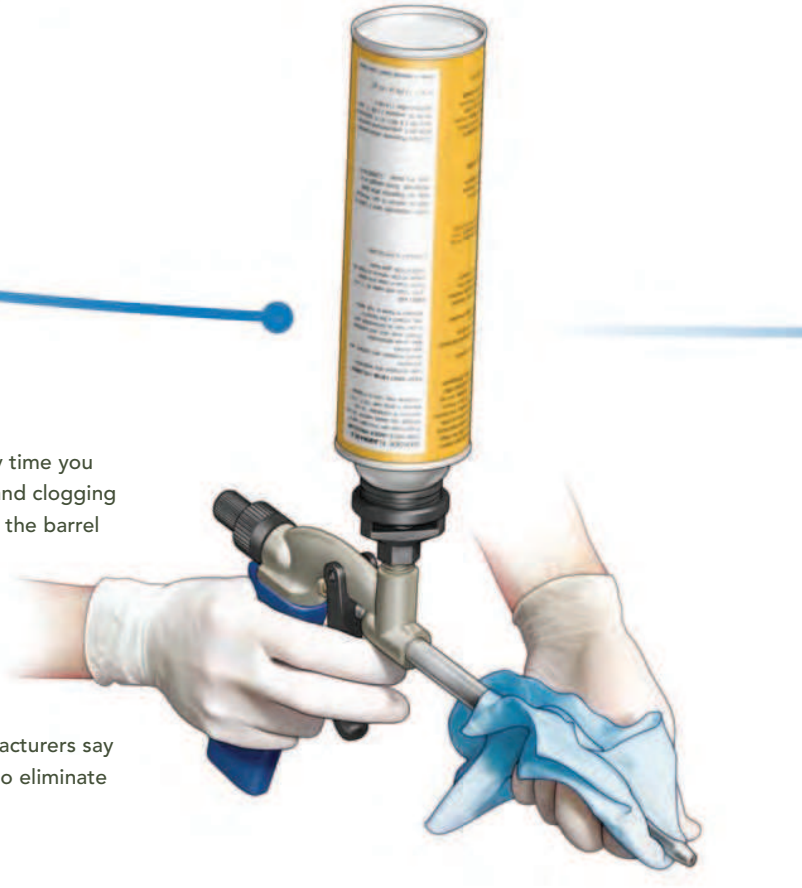
You want the foam within your gun to stay free of moisture so it doesn't cure, which will cause it to clog. To illustrate this concept, we filled two bags with foam. The bag on the left was filled halfway and then sealed. Without air (which contains moisture), the foam collapsed and remained syrupy and dark brown. The bag on the right was filled to the same level, but then misted with water before being sealed, causing the foam to expand and cure.



CARE AND FEEDING



1 LOAD Set the can on a bench or table and screw the gun—upside down and with the control valve closed—onto the can. The upside-down position keeps the polyurethane resin near the bottom of the can so any leakage as the can is loaded is limited to propellant rather than resin, which can clog the ball valve below the screw adapter and make a mess. Once the can is hand-tight, turn the gun upright, open the control valve, and pull the trigger to dispense foam into a trash can. Open or close the control valve until you get the desired bead size.



2 USE Be sure to wipe the foam from the gun's tip every time you stop spraying to prevent the foam from drying on the tip and clogging the gun (an occasional coat of silicone spray or cooking spray on the barrel prevents the foam from sticking to it). Some guns have a hollow handle that allows you to carry a rag or paper towel on the gun. Scraping the cured foam from the end with a utility knife or rubbing it on a concrete floor will damage the critical seal that keeps air from reaching the foam in the barrel. When you're done for the day, close the control valve to prevent accidental discharge. If you're storing the gun for a while, manufacturers say that you should ideally run some foam through it every 30 days to eliminate the chance of the foam curing inside the barrel.

air out of the gun. Otherwise, the polyurethane resin that remains in the barrel will start to cure, which will restrict the flow or stop it altogether.

Cans of foam have either a rubber or plastic valve that releases the foam and propellant. Because plastic expands and contracts less than rubber, cans with plastic valves create a more reliable connection between the gun and the can of foam, keeping out moisture. Leaky valves release propellant and allow moisture into the can, causing the foam to harden. These leaks can happen even when the can is on a store shelf. You can see if the foam is still good by giving it a shake before placing it on the gun. If the liquid resin feels thick or doesn't move at all, or if the expiration date has passed, toss the can.

Don't treat your foam gun like a caulk gun

If you store your foam gun in a crate with other tools, let it roll around on a shelf in your van, or shove it behind the seat of your truck between jobs, you should expect it to fail quickly. If you want this tool to last, think of it as a precision tool, with a delicate valve that

Drawings: Christopher Mills

OF A FOAM GUN

4 CLEAN Close the control valve, put the can on a table, and unscrew the gun. If foam oozes out the top of the gun, it's likely that a small amount of cured foam is preventing the ball valve from fully sealing. Spray the basket and ball valve with cleaner, and if necessary use a slim wood dowel or a golf tee to free the ball. As quickly as possible, screw the gun onto a new can of foam, following the upside-down loading procedure.

3 PURGE When a can is spent, hold the tool upright and use the remaining propellant in the can to clear the foam in the barrel. Once the foam stops sputtering out, you can stop. This step prevents uncured foam in the gun from being released as the empty can is removed.

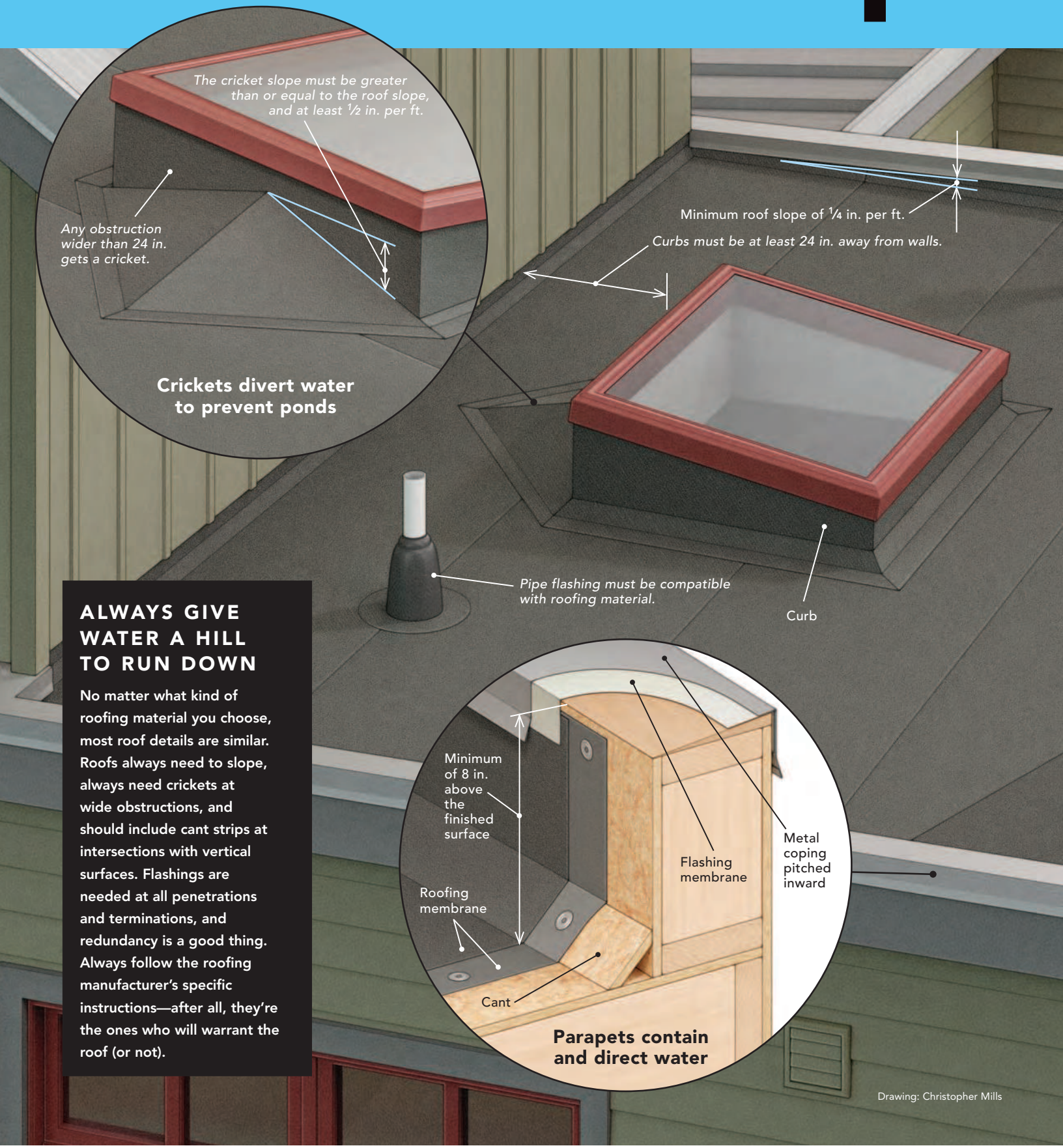
To see a video on the care and feeding of your foam gun, and to learn more about how much to spend on this tool, visit finehomebuilding.com/magazine.

must maintain the separation between air and polyurethane resin. You should always have a can of foam on the gun, even if it's empty, because without a can you're exposing the uncured foam within the gun to the moisture in the air. If the foam within the gun itself cures to the point that the trigger won't move, the tool is toast. If the gun's trigger moves, but it won't dispense foam or dispenses slowly, it can often be revived with an acetone-based foam-gun cleaner.

To use, screw the cleaner onto the gun and spray the gun onto white paper within a cardboard box or trash can until the stream runs clear, which means the resin has been completely flushed from the gun's system. You should keep cleaner use to a minimum, though, as it takes a toll on the foam gun's internal seals, leading to the gun's early demise. It's also a good idea to keep the gun in a case. This helps to prevent the can from jostling on the gun during transport, which can create a leak where it screws into the adapter that allows air into the system. □

Patrick McCombe is associate editor.

