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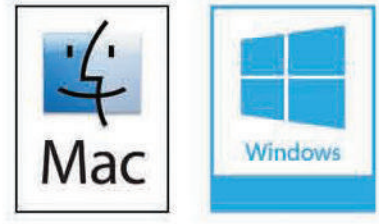

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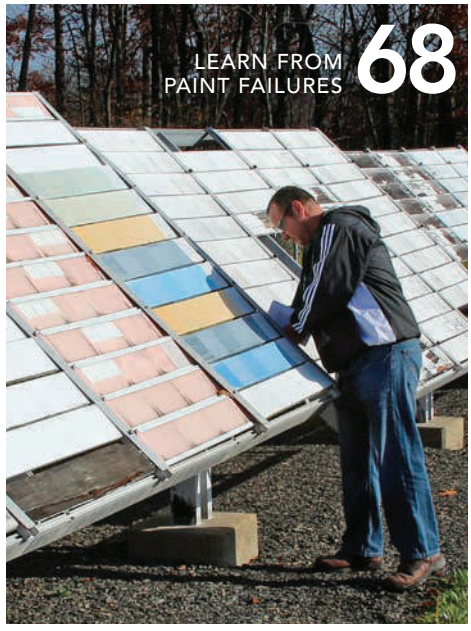

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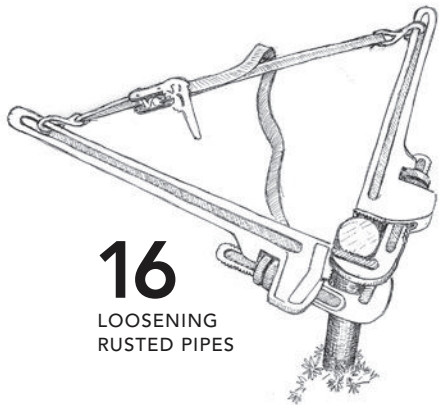

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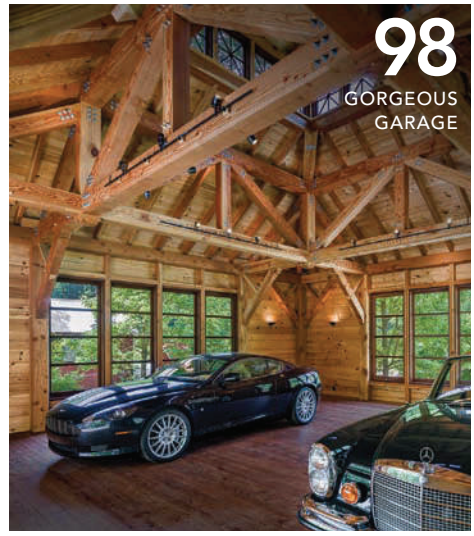

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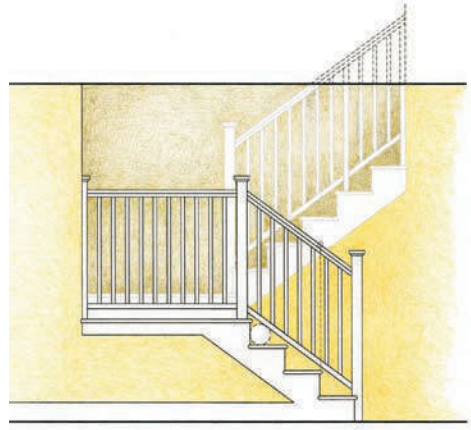

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The Taunton Press
Inspiration for hands-on living®

ON THE COVER: *Fine Homebuilding* ambassadors Brian Kitchin and Nick Aitchison hang drywall on a ceiling in Sudbury, Ont. On pp. 32-35, read about the techniques they use that keep them working for the best builders in their area. Photo by Patrick McCombe.


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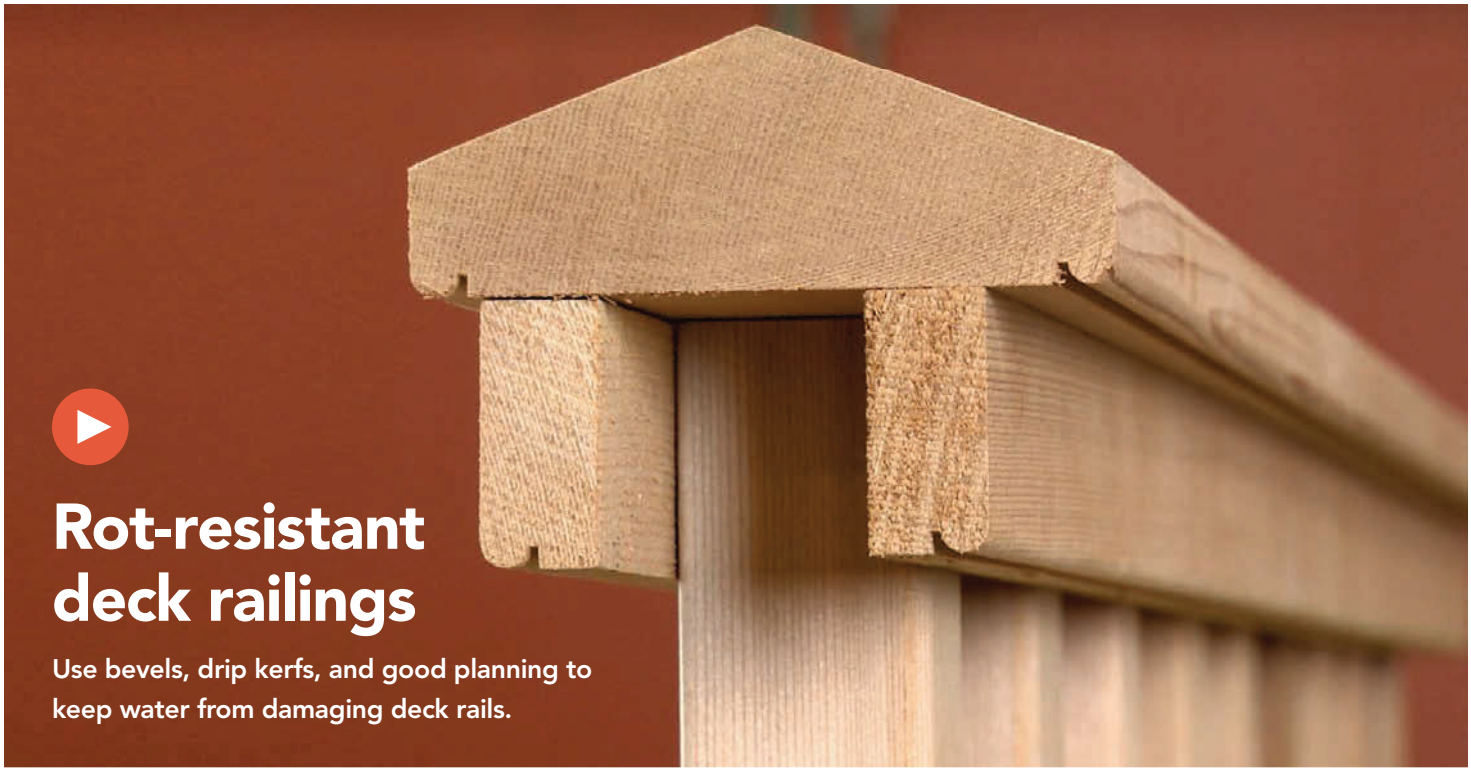


Rot-resistant deck railings

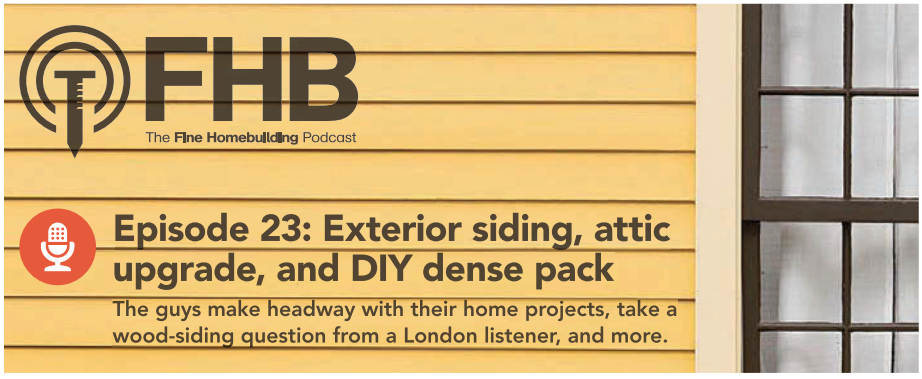
Use bevels, drip kerfs, and good planning to keep water from damaging deck rails.