Guide to Low-Slope



ALWAYS GIVE WATER A HILL TO RUN DOWN

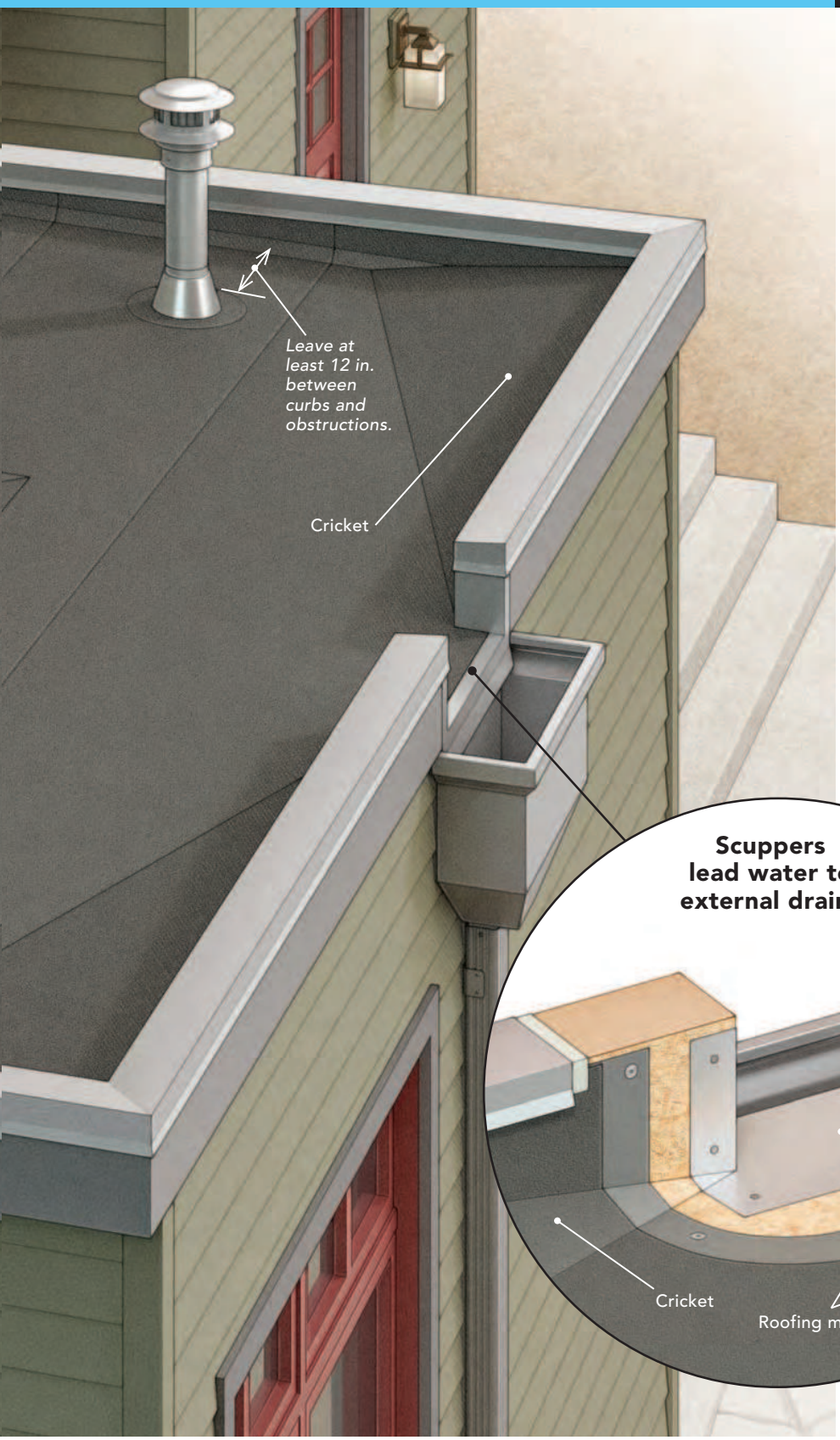
No matter what kind of roofing material you choose, most roof details are similar. Roofs always need to slope, always need crickets at wide obstructions, and should include cant strips at intersections with vertical surfaces. Flashings are needed at all penetrations and terminations, and redundancy is a good thing. Always follow the roofing manufacturer's specific instructions—after all, they're the ones who will warrant the roof (or not).

Drawing: Christopher Mills

Roofing

Learn the alphabet soup of materials, but first get the slope and underlying details right

BY DAVID CROSBY



A good low-slope roof (3-in-12 pitch or lower according to the National Roofing Contractor's Association, or NRCA)—rarely gets any attention. A bad one brings the kind of attention nobody wants. I see a lot of bad low-slope roofs and don't know which is more astonishing: how little additional effort would have been required to build it right, or the extraordinary cost of correcting the roof and repairing the associated damage.

Karen L. Warseck, AIA, president of Building Diagnostics Associates, a Florida-based firm that specializes in identifying and fixing building-envelope problems, identifies the causes of roof failures in an *Architect* magazine article titled, "When It Leaks, It Pours": "Normally we find that it's about 60% to 70% construction, 20% to 25% design, and 10% materials."

In short, the roof is the wrong place to try to save money.

Though Warseck's experience proves that the skill of the workers and the quality of the roof design are more important than the choice of materials, the first question I usually hear is, "What's the best material?" Well, the answer is, "It depends." If there were one best roof for every application, we would have figured it out by now.

Even standard asphalt roofing shingles can be used on roofs as low-sloped as 2.5-in-12, as long as the underlayment is installed in a double-coverage configuration. That simply means that there must be two layers of underlayment everywhere. So, instead of lapping a 36-in.

ASPHALT-BASED ROOFING old school

New school meets old school. *Asphalt roofing was originally bedded in molten tar, but newer versions include peel-and-stick membranes.*

Most people are familiar with built-up asphalt roofing (BUR)—multiple plies of saturated felt or fabric applied shingle-style and layered with asphalt. The asphalt is melted in a big pot and pumped or bucketed to the roof and then mopped on. It is then covered with a cap sheet that has a mineral surface or a reflective coating (possibly acrylic, urethane, an asphalt-based emulsion—often with aluminum—or actual gravel carried up to the roof and spread by hand).

BUR showed up in the mid-to-late 1800s; the asphalt used was originally a by-product of petrochemical refining. By the 1970s, advances in refining technology and market pressures resulted in changes to the asphalt used for roofing. Meanwhile, in the felt, rag content decreased and asbestos fiber was phased out. The sense in the roofing industry was that these changes decreased the quality of BUR, and I see it less and less these days.

Unlike other options, BUR components are site assembled, and the finished product is heavily dependent upon the skill and diligence of the installer. BUR does not have as much ability to expand and contract without damage, it's relatively heavy, and it's not as durable under extreme swings in temperature as other options. It's tough to inspect, maintain, find leaks in, and repair. It's also no longer allowed in some high-wind areas, and tearing it off is a first-class mess. Once upon a time it made a good roof, but considering advances in the industry, I don't know why I would ever use it now.

MOD BIT

To build an asphalt roof today, I'd go with a modified-bitumen product. Bitumen is an asphalt component that occurs both naturally and as a by-product of oil refining. For roofing, it's modified with the addition of chemical plasticizers and stabilizers that enhance flexibility and durability. This so-called modified bitumen (mod bit) is reinforced with at least one layer of fabric (fiberglass is common, but there are several types) and usually comes in 3-ft.-wide rolls, with a thickness around 150 mils. In most cases, a cap sheet is installed over a mechanically fastened base sheet about half that thickness, but other installations are possible.

Mod bit was introduced to the U.S. in the mid 1970s and gained widespread acceptance quickly as an economical, high-quality roofing material. It has become very popular for its durability, resistance to damage, ease of repair, reliability, and standardized installation methods. Different manufacturers and applications may dictate choices about number of plies and specific components, but the key to remember is that these are manufactured products of consistent quality with uniform, predictable properties and performance characteristics.

APP&SBS

There are variations in mod-bit products. Two common designations are APP and SBS, and they refer to the type of modifiers in the bitumen. APP is typically torched down, while some manufacturers also make products that are self-adhering. Depending upon manufacturer and product, SBS is available for a number of applications: torched down, hot mopped, cold processed, mechanically fastened,

Photos this page and facing page: Rodney Diaz

with a few new tricks

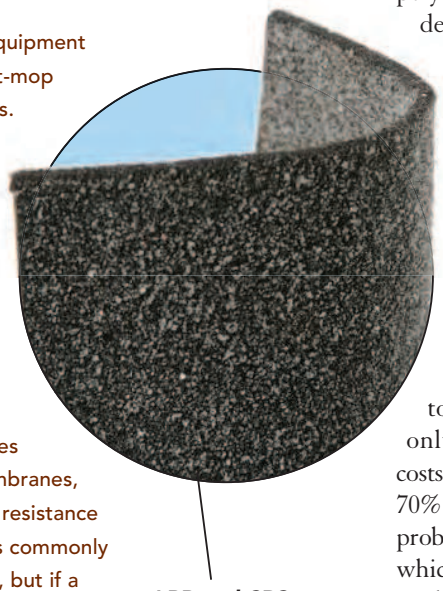
and self-adhered. "Torched down" is just what it sounds like. First, a fireproof base sheet is laid. Some fasten mechanically with screws or ring-shank nails through metal plates; others self-adhere. As it's unrolled, the underside of the cap sheet is heated with a torch until it melts, allowing it to bond to the base sheet and the seam of the previous course.

Because of the risk of fire during installation, insurance companies don't seem to appreciate torch-down application, but it's particularly handy on small or cut-up roofs, or where access is difficult. I have seen great results from torch-down applications, but you have to be thoughtful and careful, particularly at terminations of any kind, especially walls, curbs, parapets, and other details. Stay on the job for at least two hours to ensure there is no risk of fire, and a non-contact infrared thermometer is handy for locating any spots hotter than the ambient roof temperature that could indicate smoldering materials.

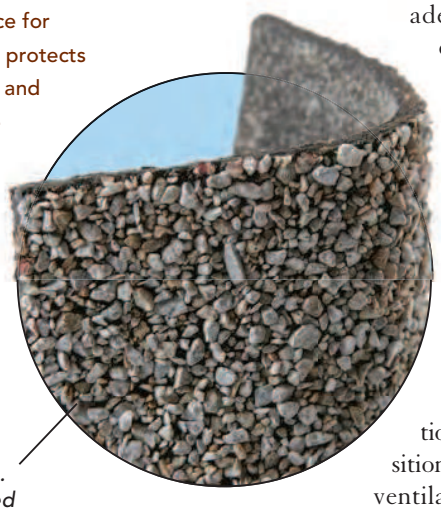
A hot-mopped application—that is, a cap sheet set in asphalt heated to a liquid state—poses less risk of accidental fire, but attention to detail and safety is still important, especially at penetrations of any kind, to make sure hot asphalt does not accidentally run into the building. Cold-process applications with unheated asphalt and self-adhering options (peel and stick) are safer and easier if you don't have the specialized equipment or skill required for hot-mop or torch-down methods.

I prefer mod-bit roofing on jobs where mechanical damage to the roof is a possibility (for example, from foot traffic). Mod bit will take a lot of abuse and is easy to repair. It can be two to four times thicker than other membranes, providing stability and resistance to puncture. Mod bit is commonly surfaced with granules, but if a reflective roof is desired, acrylic or urethane coatings on smooth-surface mod bit can work well.

With some mod-bit membranes, the use of a base sheet is optional, but it's money well spent. A base sheet separates the waterproofing membrane from the substrate, acting like a bond breaker to allow for slight thermal movement. It's nailed to the roof deck with ring-shank cap nails or plates and screws, making future tear-off easier than with membrane directly adhered to the deck. A base sheet provides a reliable fastening surface for cap-sheet adhesives, and protects the cap sheet from joints and minor irregularities in the deck. It functions as a strengthening layer and in some cases as a vapor retarder, and it reduces the amount of asphalt dripping through the deck in hot applications.



APP and SBS are mod-bit variations. *Different modifiers in the tar distinguish these membranes and their installations. Some rely on heat-activated adhesives (torch down), while others are bedded in hot or cold asphalt.*



Mod bit simplifies tar-based roofing. *Modified-bitumen roofing comes in rolls, and is commonly a two-layer system. The first layer is a mechanically fastened base sheet, topped by a thicker cap sheet that adheres to the base.*

underlayment the typical 2 in., the overlaps are 18 in. each.

For lower roof pitches, there are two broad categories of roofing: asphalt based and polymer based. But the best material choice depends on a variety of factors: location, weather, type of construction, intended use of the building, configuration of HVAC and rooftop equipment, anticipated foot traffic, foreseeable potential for damage, and ability to maintain the roof.

Good roofs start with good design

Drainage is the single most important consideration in roof design. According to the article in *Architect*, "while roofs only make up about 2% of construction costs, water intrusion accounts for more than 70% of construction litigation." Most of the problems I see relate to inadequate drainage, which can mean inadequate slope, a lack of crickets where needed, and drains that are not properly constructed or maintained.

We often hear low-slope roofs referred to as "flat roofs," but no roof should be dead level. The closer a roof is to level, the more likely sagging rafters will make a pond. An adequately pitched roof with a sagging middle will still slope enough to drain.

Codes prescribe a minimum slope of ¼ in. per ft., while the NRCA calls for "no ponding water on the roof 48 hours after a rain during conditions conducive to drying." Roofing manufacturers have their own requirements. It's a good idea to become familiar with all three perspectives and build to the most restrictive.

It's unusual for the field of a roof with adequate slope to leak. Penetrations, obstructions, terminations, drains, improper flashings—here is where trouble lies. Anywhere the designer has to lift the pencil is a potential leak. To avoid putting the roofer in an impossible situation, the designer and the builder need to provide structural support for all anticipated loads, adequate slope, a suitable surface for attachment (which varies depending on wind conditions), sound parapet configuration, smooth surface conditions at transitions and changes in elevation, adequate ventilation, and proper installation of the sheathing. All openings in the roof should

POLYMER-BASED ROOFING easy to clean,

One layer does the trick. *TPO, PVC, and EPDM roofs fasten to the deck in a variety of ways and are highly reliable, but often require special tools and training to install.*

In cases where the roof is not subject to mechanical damage—say, by regular access required to maintain rooftop HVAC equipment—single-ply polymer-based membranes such as TPO, PVC, and EPDM are a terrific option. They are easy to clean, easy to inspect, and easy to repair in an emergency (although permanent repairs should be done by a professional certified in the manufacturer's system). Polymer-based roofing is lightweight, which makes it a great choice for going over an existing roof, and installation is fast. It can be mechanically fastened, fully adhered to the roof deck, and, in rare cases, ballasted with gravel. When mechanically fastened, nails or screws and sheet-metal plates are used at the top of the sheet where the next layer will overlap them. This seam is then glued or taped. Attention to the manufacturer's details is crucial, and it's important to recognize that with single-ply there are no redundant layers. If there is no insulation above the roof deck, an underlayment will be used to protect the membrane from the deck.

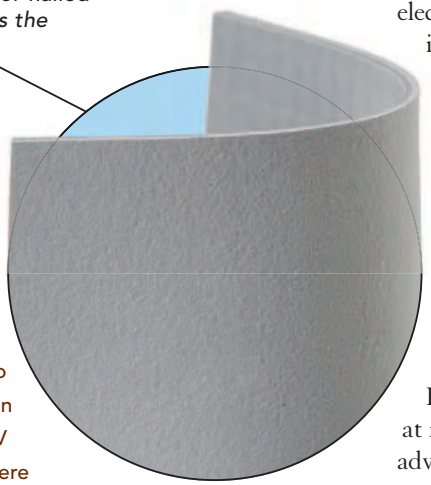
TPO & PVC

TPO and PVC are both fabric-reinforced plastic materials. TPO is probably the most widely recognized. It was introduced in the 1980s and the version we're familiar with today caught on in the early-to-mid 1990s. Some of the materials used in TPO and PVC have a bad rap as a result of early formulation troubles, but today these are highly reliable products. There is a wide range of characteristics for each material and brand, but for our purpose here, the most important feature

Photos: this page, Patrick McCombe; facing page, Rodney Diaz

inspect, and repair

Plastic roofing. *TPO and PVC are single-layer plastic materials that come on rolls. Typically screwed or nailed down on their upper edge, the next course laps the fasteners and the seams are heat-welded.*

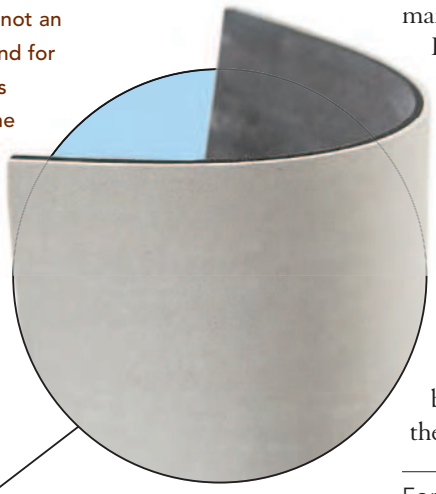


is that everything outside of the fabric reinforcement is part of a sacrificial layer that deteriorates at a predictable rate. These materials range in thickness from 45 mils to 80 mils or more. Thinner membranes are generally cheaper, while thicker membranes are more puncture resistant and last longer. Generally I would go with a thickness of at least 60 mils. These products work particularly well and are highly reliable where severe daily temperature swings and intense solar exposure are considerations. Following mechanical fastening, the seams are hot-air welded, typically with a handheld heat gun or an automated cart-mounted welder. One company, Sarnafil, makes a peel-and-stick version. Although other colors are available, TPO and PVC roofs are generally white, which helps to reduce summer cooling loads.

EPDM

EPDM is sometimes called "rubber roofing." It was introduced to the U.S. in the early 1960s, and continues to enjoy great popularity. The dark color is regarded as a benefit in some parts of the country, particularly in northeastern climates where it absorbs warmth from the sun and quickly melts snow and ice. Black roofs are not as desirable in the Southwest, but you can now get EPDM with a white surface. In my experience, black EPDM is more prone to damage from expansion and contraction and UV degradation under severe solar exposure than other single-ply membranes. Because the seams are glued or taped, installer skill and ambient conditions are particularly important, and while there have been improvements over the years, the seams tend not to be as strong as the welded seams of TPO and PVC. Available in widths up to 25 ft., EPDM can be a seamless roof.

I've worked on one ballasted EPDM roof, meaning the membrane is held in place with river rock. This is not an installation I recommend for residential use. It takes surprisingly long for the roof to dry out after a rain (and it's difficult to find leaks or repair them), and removing the existing roof to replace it is about as difficult as you'd expect.



Rubber roofing. *EPDM is a synthetic rubber available in very large sheets. Usually glued down to the substrate, any seams are glued together or capped with a special tape.*

be completed before the roofer shows up. In high-wind areas, I have increased the thickness of the roof sheathing to provide better fastener anchoring. It costs a little more, but I sleep better.

Talk before work starts and as needed during the job. Make sure the framer, plumber, electrician, HVAC contractor, and site superintendent are involved. Clear detail drawings are crucial—you don't want the lowest-paid roofer on the job reaching for a tube of caulk because he doesn't know what else to do.

Have the roofer review the drawings prior to construction and comment on curb heights, nailing surface for flashing, distance from walls for penetrations, and configuration and location of pipe penetrations. One of the ways I have been able to get a better product at no additional cost is to ask the roofer in advance what he needs to see when he shows up—blocking, nailers, curbs, crickets, even access details and material storage areas—anything that makes his life easier will make my life easier, too.

Good workmanship needs guidance

I don't suppose many people show up for work planning to do an inferior job, but there is a lot we can do to help everyone do even better work. "Built to code," or "That's how we always do it," simply isn't good enough. Clear standards of quality and workmanship should be agreed on before the contract is signed, reviewed before the crew gets on the roof, enforced throughout the job, and proven in inspections upon completion. The manufacturer's specifications and the NRCA Roofing and Waterproofing Manual should be referenced in your contract. This is how all parties can agree to standards that are impartial, relevant, achievable, and verifiable. The NRCA Roofing Manual provides excellent design details, but at $650 for a non-member, it's not cheap. Fortunately, the manual is broken into four books, and for low-slope roof details you can buy the Membrane Roofing Systems book for $195—far less money than even the smallest leak will cost to fix. □

For the past seven years, David Crosby was a public-sector project manager responsible for 2.5 million square feet of low-slope roof.

Affordable

The ProHOME team finds a balance between improved performance and construction costs

A "net zero" designation means there is enough on-site renewable energy to offset a house's annual usage. The term could apply as easily to a highly insulated envelope as one built to energy-code minimum. In the custom-house market, the balance between spending on the size of the PV array vs. the building envelope can be influenced by aesthetic concerns, environmental beliefs, and lifestyle decisions. The ProHOME, however, is a spec house built for the affordable market, so there's a laser focus on the marginal costs of improving the envelope relative to the cost savings of an additional kilowatt of solar energy.

Here's a look at how Paul and Tim Biebel designed the foundation and framing to find the sweet spot between material costs and labor costs for the net-zero 2017 ProHOME. □

Sean Groom is a contributing editor.

A SLAB APPEALS TO POTENTIAL BUYERS

To reduce the cost of the building envelope, the ProHOME is built on a slab. This requires less excavation, less formwork, and less concrete, reducing the cost and the duration of the build. The slab is also a plus for the ProHOME's target demographic, since older, downsizing homeowners looking for one-level living aren't interested in a flight of stairs down to subterranean space.

The ProHOME foundation relies on traditional footing and stem-wall construction to reach below the frost line. The inside of the stem walls are insulated with 2 in. of Amvic Envirosheet. In the past, the Biebels have experimented with ICF stem walls, but after factoring in the cost of protecting the foam on the exterior wall, have reverted back to formed stem walls.

ELEVATING THE STANDARD

Amvic SilveRboard insulation

SilveRboard subslab insulation under the ProHOME offers R-5 per in. and a compressive strength of 35 psi. Each face of the EPS foam is laminated with a polypropylene film, adding strength and durability to reduce breakage and cracking during the construction process. The EPS contains no CFCs or HCFCs and is available in four compressive strengths between 12.8 psi and 44.4 psi.

To insulate the slab, they used 4 in. (R-20) of Amvic SilveRboard. Before the slab was poured, Tim's crew rolled out a 15-mil vapor barrier over the insulation. All seams are overlapped and, along with slab penetrations, sealed with tape. At the slab edges, he draped the vapor barrier up the side and over the top of the stem wall and let it run long. After standing the walls, the vapor barrier was taped to the outside face of the wall sheathing.