Fitting a cabinet between two walls

How to get a tight fit when your built-in is squeezed between Sheetrock and a hard place.

Hybrid coffered ceiling

Break up this popular ceiling treatment with a mixture of painted drywall and natural wood.



Episode 23: Exterior siding, attic upgrade, and DIY dense pack

The guys make headway with their home projects, take a wood-siding question from a London listener, and more.

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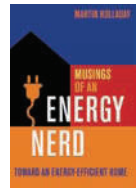

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contributors

THE VOICES OF EXPERIENCE

A third-generation general contractor in Litchfield County, Conn., **RYAN OLIVIERI** ("Bombproof Chimney Cap," pp. 61-65) spent more than two years of his childhood in Italy and was stirred by the antique woodwork of medieval Umbrian hill towns and by the Greek ruins of southern Italy and Greece. For most of his career, he has been immersed in all stages of home building but now specializes in projects combining wood, metal, textiles, and composites.

The holder of a Ph.D. in physics from the University of Florida, **ALLISON A. BAILES III** ("Bad Ducts = Bad Air," pp. 46-50) has run a home-performance company, built a high-performance home out of structural insulated panels, and worked as regional manager for a green-building program. He writes the "Energy Vanguard" blog for the company of the same name, which he founded in 2008. He also contributes to GreenBuildingAdvisor.com's "Building Science" blog.

Having grown up as an assistant in his father's furniture shop, **STEVE SMITH** has been working with wood for as long as he can remember. After sojourns into the world of higher education to study economics and physical therapy—funded by part-time work in the trades—he decided to return to his first love. He now remodels historic homes in the greater Seattle area. In this issue, he writes about his testing of 18v cordless multitools (pp. 56-60).

After graduating from Drexel University with degrees in construction management (his) and interior design (hers), **TYLER GRACE** and his wife, Rachel, formed TRG Home Concepts, a remodeling company specializing in kitchens, bathrooms, and finish carpentry. In collaborating, Rachel learns about the technical end of home renovations, while Tyler benefits from her insights on design. In this issue, Tyler writes about transforming a single bathroom into two (pp. 51-55).

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 address changes to Fine Homebuilding, The Taunton Press, Inc., 63 South Main Street, PO Box 5506, Newtown, CT 06470-5506.

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

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A SKILLED LABOR SHORTAGE IS THREATENING THE AMERICAN ECONOMY.
Though construction is among the fastest-growing industries, professionals face challenges in hiring capable employees across all building disciplines. At *Fine Homebuilding*, we're building toward a solution. We're helping to close the skills gap by bringing awareness and funding to trade education and training opportunities. And as we've done for more than 35 years, we're celebrating craftsmanship in all its forms as a valuable and honorable lifelong pursuit.
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FROM THE EDITOR

Help keep craft alive

Supporting the next generation. *Editorial adviser Mike Guertin gets students ready to tackle their next project on FHB's ProHOME. We're supporting those who are following their passion into home-building careers, and we've devoted a new section of the magazine to celebrate those who are helping to keep craft alive (p. 96).*

Fine Homebuilding rarely dives into the economics of the construction industry and the factors that contribute to its growth or decline. We have always focused our content on the practical side of design, building, and remodeling. Even so, we have never completely divorced ourselves from developments within the industry at large. Our success, and yours, is far too dependent on its policies, economics, and labor changes. Right now, a lot is happening in this industry, and not all of it is for the better. Though the postrecession housing market is bouncing back, the construction workforce is not, and that's posing significant challenges to anyone who works on or owns a home.

A disparity between the employment demands of a growing housing industry and the shortage of trained, qualified labor—the so-called skills gap—is rocking home building to its core. In a 2016 industry survey prepared by Marianne Cusato, a professor at Notre Dame's School of Architecture, 93% of professionals felt that their businesses would grow over the next year if not for difficulties in hiring skilled employees. Of those who are qualified as skilled laborers, 61% attribute the shortage to a lack of exposure to the trades for younger generations. Many of you have echoed these struggles, whether in trying to hire an employee for your own crew or when trying to find a qualified contractor to work on your home. Blame it on the housing crisis and the Great Recession, the lack of formal apprenticeship programs, the reduction in an immigrant labor pool, or the rampant extraction of shop class and technical training in public education since the 1990s, but the fact remains that there is home-building work to be done in this country and not enough trained builders and remodelers to do it. From the pace of building, to the cost of construction, to the prices of homes, to the quality of our housing infrastructure, the skills gap is having deep and far-reaching influence.

That's why the team here at *Fine Homebuilding* is launching a campaign to help close the skills gap. We're calling it Keep Craft Alive, and we're leveraging all of our resources to bring awareness to the cause. Starting this year, we'll be partnering with industry organizations and influencers to build awareness of the skills training and educational opportunities that exist in this country, and we'll be funding student scholarships to support those who want to pursue a path in the trades. Also—and this is perhaps our most challenging and important task—we'll continue to celebrate the value of true craftsmanship in all trades in order to influence the cultural narrative about what it means to be a respected, successful professional.

Visit KeepCraftAlive.org to learn more about our efforts and how you can help. And show your support for those who have pursued their passion into a career in design, building, and remodeling by using the #KeepCraftAlive hashtag. This is important, ambitious work, and I know of no better community than the readers of *Fine Homebuilding* to help us in this effort.

—ROB YAGID editor in chief

Photo: Brian McAward

Fine Homebuilding

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A terrace in detail

I am a longtime subscriber and enjoyed the article "Small Addition, Big Impact" in *FHB* #264. I have a question about the construction of the

backyard terrace featured on pp. 56-57. Given that the home is in Minnesota with a freeze-thaw cycle, would a similar terrace work in my area of northern Indiana?

—HERMAN WALLACE
via email

Architect Paul Buum replies: Since northern Indiana is one climate zone warmer than central Minnesota where the terrace was constructed, a similar design should work fine in your area, too. The terrace was set on an 8-in. perimeter foundation wall with 16-in.-wide footings set 42 in. below grade. A 4-in. concrete slab was poured, leaving a 4-in. stone ledge. Bluestone pavers were then installed and grouted, and a limestone face was laid around the perimeter to match the existing stone base on the house.

Smoke alarms for the hard of hearing

Your article "What You Didn't Know About Alarms" in *FHB* #264 was great. I have a high-frequency hearing loss, however, and all of the alarms I have found produce such a high-frequency sound that I cannot hear them at all. Are there any alarms on the market for those who are hard of hearing?

—GEORGE LEWIS
via email

The editors reply: Several alarm products have been designed specifically for those who are deaf or hard of hearing. One supplier is Harris Communications (harriscomm.com), which provides fire, carbon-monoxide and severe-weather alarms that use a low-frequency siren, strobe lights, and/or bed shakers to notify homeowners of danger. Make sure that any such alarm you're considering meets the UL standard 1971, which covers signaling devices specially designed for the hearing impaired.

Protect the tongue on subfloor sheathing

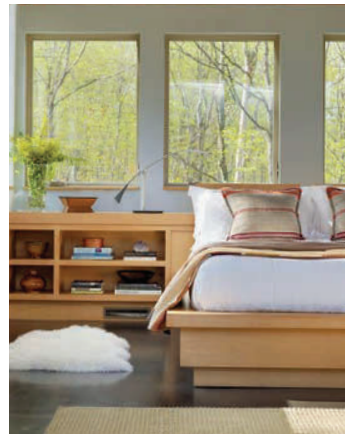
I was interested to read "Building Skills" in *FHB* #264 about installing a subfloor, which is something I have done many times. While there has been an improvement in the fit of tongue-and groove sheathing, the pieces usually do not slip together very easily. A 5-ft.- to 6-ft.-long 2x4 and a sledgehammer are the usual requirements for coercing the sheets together. Although the photo on p. 90 shows otherwise, it is best to drive the 2x4 against the groove and not against the tongue, which is more fragile. Also, the article shows each sheet being fully nailed off all the way to the edge. In my experience, leaving the edge free of nails until the following sheet is in place makes it easier to fit the sheets together.

—DAVID GREGSON
via email

Keep joists straight

In *FHB* #264's "Building Skills," the author states that it makes no difference whether you start with the tongue or the groove when aligning sheets of tongue-and-groove subflooring to the layout line. My experience says that you want to start with the groove so that when you need to persuade a sheet to engage, you're not deforming the tongue by bashing it. Also, joists are not always straight. I screw down a 1x4 or something similar a foot or so beyond the snapped line with an accurate joist layout marked on it. This way, I can pull bowed joists into alignment before nailing off sheets of subflooring.