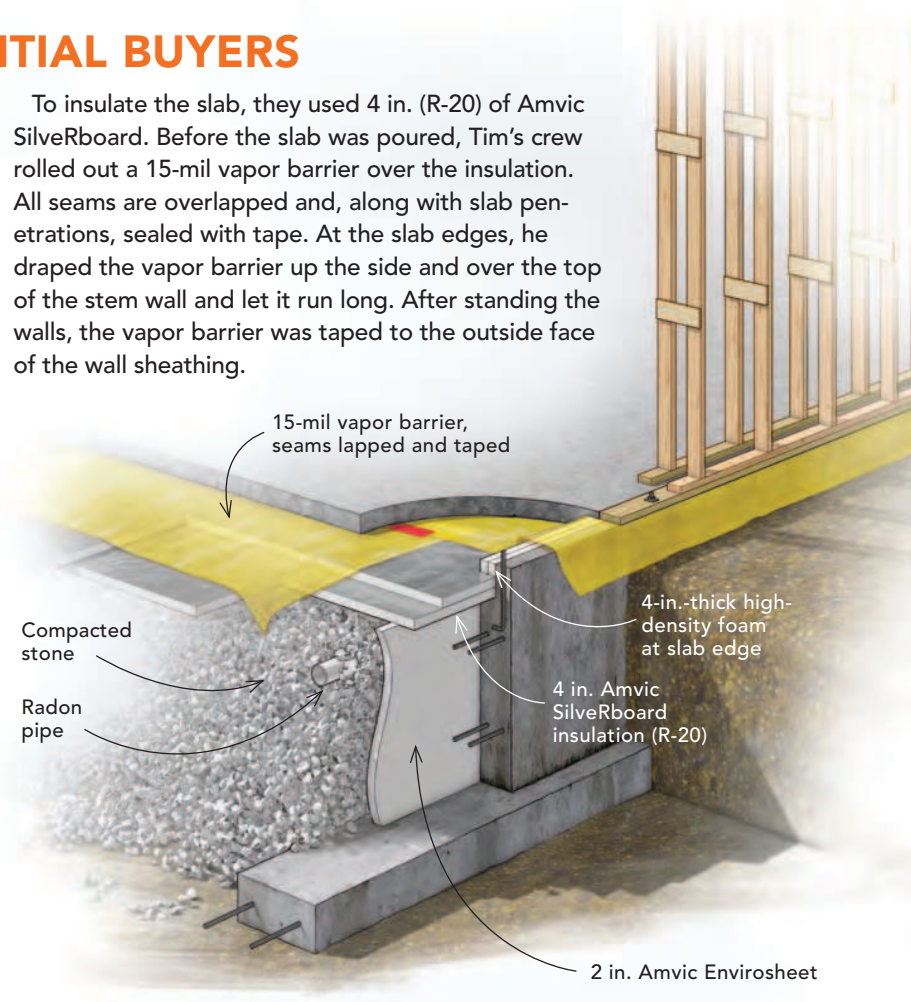
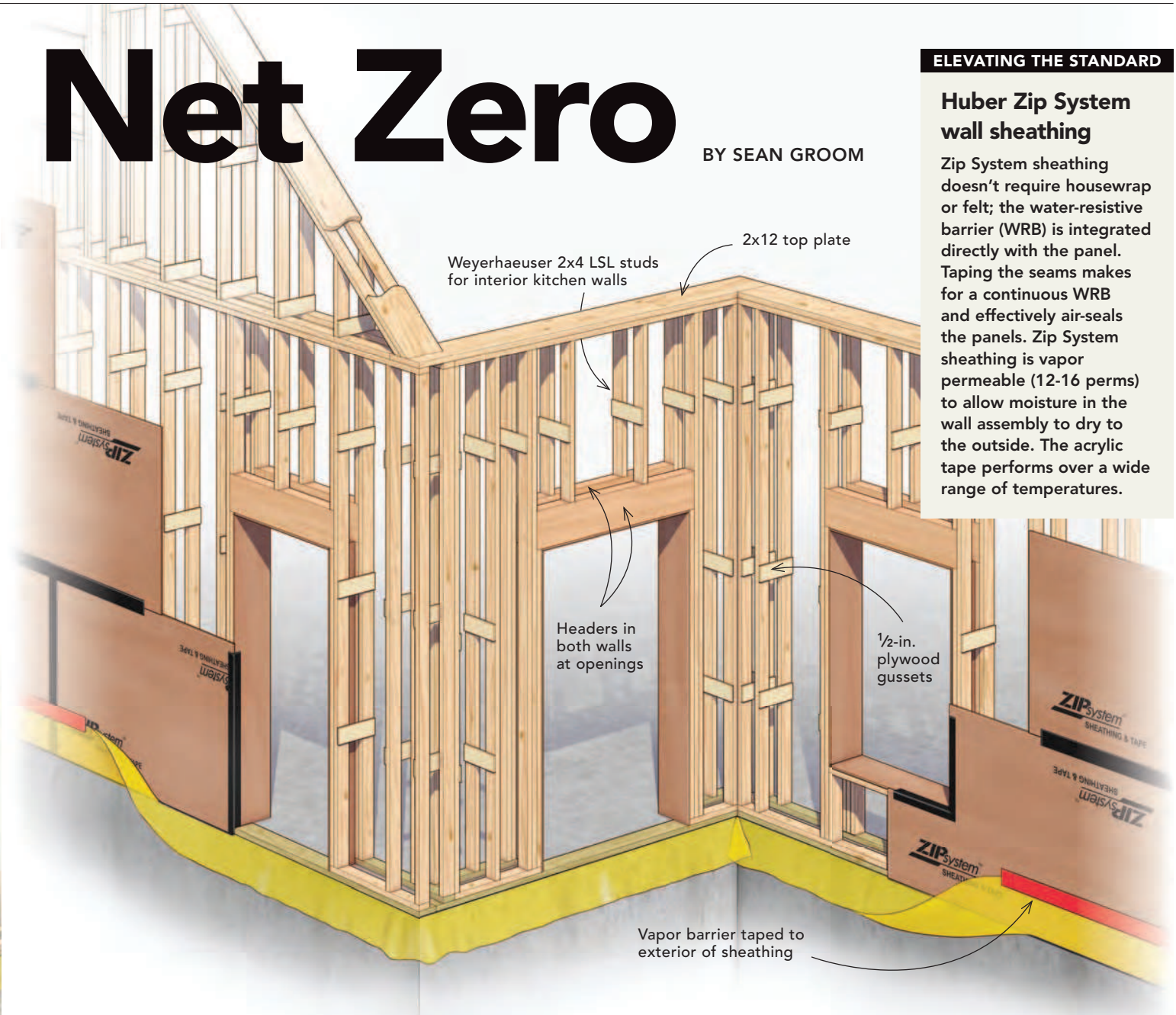


Photo: Brian McAward; drawings: John Hartman

Net Zero

BY SEAN GROOM



ELEVATING THE STANDARD

Huber Zip System wall sheathing

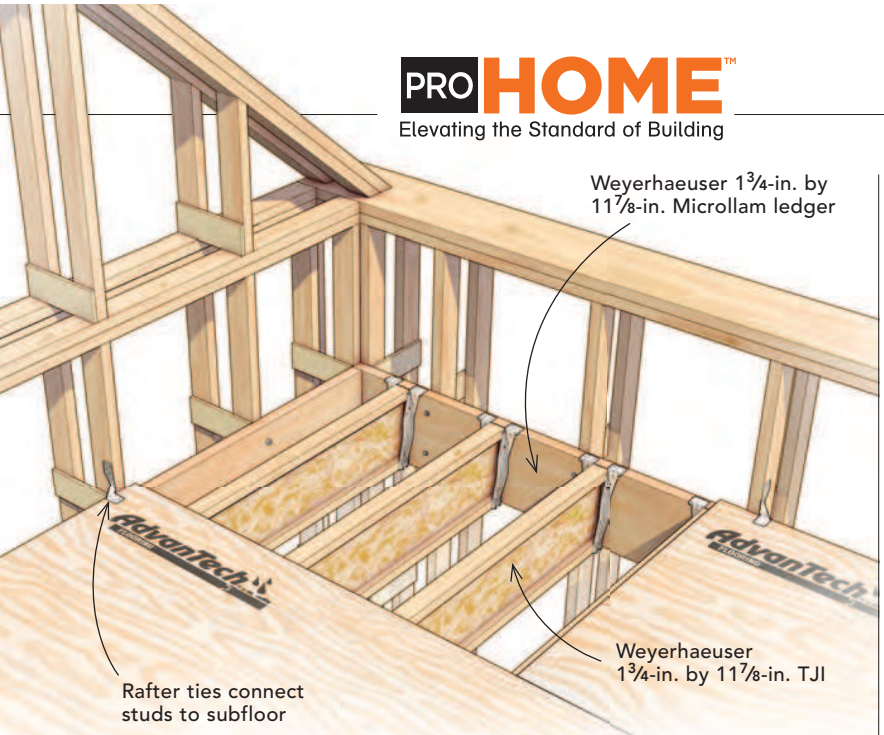
Zip System sheathing doesn't require housewrap or felt; the water-resistive barrier (WRB) is integrated directly with the panel. Taping the seams makes for a continuous WRB and effectively air-seals the panels. Zip System sheathing is vapor permeable (12-16 perms) to allow moisture in the wall assembly to dry to the outside. The acrylic tape performs over a wide range of temperatures.

THICK WALLS ARE FASTER, CHEAPER, AND BETTER INSULATED

The ProHOME's well-sealed and well-insulated envelope adds material and labor costs, but the smaller heating and cooling system has lower purchase and operating costs and requires fewer solar panels to achieve net-zero energy.

Although Vermont's energy code requires R-23 to R-25 walls (depending on the insulation method), Paul and Tim built R-45 walls. Two common ways to a build a well-insulated wall with minimal thermal bridging are to wrap the sheathing of a traditionally framed wall with exterior insulation or to pack thick double-stud walls with cellulose insulation. The decision to use the double-stud wall method for the ProHOME came down to a matter of cost. When they looked at the price of materials and labor, Paul and Tim found that an R-40 2x6 wall insulated with closed-cell spray foam in the cavities and 2 in. of rigid foam on the exterior would be 14% more expensive than their R-45 double-stud wall.

The ProHOME's double-stud walls are framed with 2x4s with a 4¼-in. gap between them, connected by 5-in.-wide, ½-in.-thick plywood gussets fastened 32 in. on center. These gussets—½-in. plywood bucks that line each window and door opening—and the 2x12 top plate are the only thermal bridges in the wall framing. Energy-conscious builders have long been constructing double-stud walls in this fashion, but a few years ago Paul added his own twist. He balloon-frames the walls, using continuous studs from the bottom plate of the first floor to the top plate of the second floor. This was a common technique



a hundred years ago, and Paul does it today to remove the floor joists from the wall cavity. Instead of setting the second-floor joists on the top plate of the first-floor walls, the joists are hung from a ledger fastened to the inside wall. This allows the full 11¼-in. depth of insulation to run continuously behind the floor joists. If Paul were platform-framing 2x6 walls, he'd have less insulation where the floor system attaches, as the top and bottom plates, rim joist, and floor joist all meet in the wall cavity.

ELEVATING THE STANDARD

Huber AdvanTech

AdvanTech subflooring is engineered to exceed the strength of plywood and OSB panels and to be highly water resistant. Coating each wood strand in a moisture-resistant resin and sealing the edges prevents edge swelling so effectively that Huber guarantees that an AdvanTech subfloor won't have to be sanded even with 500 days of weather exposure.

The exterior double-stud wall assembly is the load-bearing wall because the bottom plate of the inner wall lands on the slab. Accordingly, structural headers are used in the outer wall. However, to simplify and speed up framing, every opening in each wall is framed with a header. Tim finds that building every opening the same way saves enough time to offset the small additional lumber cost.

The house is sheathed with Zip System. The taped seams and surface treatment of the panels function as an air barrier. On this house, they are a secondary air barrier, as the continuous barrier from wall to second-floor ceiling will run on the interior. The Zip panels, however, are a water-resistive barrier that eliminate the need to install housewrap. Huber claims that the bumpy exterior face creates enough continuous space behind the siding to serve as a drainage plane. This water path meets the siding manufacturer's requirement for a drainable housewrap, so the Biebels don't need to apply a secondary wrap or attach strapping to create a space behind the siding.

A ROOF FOR INSULATION, SOLAR PANELS, AND BEDROOMS

While many of the potential home buyers for this small development want a floor plan that accommodates single-level living, that was just one of several concerns guiding Paul as he designed the homes for this neighborhood. He wanted the houses to have a visually interesting roof line, and they needed to include bedrooms on the second floor for customers who need more space. They also had to have a large south-facing roof plane to accommodate a PV array.

His solution is a one-and-a-half-story design with intersecting roofs and gable ends. This creates a more interesting roof line than a simple boxlike ranch, and the 10-in-12 pitch on the ProHOME allows for enough usable space on the second level to tuck two bedrooms and a bathroom under the roof. There is also a good deal of conditioned storage space that helps make up for the single-car garage and the lack of a basement. The 40° roof slope is also within the Vermont location's ideal range for maximizing solar production over the course of the year.

Although the gables and valleys were added to create visual interest, the single south-facing roof plane is large enough to accommodate up to 10kw of PV. Based on the Biebel's experience with the first house they built in the development, Tim believes an array of this size should be enough to allow a family of four to reach net zero.

Paul and Tim have used both trusses and stick-framed roofs on their houses, letting cost dictate the choice. The roof shape of the ProHOME added enough complexity to the truss design that stick-framing was the cheaper option. The structural ridge beams are 3½-in. by 18-in. Weyerhaeuser Eastern Parallam PSL beams and smaller 1¾-in. by 14-in. Microllams for the valley rafters. The common rafters are 2x12s. However, they don't provide the depth needed for 16 in. of dense-packed cellulose insulation to achieve R-60 in the lower portion of the ceiling. The solution is to drop the ceiling below the top plate by furring the rafters down with 2x4s. The upper end of each 2x4 is nailed to the collar tie and the lower end toe-nailed to the stud below the top plate with gussets in the middle of the run.

ELEVATING THE STANDARD

Huber Zip System roof sheathing

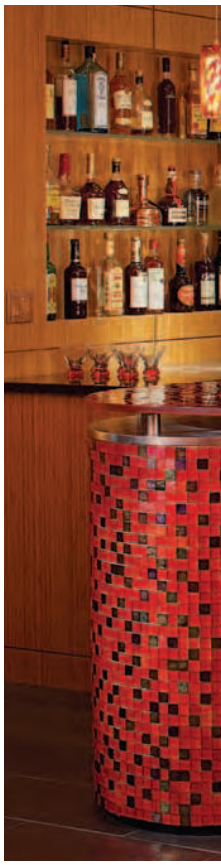
Zip System roof sheathing is available in 7/16-in., ½-in., and 5/8-in. thicknesses. The 5/8-in. tongue-and-groove version has the greatest span capacity, up to 40 in. for rafters and trusses. The Zip System tape used on the wall and roof sheathing is applied to the panel edges and adhered with the help of a J-roller to ensure a tenacious bond and help dry in the roof.