—MARK DAWSON
Lopez Island, Wash.



Credit due

On p. 74 of *FHB* #264, Mitra Designs of Bristol, Vt. (mitradesigns.com) should have been credited with the design of the master bedroom captured by photographer Susan Teare.

Photo left: Troy Thies

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.

—ROB YAGID
editor

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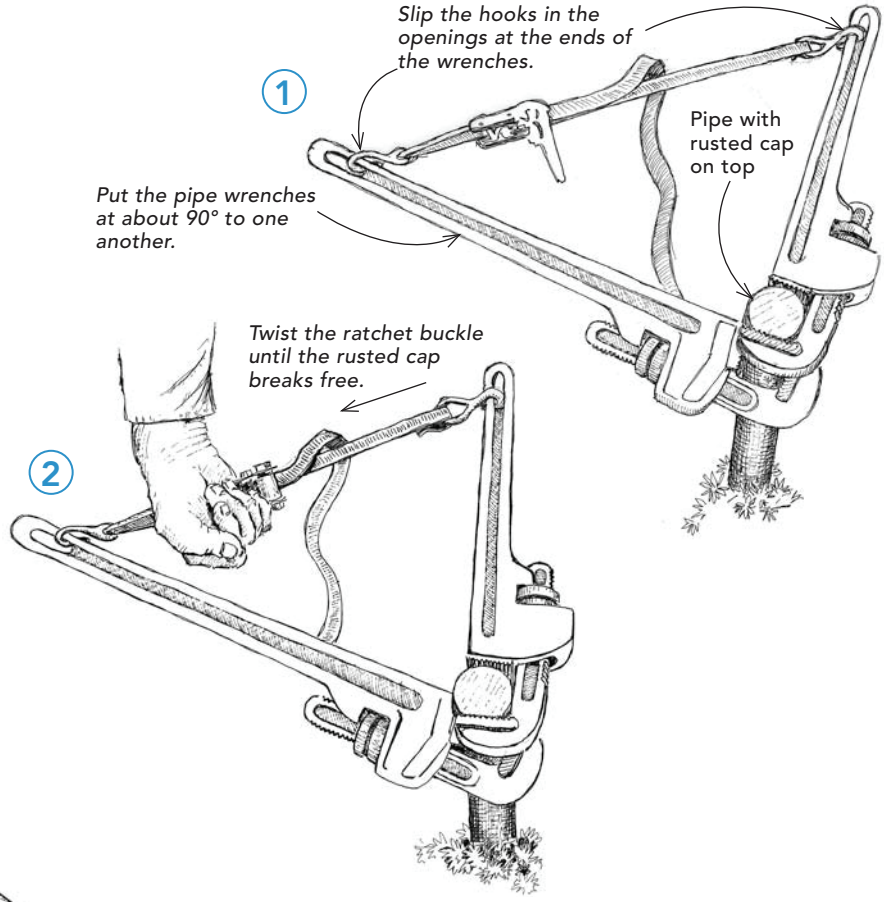
Loosening rusted threads

While working on a galvanized-steel waste pipe, my helper and I couldn't budge the rusted old threads. Faced with cutting the pipe, I sent my helper to the truck for a small nylon ratchet strap.

With two pipe wrenches hanging on the pipe at about 90° to one another, I slipped the hooks on the strap into the eyes on the ends of the pipe-wrench handles and tensioned the strap with the ratchet. The tension generated by the ratchet slowly pulled the wrenches together and got the old joint loose enough that we could turn it the rest of the way by hand. Since then, the guys who work for me have started using ratchet straps any time it is hard to get a pipe joint turning.

—RANDALL THOMAS
Salmon, Idaho



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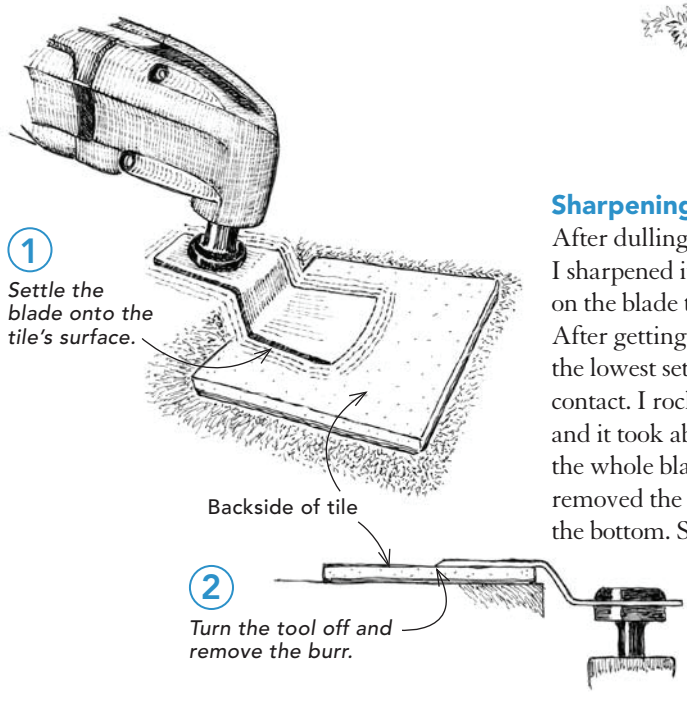

Sharpening multitool blades

After dulling an oscillating-multitool blade on grout, I sharpened it with a piece of tile. I angled the bevel on the blade to lie flat on the unglazed back of the tile. After getting a feel for the angle, I turned the tool to the lowest setting and carefully brought the tile into contact. I rocked it a bit to sharpen along the curvature, and it took about 10 seconds of sharpening to refresh the whole blade. Then I unplugged the tool and removed the burr by hand by running it flush along the bottom. Since then, I've found that any section of flat, unglazed ceramic or stone tile works. I now keep a small piece in my multitool box.

—CONNOR WARNECK
Royal Oak, Mich.

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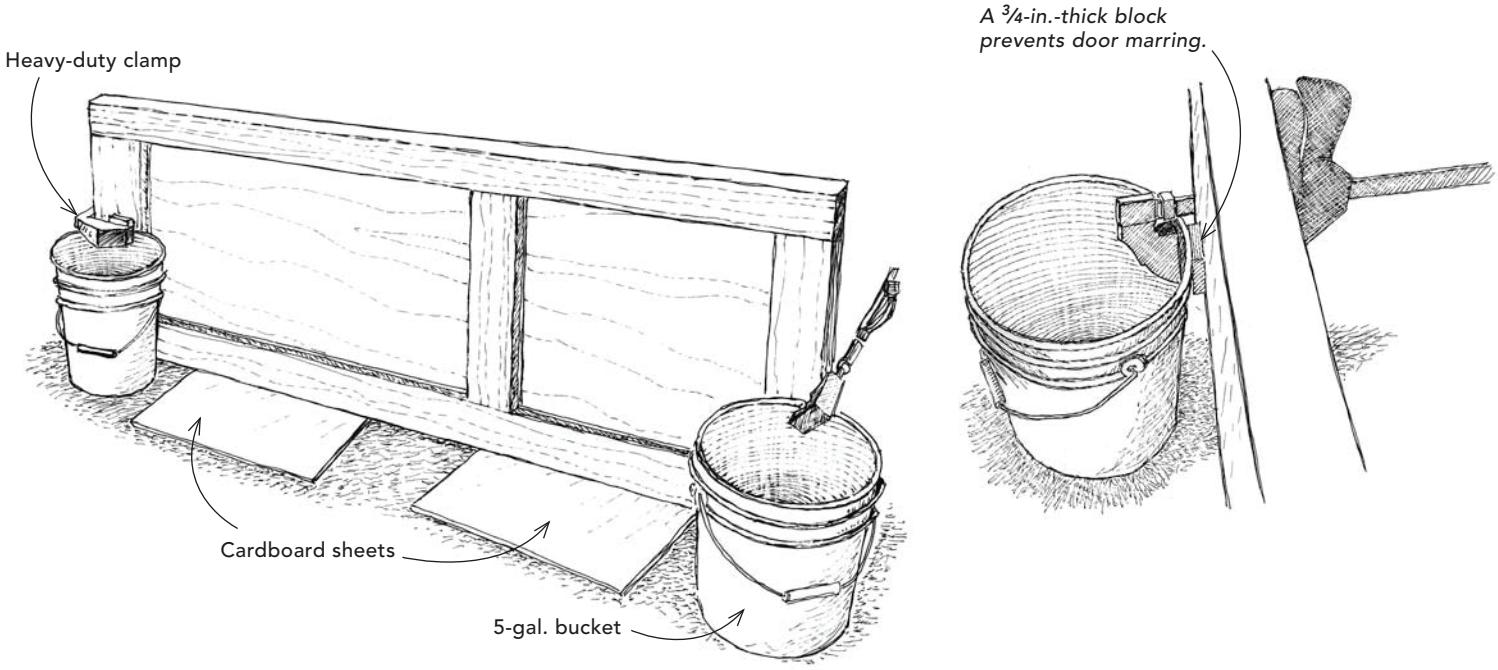


Impromptu job-site door buck

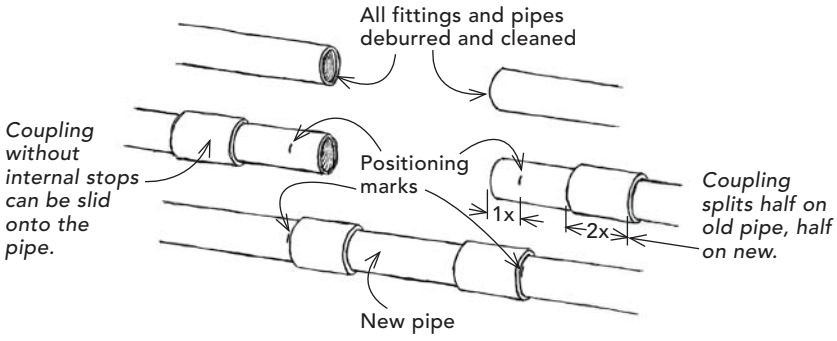
On a job a while back, I had to mortise hinges on several doors. I hadn't planned for this, and I didn't have any proper door bucks on hand to hold the 80-lb. doors on edge, so I came up with an alternative. Using heavy-duty clamps, I attached a 5-gal. bucket to each end of a door, with scraps of wood between the bucket and the door to prevent marring.

This isn't the most stable door holder, but it worked perfectly when I couldn't follow my usual practice.

—DANIEL BOYCE
Red Feather Lakes, Colo.

Replacing copper pipe with no wiggle room

Sometimes you have to replace a section of copper pipe in a run where there isn't any play. I encountered this when an old, obsolete saddle trap was leaking and needed to be replaced with a new piece of pipe. In these situations, you want to use couplings without internal stops. These couplings allow you to slide the new piece of pipe into place.



As shown in the drawing below, I cut the new section so that it fit right up against the existing pipe ends, and I put marks on the existing pipe to show how far down to slide the couplings. Then I slid the couplings over the new section, using the marks to tell me where to stop.

—NICK FERA
Brielle, N.J.

Plastic wedges

I find plastic tree-felling wedges to be useful in all kinds of home-building work. They are larger cousins of the plastic wedges commonly used to shore up a wobbly toilet, but they come in 4-in. to 10-in. lengths and are designed to be struck by a hammer, making them useful for all sorts of temporary work. For example, I've used them atop a column to get a beam leveled, and I've used them for leveling and plumbing a window. I have also used them to level a stone lintel temporarily, to level a condenser unit, and to plumb a door jamb. They are light, durable, and won't splinter like wood.

—J. KAYE
Phenix, Va.

Vacuuming footings

After digging post holes for deck footings, I was having trouble cleaning out all the loose dirt before putting the footing tubes in. It was even harder to clean out loose dirt from inside the footing tubes after backfilling around the outside. I had dug down to the bedrock and wanted a clean surface for the concrete to settle on. I found that a shop vacuum does a great job of sucking up this loose dirt.

—DAYLE HOGG
Toronto

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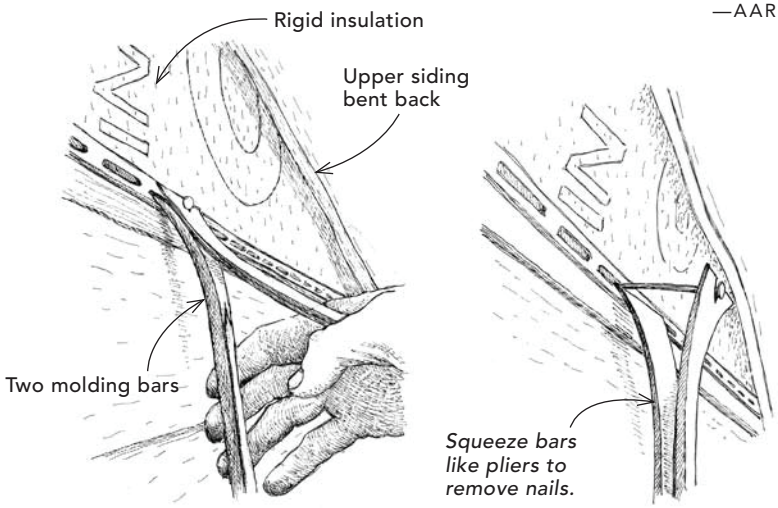
On a recent job, I found myself struggling to remove nails from vinyl that was installed over foil-faced rigid-foam insulation. The foam isn't dense enough to pry against, but I found that using two molding bars (one has to have a notch) back to back allowed me to remove the nails without crushing the foam or siding. I simply squeezed them like pliers to remove each nail.

—AARON GALLEY
Ludlow, Vt.



ISSUE 182 // 2006

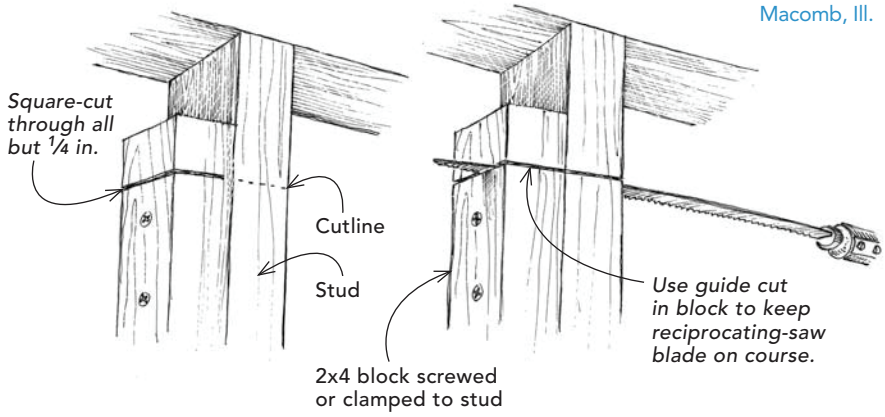
TIP FROM THE ARCHIVES

Improved guide block for reciprocating-saw cuts

It is standard practice to use a wood block as a guide when cutting with a reciprocating saw. But if the block is on just one side of the blade, either above or below, the blade can still wander beyond the cutline.

I began to search for a way to guide both sides of the blade recently when cutting the tops off some old studs prior to installing a header. As shown in the drawings, I simply took a scrap of 2x4 and made a square cut almost all the way through it. Then I attached it to the old stud with the square cut aligned with the cutline mark on the stud. The cut guided the blade straight and square.

—DON MATHIS
Macomb, Ill.



TRACK-GUIDED SIDEWINDER

I've been using Festool's new 18v cordless 6¼-in. circular saw and its companion guide rail for the past month. Unlike the Festool track saws most carpenters are familiar with, the HKC 55 looks and operates like a regular sidewinder circular saw. This tool's ample power and pair of quick-charging batteries let me cut 2xs and sheathing all day. This is the first cordless saw that I think can replace my corded saws for 85% of the work I do.

The saw directs almost all of the dust it produces through a swiveling discharge port rather than spewing chips all over. And when connected to a dust bag or vacuum, the saw makes practically no mess. The depth-of-cut adjustment is a simple squeeze lever at the rear, and the indexing scale is precise. When the saw is located directly over a cut, you just start the motor and plunge the saw into the workpiece, where it stops and locks at the chosen depth setting. Festool also has simplified retracting the blade guard with a front-mounted lever that makes starting bevel cuts easier.