ProHOME SPONSORS

The 2017 ProHOME is supported by a host of industry sponsors. As a brand, we're not comfortable telling you to put products in your homes that we wouldn't put in ours. We've worked with our build team to identify appropriate products to include in this project. Our sponsorship model is built on an invitation-only, first-come, first-served basis. A variety of methods and products are available to construct a home of this caliber, but we chose based upon what works best to meet the goals for this home. For a complete list of project partners and more information on the products and materials used in the 2017 ProHOME, visit FineHomebuilding.com /prohome.

Subterranean sizzle

We all know that finishing a basement is a great way to add space to a home without an addition, but this project proves just how true that is. This incredible lower-level entertainment and exercise complex was designed for a busy professional couple. The well-appointed space has everything one might want for restorative activities, entertaining friends, or just some downtime. There's no need to get in the car to drive to the gym, a movie theater, or even a restaurant—all that's required is a quick trip down a flight of stairs. In the state-of-the-art kitchen, family and friends can join the homeowners as they test new foods and different ways to prepare them. A fully furnished bar with wine room and beer tap adds to the social aspect of the kitchen. After enjoying dinner and drinks, there's no need to call it a night. Just a few steps from the bar is a home theater, perfect for taking in a sporting event or movie. To make sure that living it up on the lower level doesn't weigh down the homeowners, the 1,875 sq. ft. of finished basement space also includes a well-appointed workout room and spa bath complete with sauna. —*Maureen Friedman*



Architect Douglas Dick, AIA, LDa Architecture & Interiors, LLP, Cambridge, Mass., lda-architects.com **Interior design** David Nault and Paul White, Weena and Spook, Boston, weenaandspook.com **Builder** Doug Stevenson and Ken Frommer, Kistler & Knapp Builders, Acton, Mass., kistlerandknapp.com **Photos** Greg Premru, gregpremru.com

Ready, set, cook. *The kitchen was inspired by the color, precision, and technology of a sports car with it's stainless steel, glass, and Ferrari-red color. Overhead TV screens enable streaming of cooking techniques and demonstrations.*

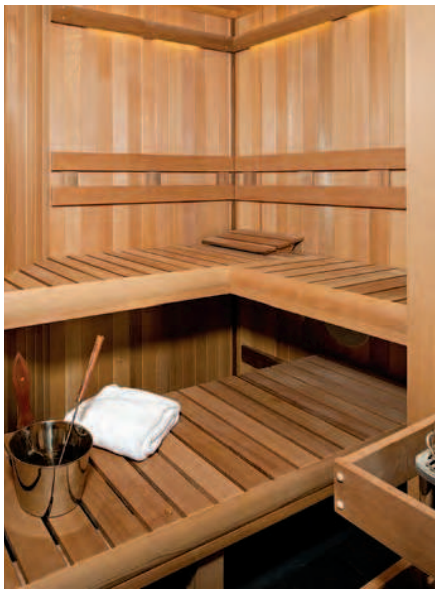
Pass the popcorn. *The 17-ft. by 23-ft. home theater comfortably seats 10 in red-leather reclining chairs. The interior has fabric-wrapped sound-absorbing panels accented by LED-lit pilasters. The walls and ceiling are sound-proofed with mineral-wool insulation and additional layers of gypsum.*

More than meets the eye. *The bar and the 1,014-bottle wine-storage room are split by butt-glazed panes of glass. One end of the bar is actually within the temperature- and humidity-controlled wine room, providing the perfect spot for tastings. The custom bar is wrapped in Tessera Disco Inferno tile by Oceanside Glasstile and is topped with an opaque UltraGlas Squiggle counter.*

Clearly time to exercise. *The workout room, with its Roppe rubber floor, is visually open, but when the doors are closed, the sound, temperature, and humidity levels are separated from the other areas. The adjacent shower room is capped with a skylight to bring in daylight, though the entire space is below grade.*

Bathing in water and light. *An invigorating after-workout shower includes water flowing from the rainfall showerhead and three wall-mounted body jets, plus light streaming in through the skylight. The Bali White pebble floor and Cascade Coil Serenity aluminum shower curtain enhance the shower's modern aesthetic.*

Elegant and serene. *An accent wall of Extrados tile from Oceanside Glasstile beautifully complements the Fioro ceramic wall tile. A wall-mounted sink, stainless-steel fixtures, and an unframed mirror complete the simple lines of this spa-inspired bath.*



A room to relax. *After a workout or a long day at work, a respite in the sauna is just what the doctor ordered. The benches and walls are made of western red cedar. Heat for the sauna is generated by a soft heat maxi heater, complete with rocks for traditional steam output.*

FAST SET
POLYURETHANE ADHESIVE

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YOUR ADHESIVE SHOULDN'T

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senior editor

Charles Peterson
flooring expert

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Roof venting doesn't affect cooling loads

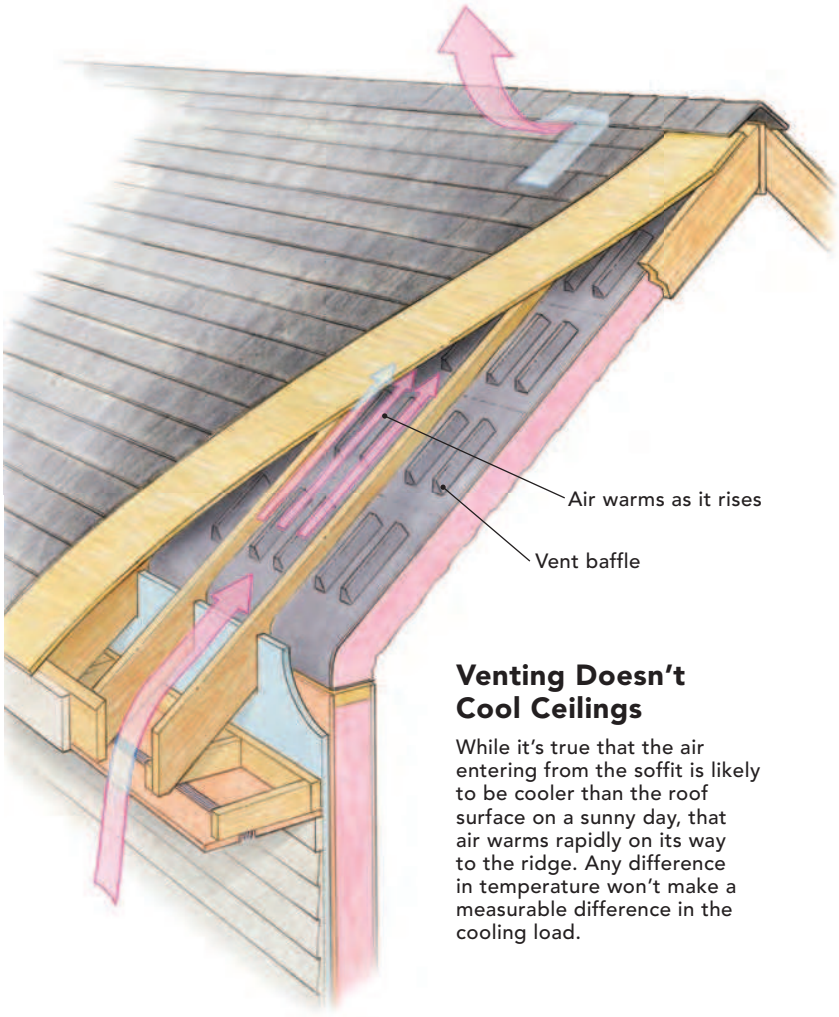
In Martin Holladay's article, "How to Build an Insulated Cathedral Ceiling," he says, "During the summer, roof ventilation does not significantly lower the temperature of asphalt shingles or other types of roofing." This statement seems to indicate that there isn't a shingle-temperature benefit to venting, but what about reducing cooling loads in the summer? A roof can easily reach 140°F during a sunny day. Suppose the cathedral ceilings are insulated with spray foam with no venting. That means the temperature gradient from one side of the insulation to the other is 70°F (140°F – 70°F). Heat will move through that insulation as a function of its R-value and the temperature difference. Now suppose we add soffit vents in order to displace the 140°F air on the back of the sheathing with the 90°F air from outside. Now we have just a 20°F temperature gradient (90°F – 70°F) across our insulated ceiling, which should reduce the cooling load. Of course, the actual air temperature in the vent channels will be higher than the outdoor air temperature, but you see my point. It should mean huge savings during cooling months, but I don't see anyone discussing this benefit.

—CHRISTOPHER HANSEN
via email

Martin Holladay: Several researchers, including William Rose and Jeff Gordon, have tried in vain to measure cooling energy savings that might be attributed to the existence of a ventilation channel. No researcher has ever succeeded in measuring such savings, because they don't occur.

In a vented cathedral ceiling, the air entering the soffits is, as you guessed, at the outdoor air temperature. But by the time the air is one-third of the way up the roof, the temperature of the air in the ventilation channel is much higher than the outdoor air. The conclusion: Ventilation doesn't result in significant cooling of the roofing or of the roof sheathing.

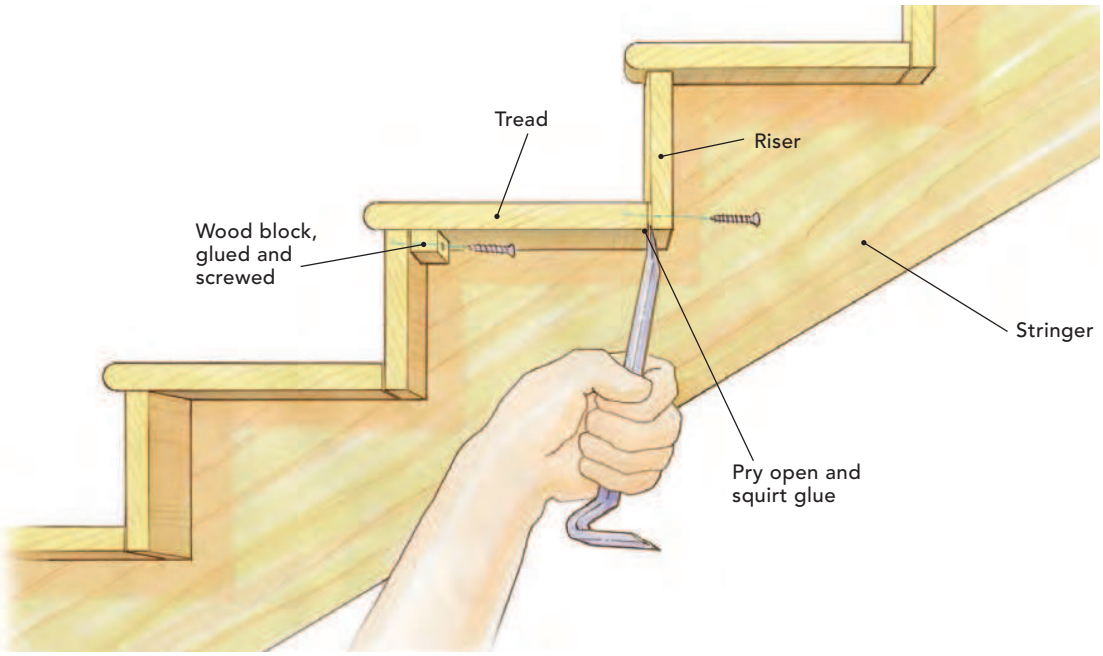
A ventilation channel won't significantly change the temperature gradient across an insulated ceiling, either. Even if it did, you won't have any significant energy savings if the roof assembly has code-minimum levels of insulation. (In most U.S. regions, building codes require a minimum of either R-38 or R-49.) Once you install that much insulation, the heat flow through the assembly is already quite small.



Venting Doesn't Cool Ceilings

While it's true that the air entering from the soffit is likely to be cooler than the roof surface on a sunny day, that air warms rapidly on its way to the ridge. Any difference in temperature won't make a measurable difference in the cooling load.

Photos: top and middle, *FHB* staff; bottom, courtesy of Randy O'Rourke. Drawing: Dan Thornton.



Fixing squeaky stairs

My house is just 15 months old, but the hardwood stair treads have begun to squeak when stepped on. The squeaks seem to be coming from where the risers join the back of the treads. Can you give any advice on how to silence this problem?

—STEPHEN F. SCARPINO
via email

Andy Engel: My guess is that the connection between the back of the treads and the front of the risers is failing and allowing them to move independently, so they rub together and squeak. To fix the problem, you'll need access to the back of the stair, which probably means removing drywall. Once the back of the stair is accessible, open the tread/riser joint with a putty knife or a small prybar and squirt in some carpenter's glue with a syringe (glue syringes are widely available online, but you can also use a basting syringe from a housewares store). Even better is to have a partner squirt in the glue from above as you hold the joint open from under the stair, making sure to be diligent when cleaning it off the finished surfaces. Next, drive screws—spaced every 8 in. or so—through the back of the riser into the tread. (Wear a hat when doing this to keep the glue out of your hair.) Use quality self-drilling screws, not drywall screws, which are too prone to breaking. If you find that you can't open the joint and get some glue in, just screw it.

If it turns out that the problem is between the front of the tread and the top of the riser, glue and screw 1x wood blocks to the back of the tread/riser joint.

Another possibility, particularly if the stairs are site-built with traditional notched stringers, is that the stringers have dried and shrunk away from the treads. Again, you need to open up the back of the stairs. If there's a gap between the tread and the stringer, squirt in glue until it drips, and then slide in shims until they fit tightly. Finish by checking the riser/tread joint as mentioned above, and add at least a few screws for good measure.

Finishing rough-sawn flooring

My older house was built with the hardwood flooring laid directly on the joists. I'm going to use this current floor as a subfloor for new, rough-sawn, tongue-and-groove white-pine flooring. How should I finish this new floor? Should I give it a light sanding and then oil it? I want to keep the rough-sawn look, but I'm worried about splinters.

—SEBASTIEN CARON
via email

Charles Peterson: Before we get to finishing, let's talk about prep work. If you're installing the new flooring parallel to the existing nail-down floor, you need to add a minimum of ⅜-in. plywood underlayment first—otherwise, large gaps can occur from the combined seasonal dimensional changes of the two wood floors. If you're installing the new flooring at a 45° to 90° angle to the existing, additional underlayment may not be required.

The romance of rough-sawn wood flooring generally wears off if the floors are not lightly sanded

Abrasive buff. *To get a rough-sawn floor smooth enough for bare feet while retaining its rustic character, use a floor buffer with a maroon pad and 220-grit abrasive strips.*

Drawing: Dan Thornton; photo: Randy O'Rourke

before finishing. Typically, I first work any areas that might catch a foot with a hand-held orbital or belt sander. Then I use a flooring buffer with a fine-grit maroon abrasive pad and 220-grit sandpaper strips to sand the entire floor until it's smooth enough that bare feet won't pick up splinters.

Waterlox (a tung-oil finish) is a common option for eastern-white-pine floors. Try some on a sample board. If you want more color, try adding a tint to the Waterlox (for example, a 25% to 50% mixture with DuraSeal Golden Brown stain) on the first and second coats. A pine floor will require at least four coats, and you'll know you've put enough on when the sheen is even across the entire floor and no areas look bare. I have had 200-year-old floors take seven coats of finish. To apply it, I like using a roller. You can brush it on, but that's time consuming. A traditional lamb's wool applicator can also work, but it might leave fibers on rough areas as you draw the applicator across the floor.

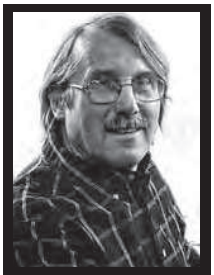
Pressure-treated lumber worries

Because of a termite issue, I need to replace some interior framing with pressure-treated lumber. Is there anything that you can recommend to seal the PT wood in order to keep it from outgassing, to keep any toxins from coming into the home through the drywall?

—RUSSELL GURSTEIN
via email

AE: While no building product is entirely without risk, this isn't something I'd give a second thought. Colin McCown, from the American Wood Protection Association, told me, "With most of the current waterborne preservatives, there aren't really any volatile organic compounds (VOCs) to speak of in the formulations, so nothing really 'off-gasses' or 'outgasses.' It's either all or nearly all water vapor."

If you're still concerned, you could paint or varnish the PT lumber, but you will definitely experience outgassing from whatever finish you use. An alternative you might consider is borate-treated wood. While relatively non-toxic to humans, borates are effective at preventing wood rot. However, they remain water soluble, and so are limited to interior use.



"Musings of an Energy Nerd" showcases the best of Martin Holladay's weekly blog at GreenBuilding Advisor.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.

Green Building Advisor

Green Building Advisor is for designers, engineers, builders, and homeowners who craft energy-efficient and environmentally responsible homes.

Closed-cell foam between studs is a waste

Open-cell spray foam has an R-value of about R-3.7 per inch, while closed-cell spray foam has an R-value that may be as high as R-6.5 per inch. If you want to install spray foam in a stud wall, and price is no object, then it would seem to make sense to specify closed-cell spray foam, right? Well, not necessarily.

What really matters is the R-value of the whole wall, not just that of the insulation. There isn't much difference in whole-wall R-value between a wall insulated with open-cell spray foam and one insulated with closed-cell spray foam.

To understand why, we need to start by understanding the "trimmability" of cured foam. Closed-cell foam is so dense that it is difficult to trim. To avoid having to trim closed-cell foam in a 2x4 wall, for example, the installer will usually stop at a maximum depth of about 3 in., instead of 3½ in., leaving the typically bumpy surface of cured foam and about a ½-in. gap to the back of the drywall.

Open-cell spray foam isn't as dense, so it's easy to trim. Installers of open-cell spray foam will fill a 3½-in.-deep cavity completely, allowing the foam to expand until it is proud of the studs. Once cured, the soft foam is easily trimmed flush with the studs.

Whole-wall R-values

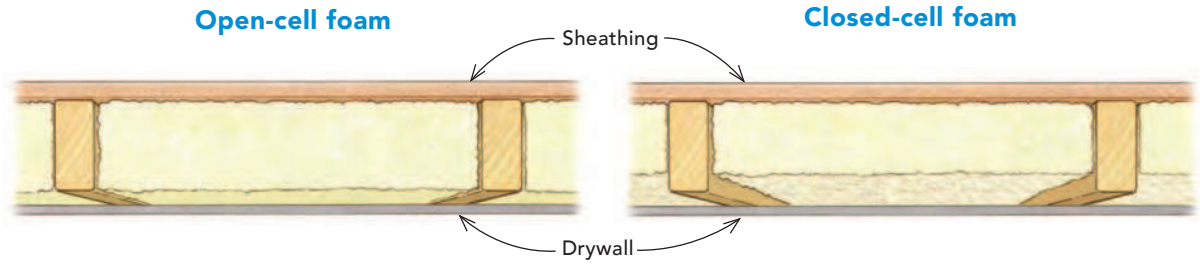
To calculate the whole-wall R-value of a wall, we have to divide it into areas, each with distinct R-values. For example, a 2x4 wall without any windows can be divided into two areas: insulated stud bays and wood framing.

A typical wood-framed wall has a "framing factor" of 25%. That means that about 25% of the wall area consists of studs, plates, and headers. The remaining 75% of the wall consists of either stud bays filled with insulation or openings for windows or doors.

To calculate whole-wall R-value, you first need to calculate the whole-wall U-factor. (U-factor is the reciprocal of R-value: U=1/R.) Let's call the U-factor of the insula-

Sprayed and trimmed. *Open-cell foam is sprayed to overfill the cavity. After curing, the foam is trimmed flush with the faces of the studs.*

MIND THE GAP



Although the R-value is less per inch than insulation, studs do have an R-value that contributes to the overall R-value of the wall. While open-cell foam gets trimmed flush with the stud faces, closed-cell foam is held back about ½ in. This ½ in. of stud with exposed sides doesn't contribute to the stud's R-value, resulting in a reduction to the wall's overall R-value.

Photos: left, courtesy of Karyn Patno; right, courtesy of Icynene.
Drawings: Dan Thornton.

tion "UI," and the U-factor of the framing "UF." Here's how we calculate whole-wall U-factor for a wall without any windows or doors:

Whole-wall U-factor =
(UI x % area devoted to insulation) +
(UF x % area devoted to framing)

When stud bays are partially filled with closed-cell spray foam, the exposed portion of the studs reduces their R-value in comparison to a wall that is totally filled with open-cell spray foam. For example, if a 2x4 wall has 3 in. of closed-cell foam insulation, the R-value of the studs is based on a stud depth of 3 in., not 3½ in. (because the exposed portions of the studs are basically "indoors" and not part of the insulated wall assembly). As a result, the heat loss due to thermal bridging through the framing is greater in a wall with closed-cell foam than it would be in a wall with open-cell foam.

Consequently, if you install a closed-cell foam insulation with a high R-value per inch between your studs, you don't really get the full value of your investment. Closed-cell spray foam is expensive, and the incremental cost is mostly money down the drain. There are more cost-effective energy upgrades, such as exterior rigid foam or mineral-wool insulation, as I point out below. It's also worth considering an even more important issue: Most brands of closed-cell spray foam are more injurious to the atmosphere than open-cell spray foams, since most closed-cell spray foam is manu-

THE PROOF IS IN THE MATH

In a typical wall where 25% of the space is framing, the R-value of the studs and plates has a significant effect on whole-wall R-value. This table compares a 2x4 wall insulated with 3½ in. of open-cell foam to a 2x4 wall insulated with 3 in. of closed-cell foam, as well as 2x6 walls insulated with 5½ in. of open-cell foam and 5 in. of closed-cell foam. The ½ in. of stud left exposed with closed-cell foam is essentially inside the house, and so doesn't contribute any R-value, bringing the whole-wall R-values much closer. In a 2x4 wall, the gain is only R-0.8, while closed-cell foam in a 2x6 wall yields an increase of R-1.9. Perhaps you're wondering, "Is it really worth a $3,000 upcharge for such a small improvement?" The increase in R-value is so small that most builders would be better off looking for a more cost-effective insulation upgrade.

Properties	2x4 wall		2x6 wall	
	Open-cell spray foam	Closed-cell spray foam	Open-cell spray foam	Closed-cell spray foam
R-value per in. of spray foam	R-3.7	R-6.5	R-3.7	R-6.5
Thickness of spray foam	3½ in.	3 in.	5½ in.	5.0 in.
Thickness of airspace	0 in.	½ in.	0 in.	½ in.
R-value of spray-foam areas	R-13	R-19.5	R-20.3	R-32.5
R-value of airspace, if any	R-0	R-0.9	R-0	R-0.9
R-value of spray foam plus airspace	R-13	R-20.4	R-20.3	R-33.4
U-factor of spray-foam areas	U-0.077	U-0.049	U-0.049	U-0.030
R-value per in. of framing	R-1.2	R-1.2	R-1.2	R-1.2
Effective framing thickness	3½ in.	3 in.	5½ in.	5 in.
R-value of framing	R-4.2	R-3.6	R-6.6	R-6
U-factor of framing	U-0.24	U-0.28	U-0.15	U-0.17
Whole-wall U-factor (see formula above)	(0.75*0.077)+(0.25*0.24) = U-0.118	(0.75*0.049)+(0.25*0.28) = U-0.107	(0.75*0.049)+(0.25*0.15) = U-0.074	(0.75*0.030)+(0.25*0.17) = U-0.065
Whole-wall R-value	R-8.5	R-9.3	R-13.5	R-15.4
R-value gained by switching from open-cell to closed-cell		R-0.8		R-1.9

factured with a blowing agent that has a high global-warming potential.