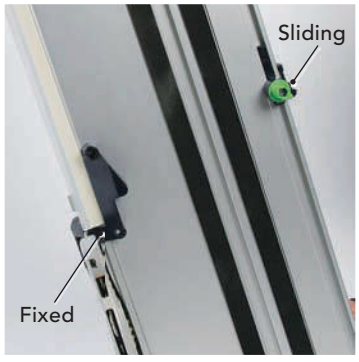
The HKC 55 works with the Festool guide rails that you may already have, but it also works with a new style of track, the FSK, which comes in three lengths that provide up to 10 in., 16 in., and 27 in. of 90° crosscut capacity. Unlike with previous Festool track saws, the FSK guides interlock with the bottom of the HKC 55, joining saw and track as one unit. An elastic cord retracts the guide to its original position when you finish your cut and lift the saw off the workpiece, readying the tool for another cut.

I used the saw and new guide rail to cut rafters, including valley jacks and hip rafters, with clean results. It cut composite exterior trim as accurately as my sliding compound-miter saw but was actually more efficient. Instead of moving heavy 16-ft. 1x12 trim pieces onto a miter-saw stand, I just cut right off the stack. One limitation is the cutting depth, which falls just shy of being able to cut through 2x stock at a 45° bevel when using a Festool track or FSK guide. I hope Festool introduces a similar saw with a bigger blade for cutting rafters and I-joists.

The HKC 55 with two batteries and a charger sells for $570. The guides sell for between $150 and $200 each, depending on length. There's also a corded version of the saw with all the same features (the HK 55), which sells for $560 with the 16-in. track.

Mike Guertin, editorial adviser

Adjustable stop aligns the track



One fixed pivot and one adjustable stop (held in position with the green thumbscrew) work together to allow the track to set at angles from 0° to 60°.

Large scale sets angles

An easy-to-read scale on the left side of the track shows the angle setting for miters. The notches cut into the track are detents for common cuts.

Track guides the saw

With the fixed pivot and adjustable stop tight to the stock, the aluminum track guides the saw.

Angles are easy

By adjusting the sliding pivot, the saw can make left and right angled cuts. The track's plastic edge lines up with the blade for accurate alignment and less splintering.

Photos this page: top, courtesy of Festool; bottom, Dan Thornton

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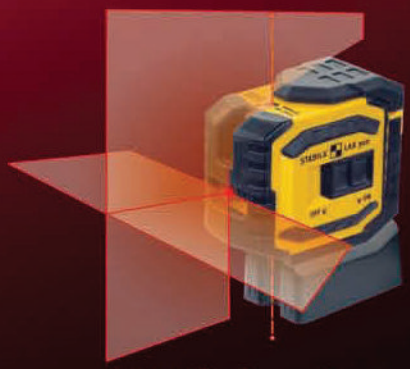

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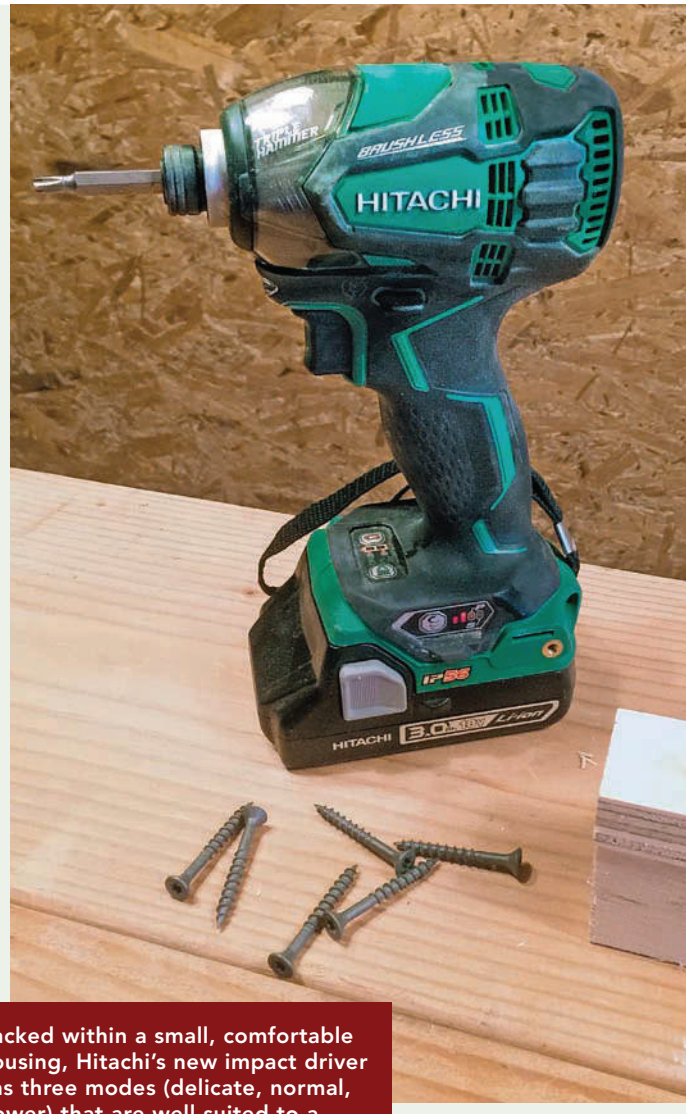
Ultrasmooth impact driver

Whenever new cordless tools hit the market, we expect them to be smaller, lighter, and more powerful—and the new WH18D-BDL2 from Hitachi definitely is. Hitachi's marketing for this new impact driver touts its three anvils and impressive torque (1832 in. lb.). I'm actually more impressed with the tool's smoothness and how much control it gives no matter what type of fastener you're driving. The secret is a little button just below the comfortable pistol grip that lets you choose one of four tightening modes. There's a soft mode for delicate work, a normal mode designed for typical screw-driving tasks, a power mode for sinking large screws and bolts, and even a self-tapping-screw mode that regulates torque so you don't strip threads when fastening into metal. In my job as a remodeler and cabinetmaker, I get to work on projects of all shapes and sizes, so I put the new Hitachi driver through its paces over several weeks. I even passed it around to the other carpenters on the crew so that they could try it out and test its durability. The consensus was that the four tightening modes gave us complete confidence in our ability to drive fasteners right where we wanted them and without stripping. Installing small bits of hardware with the soft setting was a breeze, while the rapid-fire bursts of torque in the power mode were almost scary. There always seemed to be a perfect mode for the job, no matter what size screw or type of material we used.

Another button lets you toggle the front-mounted LED light between "always on," "trigger activated," and "always off"—enough choices for every possible workspace where you might need an impact driver. And the driver's supershort body allowed us to keep working in situations where we typically would have to grab a right-angle drill. Even the case is useful, with a lid that has its own separately hinged compartment for carrying bits and other accessories. It didn't take long for this new impact driver to climb to the top of my list of favorite tools. My only quibble is that Hitachi put a charge indicator on the driver and not on the Li-ion battery itself, which means that you can't check the charge on your spare batteries without sliding them onto the tool. A kit including two 3.0-Ah batteries sells for $400.

Rob Wotzak, a remodeler and cabinetmaker in New Milford, Conn.



Packed within a small, comfortable housing, Hitachi's new impact driver has three modes (delicate, normal, power) that are well-suited to a variety of general fastening tasks. A fourth mode prevents stripping self-tapping sheet-metal screws.

Photos this page: Michelle Gervais

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BRIGHT, STURDY WORKLIGHTS

My coworkers and I depend on portable lighting because when we begin a finish-carpentry job, the final electrical work is often still weeks away. After putting three new worklights from Milwaukee to the test over several months, I've concluded that the company has made great strides in cordless job-site lighting.

Rocket

The Rocket ($400 with no battery) provides 3000 lumens, can run off AC power, and has an onboard charger for M18 batteries. Three independent heads have a 180° range of motion and can be turned individually or grouped together to pivot as one. The Rocket is power hungry, burning through a 5.0-Ah pack in about two hours at its brightest setting. Still, the power used by the Rocket is a fraction of that used by halogen worklights, which is a huge benefit when you're running other tools or lights off of the same circuit. Plus, if you lose AC power to the Rocket, the battery seamlessly takes over. How many times has someone unplugged your light while you were in the middle of a task, or how many times have you been left in the dark by a tripped breaker?

Weighing in at 18 lb., the Rocket is 41 in. long when it's collapsed and can stretch to 7 ft. when fully extended. This makes it great for when you need overhead lighting but there's nowhere to hang a light. I purposely knocked over the extended light multiple times with no ill effects.

Radius

Though less than half the size of a 5-gal. bucket, the M18 Radius ($300 with no battery) puts out 4400 lumens, which is more than enough for general job-site lighting.

At 10½ lb. and with a large handle, it's easy to carry. A sturdy hook on the bottom—wide enough for 2x stock—allows it to hang upside down for overhead lighting. Milwaukee even includes a tether for hanging the light from larger-diameter objects.