The examples aren't perfect

I'm aware that the whole-wall R-value calculations in the table are simplified versions of actual whole-wall R-value calculations. I haven't included the R-value of the exterior OSB sheathing, the interior drywall, or the associated air films. Moreover, the table doesn't reflect the entire range of framing factors of different buildings.

That said, the table is useful. It demonstrates the calculation method and does a good job of estimating the incremental R-value attributable to an upgrade from open-cell to closed-cell foam. While it's true that actual whole-wall R-values will usually be higher than the values shown in the table (due to the R-values of the sheathing, drywall, and air-barrier membranes), both types of wall (open-cell and closed-cell) benefit equally from these additional R-values.

While I've focused on walls, the same analysis applies to cathedral ceiling assemblies. If rafter bays are completely filled with fluffy insulation (except for a ventilation channel directly below the sheathing), thermal bridging through the rafters will be less significant than when 4 in. of each rafter protrudes inward beyond the depth of a skimpy application of spray foam.

So what's the solution?

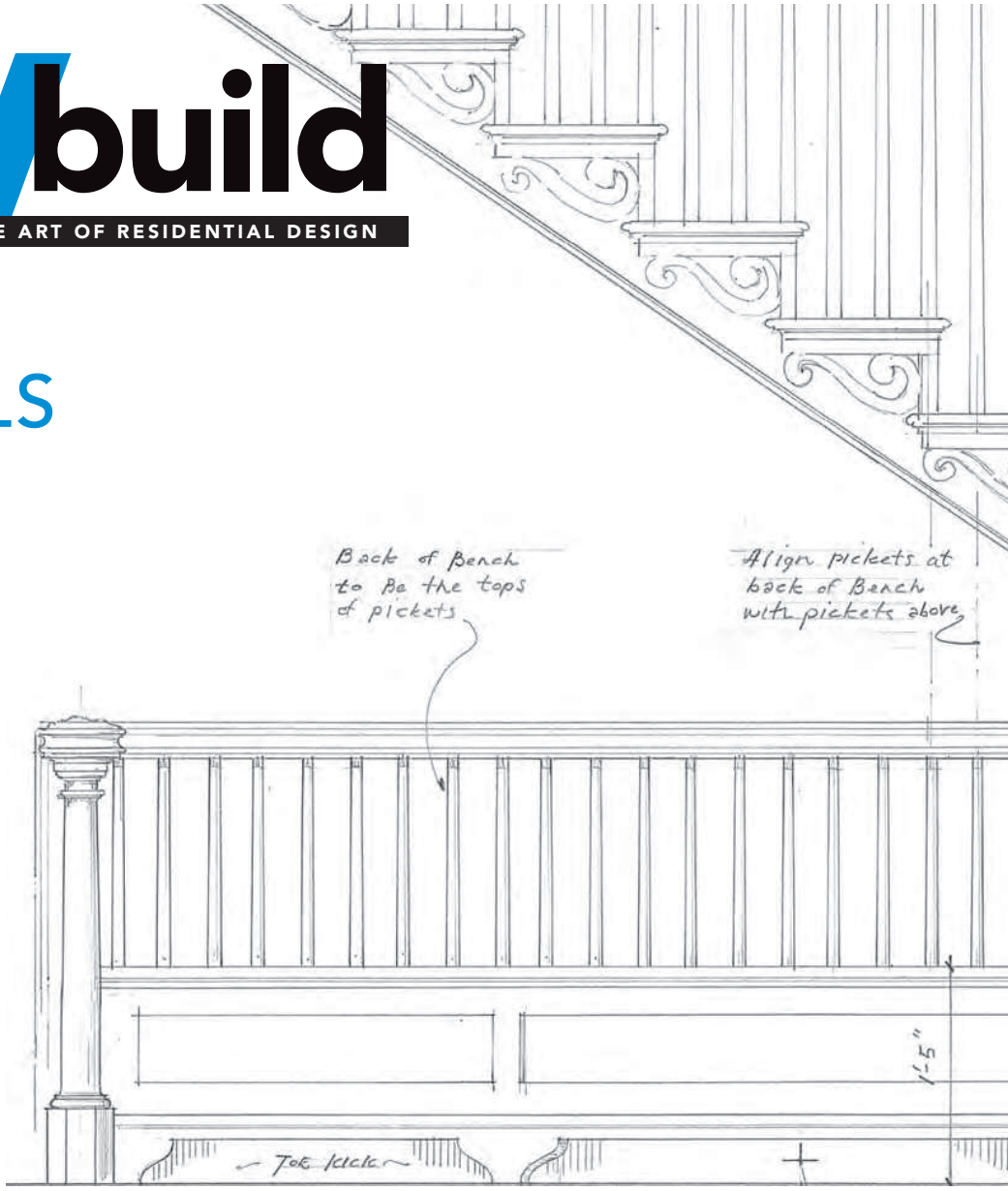
At this point, we need to consider the use of exterior rigid foam. The calculations for adding thicker continuous insulation on the exterior side of the wall sheathing are much more favorable to incremental investments than the calculations for insulation installed between studs.

If you install a high R-value continuous rigid insulation on the exterior side of the sheathing—for example, rigid foam or mineral wool—all of the insulation's R-value contributes to the whole-wall R-value (except, of course, for areas taken up by windows and doors).

Additionally, unlike between-studs insulation, exterior high R-value insulation helps to minimize the thermal bridging effect of the studs. Used properly, it also reduces the need for a vapor retarder by keeping the sheathing warmer than the dew point. Even though exterior rigid insulation requires extra detailing around windows and doors, it still offers excellent value for your money.

STAIR NEWELS

BY MARIANNE CUSATO



Stair newels are both a practical requirement to stabilize a railing as well as an opportunity to add a design element to your home. While historic styles dictate strict details, in today's homes—even those based on traditional precedent—we have a wide range of design leverage to personalize and even modernize details like a newel post. Though stair-part manufacturers offer a range of well-designed stock newel options, consider designing and building custom newels if budgets allow. This way, you can go beyond the basics and create a theme and hierarchy with variations on the newels used throughout your house. Here are a few variables to consider when designing or selecting your stair newels.

Marianne Cusato is the author of *Get Your House Right: Architectural Elements to Use and Avoid.* Drawings by the author.

NEWEL BASICS

Supporting or Terminating

A newel may support the handrail, sometimes with balusters wrapping the post (typically in a colonial or more-formal classical design). In other cases, especially on secondary stairs, the railing will terminate into a block at the top of the newel. Terminating newels are common when the railing is built from stock components. When designing or purchasing a terminating newel, it's nice to ease the end of the railing into the newel so it meets perpendicular to the newel, rather than at the angle of the stairs. This allows the terminating block to be slightly smaller, which makes the newel feel less top heavy.

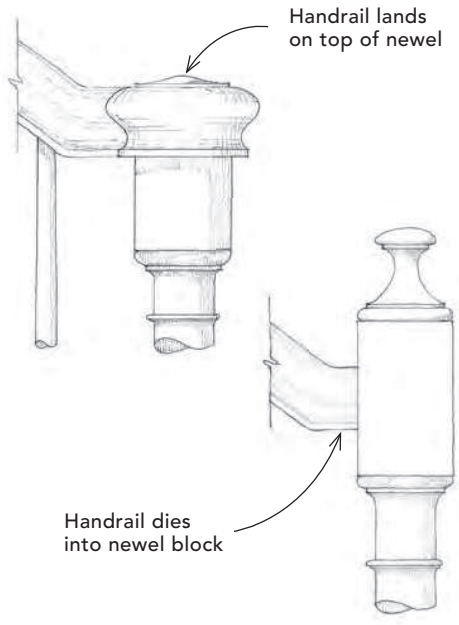
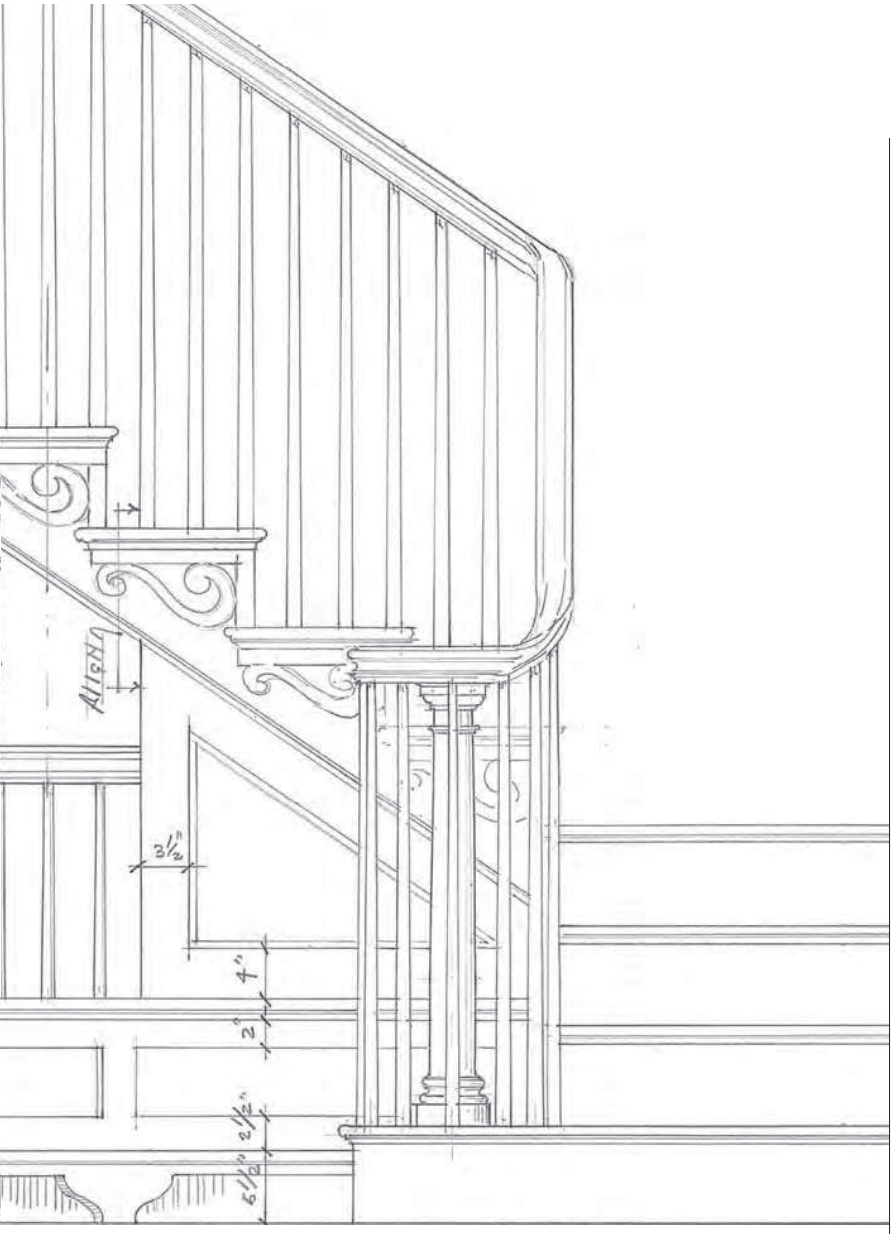


Photo: courtesy of the author



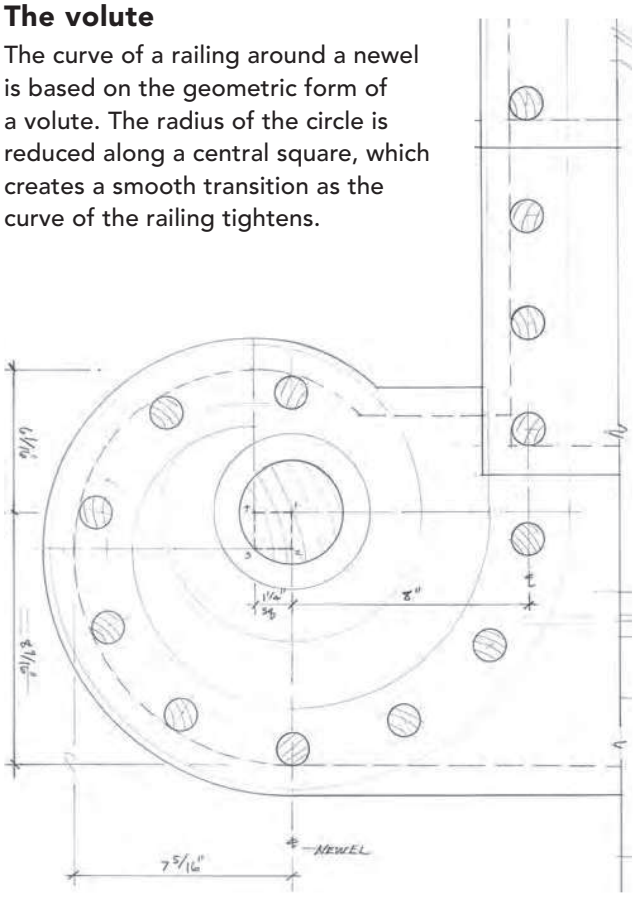
CREATE A HIERARCHY

The design featured here illustrates the hierarchy between the newel at the foot of a main stair on the first floor of the house and a newel within the same run that leads to the basement. The two newels are designed to be variations on a theme. The main newel is a full Doric column with an attic base (three primary parts separated with fillets). This newel sits on the first tread of the stair and supports the railing. The secondary newel is also a Doric column that supports the railing, but it is more subtle, with a simplified base—a single torus (a convex, round shape) sitting on a hexagonal plinth. The height of the plinth aligns with the top of the first riser, at the cove molding. Since it is at the head of the basement stair, this newel is not wrapped with balusters. In this design, the newels are tied together by a bench, which incorporates the stair balusters as the back of the bench. As you design your own custom newels, ask yourself the following questions:

- How am I creating a hierarchy that differentiates the newels within a stair run and also throughout the house?
- How am I unifying the designs of the newels, so even within the hierarchy, they work as part of a single composition?

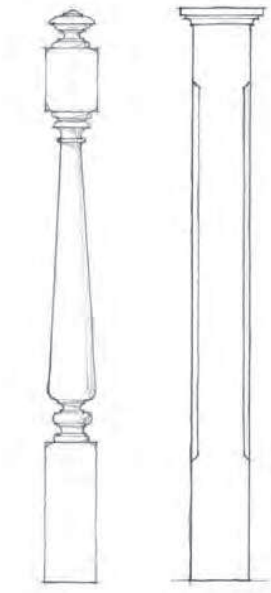
The volute

The curve of a railing around a newel is based on the geometric form of a volute. The radius of the circle is reduced along a central square, which creates a smooth transition as the curve of the railing tightens.



Box or Turned

Most newels are either box or turned. A turned newel is a single member with a profile cut on a lathe, often from 4x stock. A box newel may be a simple square post, perhaps with the corners eased, as shown here, or built up with recessed panels and moldings. For turned newels, look for a beginning, middle, and end with clearly defined molding profiles, rather than curved profiles that bleed into each other or a base that overpowers the rest of the newel. When purchasing stock box newels, less is often more. Take care to avoid box newels with heavy top moldings, as these have a tendency to look like exterior posts.



BY ANDY ENGEL

Weaving sidewall shingle corners

There are two ways to handle outside corners with shingle siding: butt the shingles into corner boards, or weave the shingles so their edges overlap in an alternating pattern. The corner-board approach is simple enough to be nearly self-explanatory, but woven corners are more complicated (and give a more elegant look, in my opinion). With woven corners, the shingles on one side run past the sheathing, while those on the other side butt to the first. The side that runs past and the side that butts alternates with each course. Because shingles are wedge shaped, the edge of each shingle in a woven corner needs to be scribed and trimmed at an angle.

Corners are installed before field shingles and serve to establish the elevations of all the courses. One trick to making shingle siding really sing is to plan the exposure to avoid having a narrow course

Continued on page 96

STEP BY STEP

1 ***Do the math once.*** *Cut a story pole to the height of the wall plus 1 in. Calculate the exposure of the shingles, and mark the courses on the pole. This will be your reference for the whole house.*

2 ***Mark the bottom.*** *Snap chalk lines on the foundation 1 in. below the sill to provide a straight reference for the bottom course. Use blue or white chalk, which wash off, and not red or black, which are permanent.*

3 ***Start with the cheap stuff.*** *Lower in quality and price, the undercourse ensures two layers of shingles at the wall bottom. Nail the first shingle with its edge flush to the corner and bottom even with the chalk line. Use 4d or 6d hot-dipped galvanized or stainless-steel siding nails.*

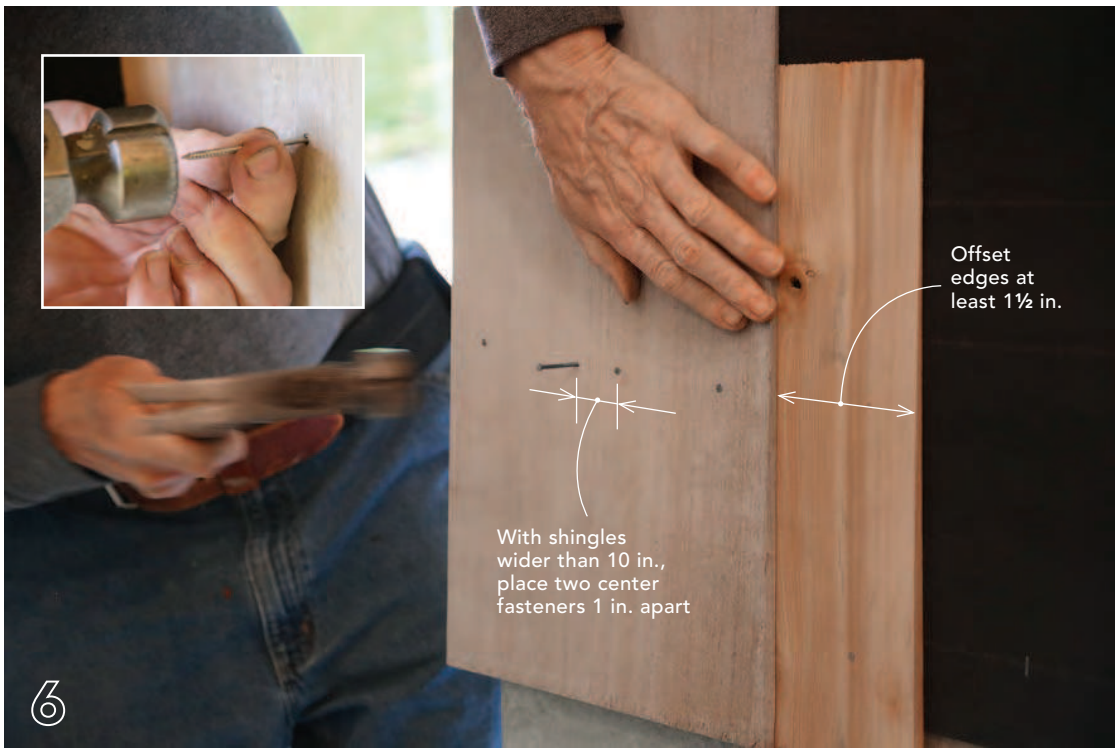
4 ***Fit the second shingle to the first.*** *Hold the second shingle in place, and scribe the angle of the first on it. Use a block plane to trim the shingle to the line, then nail the shingle to the wall.*

Photos: Rodney Diaz

STEP BY STEP

5 ***Tie the corner together.*** *Nail the edges of the shingles to keep the joint tight. To prevent splitting and keep the nail from drifting through the shingle face, drill a pilot hole about 1 in. up from the bottom. Nail into the pilot hole, using your hand to back up the shingle to keep it from being pushed out of place by the hammering.*

6 ***To split or not to split.*** *On shingles wider than 10 in., nail near each edge, and place two nails 1 in. apart in the center (2 in. above the bottom of the next course). That encourages any split to happen between those nails, leaving two reasonably sized shingles. If the shingles are splitting when you hand-nail them, try holding the nail heads against the shingle and tapping the point a couple of times. The dent in the wood and the dulled nail make splits less likely.*



7 ***Wider trims.*** *From here up, the double coverage of the shingles doubles the scribe angle. Cut almost to the scribe line with a knife, paying close attention to the grain direction so you don't split the shingle beyond the line, and then plane the edge clean.*

Continued from page 92

where the siding meets the soffit. That's a simple enough matter: Measure the wall height, add 1 in. for the shingles to hang over the foundation, then divide that number by the designer or manufacturer's maximum shingle exposure to determine the number of courses. If you're lucky, the dividend will be a whole number. But in most cases, you have to take two more steps: Round the dividend up to the next whole number, which will equal the number of courses, and then divide the wall height (including the 1 in.) by the number of courses to find the exposure. This exposure is marked on a story pole, which is used to transfer the course lines to the building. Don't exceed the manufacturer's maximum exposure—it's critical to make sure there are always two layers. This way, if the face shingle cracks, the second layer protects the wall.

You can further adjust the shingle exposure so the bottoms of the courses fall even with the tops and bottoms of the windows and doors, but those exposures have to be kept consistent all around the house so the woven corners align. I like to work four or five courses at a time, installing the corner shingles pyramid-style with wider ones at the bottom and narrower ones at the top. I'll install the field shingles of those courses, then nail on another four or five courses at the corner until topping out.

No matter the exposure, the flashing behind corners is crucial. The industry association for wood shingles, the Cedar Shake and Shingle Bureau (cedarbureau.org), calls for #30 asphalt-impregnated felt lapped at least 2 in. shingle-style as a WRB. At the corners, they recommend an additional layer of either self-adhering membrane or sheet metal extending at least 6 in. onto each wall. I like the self-healing characteristics of membranes around nails, but brake-bent sheet metal provides a very crisp corner to work with.

Senior editor Andy Engel is the author of Carpentry Complete *from The Taunton Press.*

STEP BY STEP

8 ***Tell the story.*** *Hold the story pole against the soffit, and mark the second course elevation in two places on each side of the corner.*

9 ***Reverse the lap.*** *Align shingles in succeeding courses to the story-pole marks, with the first shingle's edge aligned with that of the shingle below. Then overlap the exposed edge with the next shingle, scribe it to fit, and fasten.*

To see a step-by-step video on how to weave sidewall shingle corners, visit FineHomebuilding.com/magazine.

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keepcraftalive

CELEBRATING PASSION FOR BUILDING

Jeff Longo started Marbledale Plumbing and Heating in New Milford, Connecticut, over 20 years ago with his partner, Stark Weiner. "Whether it's a slow drain, a clogged toilet, or a leaky pipe," he says, "by the time the majority of customers call a plumber, they are very anxious to have the problem resolved."

His challenge—and a major source of satisfaction—is diagnosing the trouble over the phone so that he'll arrive with everything he needs. "If I come to your home, and we enter the realm of 'I'm charging you for my time,' I don't want to put a Band-Aid on the problem. I want to be able to fix it correctly the first time and be done."

When asked what it takes to be a good plumber, Longo says simply, "You have to care," and isn't exaggerating when he describes laying out his work to the 16th of an inch "so it lines up with the grout lines." It's a measure of his craftsmanship that he's just as meticulous in places where the plumbing is seldom seen, such as wall cavities, crawlspaces, and basements. Longo admits to being a little OCD, but insists, "There's a way things ought to be in this world, and crooked pipes isn't one of them."

— Kevin Ireton, editor at large

"Too many people see plumbers as overweight, uneducated slobs."

JEFF LONGO, PLUMBER

Keep Craft Alive is our campaign celebrating those who have chosen to passionately pursue a career in design, building, and remodeling. Find out more and show your support by visiting **KeepCraftAlive.org**, and use **#KeepCraftAlive** to share your passion for the cause.

Photo: Douglas Foulke


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