Three brightness modes and the option to turn off half of the light to conserve battery power allow you to match the light output to your needs. There's even a One Key version ($350 with no battery) so that you can control and program the light to turn on and off on a schedule from your phone. Both versions include male and female 120v plugs for connecting multiple Radius lights together. This model can also run on AC power, but it doesn't charge batteries as the Rocket does.

The Radius is IP54-rated for dust and water resistance, and the one I have has endured multiple drops without breaking. This is the light you want for general site lighting. You can illuminate a large room with a single unit.

Rover

The 1000-lumen, 2-lb. M12 Rover ($80 with no battery) is for people who want a lot of light in a tiny package. Its multiple mounting options—a high-strength magnet, a well-designed spring clamp for grabbing 2x material, and a keyhole slot—mean that you can stick it anywhere.

The flood-shaped beam has a nice even spread. The edges of the beam are a little blue, but the center is close to white. There are three light levels—200, 400, and 1000 lumens—and I found that the light will run for up to five hours on the brightest setting using a 6.0-Ah battery pack. Like the Rocket, the Rover flashes when the battery is running low.

Milwaukee claims that the Rover can survive a 9-ft. drop. That seems realistic given some of the good hits it took while I was using it, including a tumble down stairs. This is the light you want in your toolbox and within grabbing distance while you're working. It's a localized flood light with the power of a 250w halogen.

Kiefer Limeback, a carpenter in Whitby, Ont., and a Fine Homebuilding *ambassador*

Photos this page: courtesy of Milwaukee

Hose-free, hassle-free nailer

Given the convenience and speedy setup, it's no wonder that carpenters continue to switch from pneumatic to hose-free finish nailers. The latest cordless model to enter the market is an 18-ga. brad nailer from Grex, a company known for high-quality pin nailers. The Grex GC1850 is powered by an internal combustion engine similar to the setup on Paslode's hose-free tools, among others. But the GC1850 is lighter (4.4 lb.) and smaller (10½ in. long; 10 in. tall) than every other hose-free nailer out there. That's partly because instead of a proprietary rechargeable battery pack, this tool uses two standard AAA batteries, which Grex claims can drive up to 50,000 brads.

Grex also claims that the aerosol fuel doesn't go bad and that the GC1850 works consistently at high altitudes and in cold temperatures—a contrast to common complaints about Paslode's popular hose-free nailers. A quick trial using the tool with a half-dozen materials shows that it works well and has plenty of power. The adjustable power prevents overdriving fasteners, which can create oversize holes and damage the tool's internal driver. Best of all, this new nailer is smaller and better balanced than most of the other hose-free models on the market.

Patrick McCombe, associate editor

Grex GC1850
Fasteners: ½-in. to 2-in. 18-ga. brads
Shots per charge: up to 50,000
Shots per fuel cell: 1300
Price: $440

Photo this page: Patrick McCombe

Makita XFD11ZB ½-in. brushless drill
Speed: 0 to 500 rpm; 0 to 1700 rpm
Max torque: 350 in. lb.

Makita XDT15ZB brushless impact driver
Max torque: 1240 in. lb.
Impacts per minute: 0 to 1600; 0 to 3900

Black is the new teal

Two of the most promising new tools to come across my desk in recent years are Makita's new cordless drill and impact driver. Loosely based on smaller 12v drill and driver platforms, the new brushless tools use Makita's popular slide-on 18v battery packs. With a 2.0-Ah battery, the tools weigh 2.8 lb. (drill) and 2.6 lb. (impact driver). Besides looking great, these tools are extremely small (Makita calls them subcompact) and comfortable, and they seem ideal for most normal-duty carpentry tasks. A kit with the drill, impact driver, and two 2.0-Ah batteries sells for $230.

P.M.

Photo this page: courtesy of Makita

Modern Drywall Hanging

New methods and materials produce flatter walls and ceilings, and fewer callbacks

BY BRIAN KITCHIN AND NICK AITCHISON

While it's true that drywall as a material hasn't changed much since its introduction in the 1940s, the way we hang it has evolved quite a bit in the last few years. Now we have better methods and better tools, which results in smoother walls and ceilings and less effort required to achieve them.

It won't be difficult to find contractors and professional drywallers who question or even vehemently disagree with our methods. We know that because they routinely comment on our Instagram feed. All we can say is that we know our methods work because we've been hanging drywall like this for years. Because our walls are flatter and we don't get cracks and screw pops, we get to work for the very best builders in the area.

Brian Kitchin and Nick Aitchison are the owners of Drywall Nation in Sudbury, Ont., and are *Fine Homebuilding* ambassadors. Photos by Patrick McCombe.

NEW-SCHOOL MATERIALS

You won't find resilient channel, OSB drywall backers, or spray polyurethane adhesives on low-bid drywall jobs because they add to the cost of the project. That's too bad, because these products greatly improve the quality of a drywall installation. Here's how they do it (prices in U.S. figures).

Forgiving ceilings

The cold climate in this part of Ontario requires a poly vapor/air barrier. Resilient channel (22¢ per ft.) prevents the screws from putting holes in the plastic and allows 16-in.-on-center fastening on a 24-in.-on-center framing layout for a flatter ceiling that resists sagging, even with a deep layer of blown-in insulation. The channel is fastened to the framing with 1¼-in. coarse-thread drywall screws. The drywall is fastened to the channel with 1-in. fine-thread screws.

Better butt seams

Drywall backers pull in the butt edges of the panels to create subtle recesses that allow the normally time-consuming finishing of these seams to be done like tapered-edge seams. This also means fewer screw pops because the fasteners can be placed farther from the drywall's edge. We use Trim-Tex's Buttboards, which come in 4-ft. and 4½-ft. lengths ($4 to $5) but can be scored and snapped to make shorter pieces.

Improved adhesive

Polyurethane-based spray-foam adhesives ($20 to $25 per can) are easier to dispense than caulk-gun-dispensed adhesives, they produce a uniform bead, and they hold tenaciously, even to steel. Because of their superior hold, you need far fewer screws, resulting in faster hanging and fewer screw pops later on.

FORGET ABOUT STAGGERED SEAMS

The old thinking was that you need to stagger drywall joints to make the seams less obvious. Unless the wall or ceiling is subject to raking light or will be covered with glossy paint, however, this is often unnecessary. An OSB drywall backer turns a butt joint into a tapered joint that's easy to finish and so flat that it's nearly invisible even in raking light. Critics sometimes say that staggered seams make a house stronger, but it's hard for us to believe that a couple dozen screws on both sides of a drywall backer make a weaker connection than landing two sheets of drywall on a single stud.

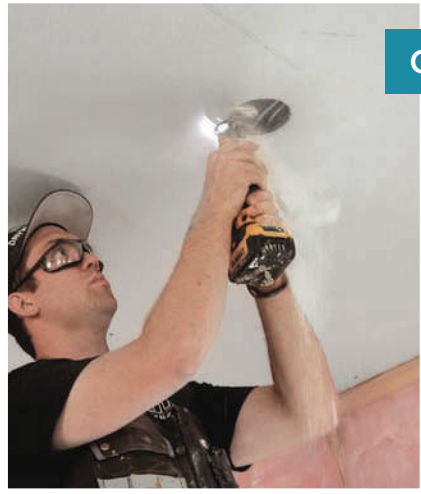
Stay away from plates

The drywall backer is kept a few inches away from top and bottom plates so that the sheet can bend to accommodate the backer's taper and the slightly different plane of the plates.

Product photos facing page: TK

UPGRADE YOUR DRYWALL SAW

Although utility knives and T-squares are still mainstays for cutting drywall, cordless drywall routers have replaced drywall saws because they cut faster with less effort.

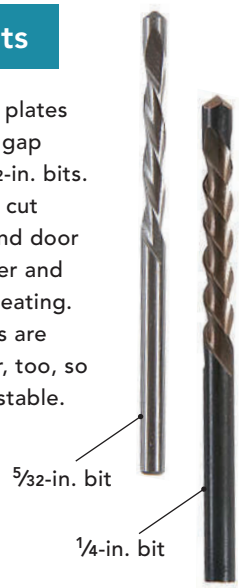


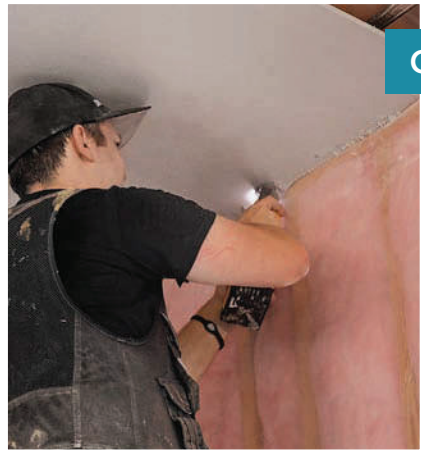
Cut the cord

Cordless drywall routers go to work quickly, free you from the hassle of a cord, and have enough run-time to last all day. For greatest efficiency, get two drywall routers and outfit them with different bits.

Use two bits

Electrical wall plates will cover the gap made with 5/32-in. bits. But 1/4-in. bits cut out window and door openings faster and without overheating. The larger bits are slightly longer, too, so they're more stable.





Cut and trim

Forget about squeezing a wallboard saw between framing and a too-tight sheet of drywall. A drywall router with a 1/4–in. bit cuts oversize pieces easily. Use it free hand for making L-shaped and U-shaped cuts, then trim away any ragged paper with a utility knife.

Dress Up a Gable With Shiplap Siding

This traditional detail is fast to install and adds historic charm, even on a new house

BY JOHN HOURIHAN

The towns surrounding Boston are a hive of building and remodeling work, so I'm not exaggerating when I say that if you stopped in at my local building department in Wellesley, Mass., you would learn that the department issues about 80 permits a year for new homes. Of those 80 permits, most are for expensive spec homes being built from plans that look like they all came from the same house-design website or that include default details that seemingly came straight from house-design software. For the seven to eight houses my company builds each year, we try to be the exception rather than the norm.

Wellesley is full of historic houses, so we like to give a nod to the surrounding architecture by incorporating classic details in our new builds. One of our favorite custom elements is to change up the type of siding on different parts of a house. For instance, it's not uncommon for us to side the main house with cedar shingles, the garage with vertical board-and-batten siding, and the mudroom connector between them with clapboards. This gives the house the look of having been added on to over the years. We also can create that traditional vibe by changing just a small section of siding, such as on the upper part of a gable end. Instead of simply running the siding material all the way up, we often use shiplap boards to set off the gables.

A three-person team—two installers working from staging who feed measurements to another worker at a cut station on the ground—can side a large gable end in an hour or two. It's a minimal change in installation technique from that used on the clapboards covering the rest of the house, as well as an upcharge for the wider boards, but it makes a substantial impact on the look and feel of the exterior.

John Hourihan is director of operations at Riverstone Custom Builders in Wellesley, Mass., and a *Fine Homebuilding* ambassador.
Photos by Justin Fink.

START WITH A SOLID GAME PLAN

ALIGN TO THE WINDOWS

Before any siding goes on the wall, use a cutoff and a tape measure to plan how the siding will course out in relation to the windows. Ideally, the bottom and the top of the window casing will be roughly in line with the gaps between courses, but often you have to settle for aligning one or the other. Achieving this usually means adjusting where the lowermost course starts and choosing a gap between boards that looks good and that works in your favor. If butt joints are necessary, avoid them under windows.

DETAILED FOR DURABILITY

Wide, face-nailed siding boards are more prone to cupping than narrow, beveled boards. To keep the gables looking their best, we use rot-resistant cedar, control moisture absorption by priming and painting all surfaces before installation starts, touch up cut edges with primer, and fasten boards with three ring-shank nails in each stud.

GAUGE THE GAP

Although commonly referred to as *nickel-gap siding*, shiplap siding can be installed with a wider shadowline between courses, which often helps the layout. To keep course spacing consistent, create a custom spacer by adjusting the depth of the rabbet on a scrap of siding.

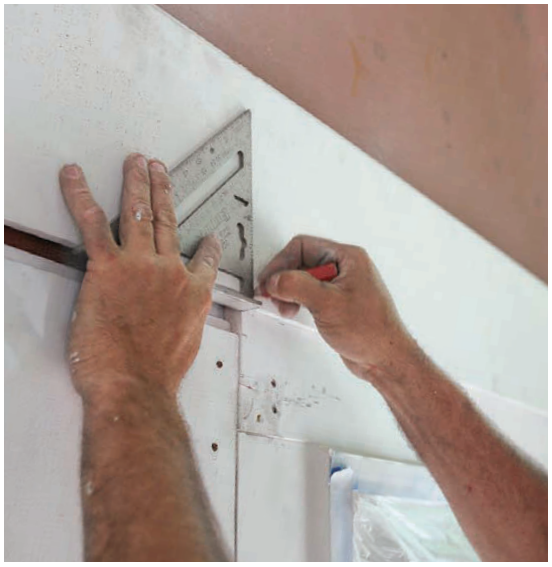
WINDOW-CASING OPTIONS

Window casing can be set flush, set off by a slight shadowline created with 5/4 casing, or furred out to project fully beyond the siding. Here, the original plan was to side the gable with clapboards to match the rest of the house. When we switched to shiplap, we opted to pad out the already installed casing with a second layer, being sure to include a metal drip cap on the head casing.

SECRETS TO A SMOOTH PROCESS

1 HIDE THE ANGLED END CUTS

To speed installation and improve the look, hide the angled cuts—necessary where the siding meets the roofline—under the rake trim. Although on this job we had several inches of space under each piece of rake trim before butting up to the unseen blocking used to space it away from the sheathing, we generally aim to slide the siding about an inch under the rake board on each side. This means our cuts have to be close, but not dead-on accurate, and it allows us to slide pieces side-to-side as necessary when fitting a single piece under both rakes.



2 MARK CUTS IN PLACE

When fitting a piece between a rake and the side of a window, or notched around the top or bottom of a window, we prefer to cut the angle first and then mark the window cuts in place. For butt cuts, a single mark is all you need. For notches, mark the outside edges of the casing (above left), then use the spacer block as a reference point for measuring the height of the notch (above right).

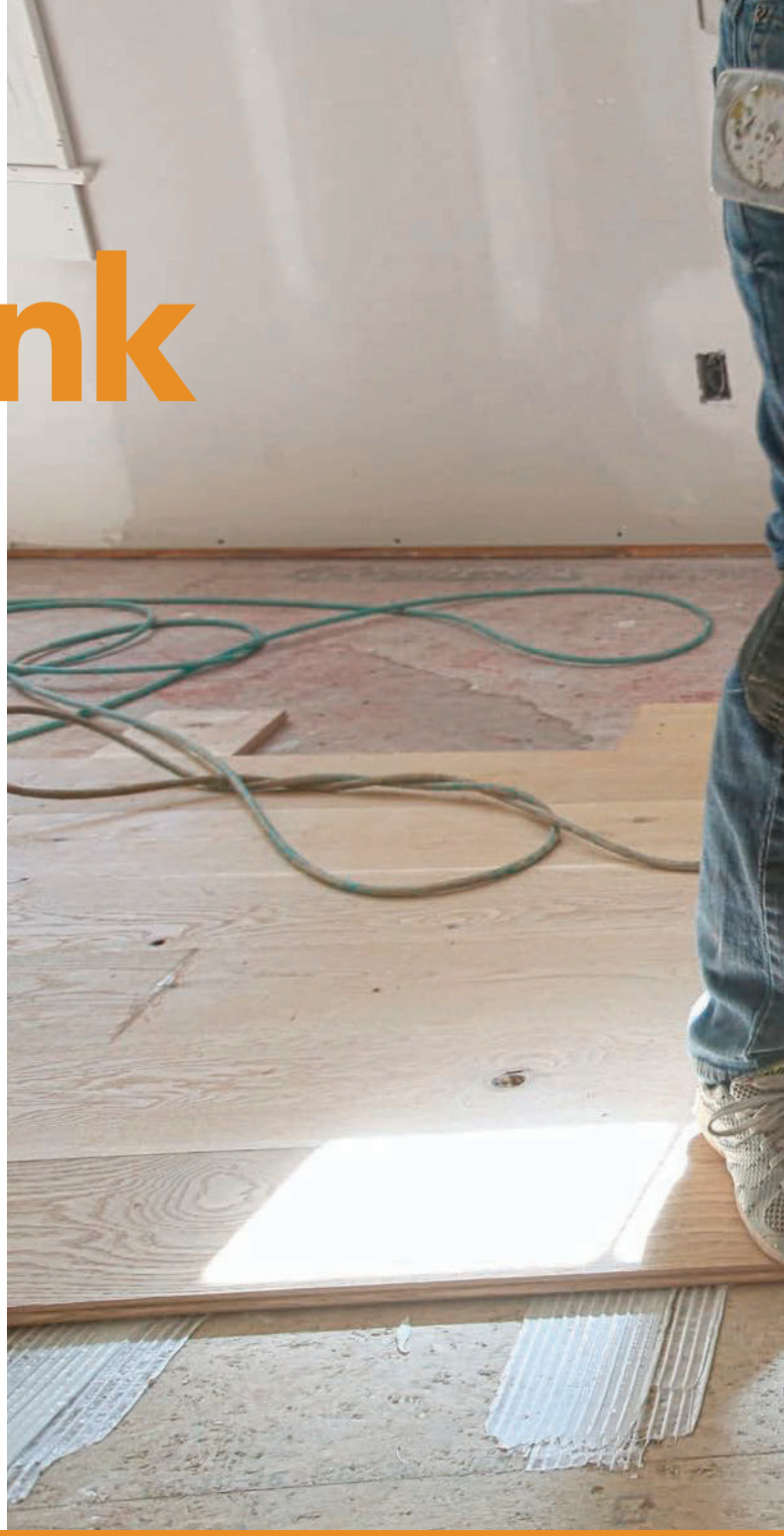
3 FLOAT THE PEAK PIECE

Because the siding slides under the rake boards, the uppermost piece must be fit at the same time as the piece below it. Once the last piece is in place, we fasten it if we can. If it's small and likely to split, we let it float without fasteners.

Fine-Fitting Solid-Plank Flooring

A long-lasting, good-looking floor starts with a smart layout and strong fastening

BY DREW RYDINGSWORD



Wood floors hold a special place in the history of home building. In the past, master craftsmen might labor on the same floor for years, meticulously cutting each intricate inlay or pattern by hand. Even the rough, hand-scraped planks that floored the homes of wealthier commoners were still the result of a painstaking process.

Historically, wide-plank wood floors were milled with square edges from whatever wood was available on the property, and they were nailed directly to the joists. By *wide,* I'm talking 14 in. wide, and as these planks expanded and contracted with seasonal changes, so did the drafty cracks between them.

The wood-flooring industry as we know it today was revolutionized just before the turn of the 20th century. In 1885, a new milling machine—called a *side-matcher*—made blind-nailing possible by creating the first kiln-dried tongue-and-groove boards. In

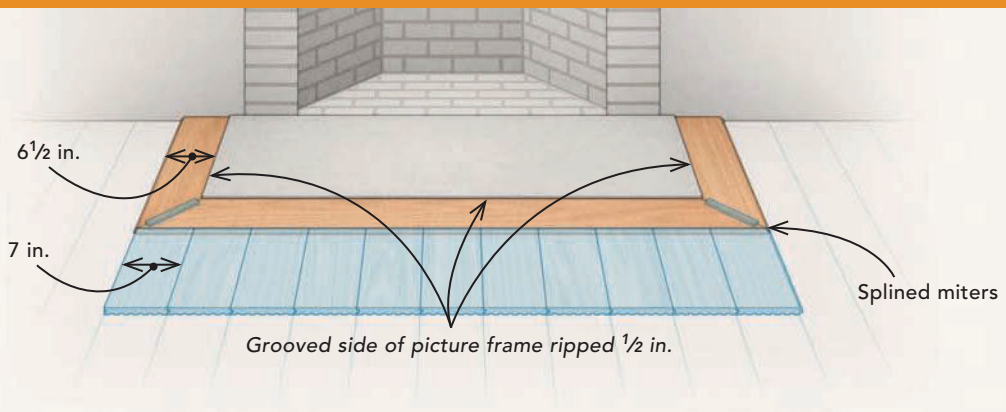
CHOOSE A STARTING POINT

Flooring layout looks best when it's driven by a focal point. The focal point depends on the situation, but for many jobs it's the fireplace hearth, which must tie purposefully into the positioning of the floorboards. This ensures that the hearth is centered and has even—ideally, full-width—boards on each side. To achieve this, I often create a picture-frame border that allows me to control the transition between the hearth and the rest of the flooring. It looks best if I rip these picture-frame boards to a width that will accommodate full-width boards to run in front of the hearthstone.

Drawing facing page: Christopher Mills

PICTURE PERFECT

Laying full-width scraps of flooring on each side of this hearthstone and then measuring (photo left) shows that it would take 11 full-width boards to go across the front without interruption; however, ½ in. will have to be ripped off the groove side of the picture-frame boards for the layout to work. The boards are installed tongue side out so that the subsequent floorboards interlock.



1898, the *end-matcher* appeared; until then, ends had to fall on joists because subfloors were not in common use.

Because my company's customers prefer a traditional look, most of the solid-wood floors we install are made of wide tongue-and-groove planks, but there is a price to pay: These plank floors cost at least 50% more than a typical 2¼-in. strip floor of the same grade. But nothing compares to the look of a plank floor's broad field of wood grain underfoot (see "A Closer Look at Solid-Wood Flooring," *FHB* #257).

We work with vendors who specialize in supplying the hardwood-flooring trade, which allows us greater creative control and less waste. The typical plank floorboard we work with is 8 ft. to 16 ft. long and 5 in. to 10 in. wide, side matched, and rough cut at the ends so we can square or end-match the boards on-site. When I order floorboards, I allow 10% to 15% for waste depending on the degree of complexity.

Be proactive, not reactive

Monitoring moisture content with solid-wood flooring is critical to achieving a proper installation. Balanced moisture ensures a long-lasting floor without gaps or buckling. Before I have any flooring delivered, I make sure that the HVAC system is up and running, which will help control the interior

A clean slate. *Thorough inspection of the subfloor helps avoid oversights or surprises once installation begins. Be sure to address any voids or squeaks, and shim, scrape, or grind for flatness. Here, a roofing scraper removes drywall mud.*

PICTURE FRAME SETS THE STAGE

The picture frame around the hearth anchors the layout because it will determine where to snap the chalkline that guides the first course of floorboards.

Before I install the picture frame, I route a groove in the miters so that the joints can be splined together for extra strength. The boards are then buttered with glue and blindnailed tongue-side facing out with finish nails.

The first course of floorboards needs to be dead on, so they are glued and installed with the help of guide blocks that follow the chalkline. That way, I can make any necessary tweaks before entering a faster production mode, where errors can compound.

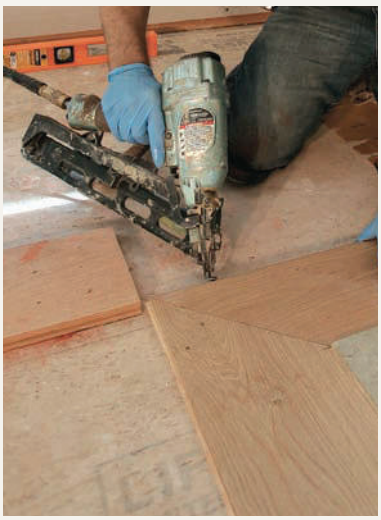
The starting line. *Butt a scrap board to the dry-fitted picture frame to establish a line of reference. Measure the distance from the line to the wall it runs parallel to, and check the wall for square. Repeat the measurement at the other end of the room, and snap a chalkline between the marks.*

Hold the line. *With the chalkline in place, tack a series of flooring scraps to the subfloor along the line—groove side toward the line—with finish nails. This prevents the first few courses of boards from creeping under the force of the flooring stapler during installation.*

Custom grooves. *A router with a standardized bit for cutting grooves affords strong joints and more flexibility with design. Here a groove is routed in each miter of the picture frame.*

Spline joint. *Spline material joins and reinforces the miters of the picture frame. This is a way to add strength and avoid face-nailing, which is unsightly and runs the risk of splits.*

Buttered bottoms. *Like the floorboards that will be installed across the rest of the room, the picture-frame boards are secured in part with Bostik's urethane-based hardwood-flooring adhesive.*



No face nails. *Blindnailing through the tongues of the picture frame with finish nails is all that's necessary to secure the boards until the adhesive sets up and provides a permanent bond.*

Measure moisture. *Ideally, the flooring has been on the job site to acclimate for at least three days. Before installing, use a moisture meter to make sure the flooring is within ±2% of the subfloor. This will avoid problems such as gaps and buckling down the road.*

humidity of the house. That way, the flooring has a chance to acclimate and stabilize before it's installed; best practice is to wait at least three days. This helps to prevent deformations that can be caused by an imbalance in the moisture content between the subfloor and the flooring.

Before scheduling a time to start installing, though, I make sure that the other subcontractors have finished any work—such as a hearth, threshold, or stair bullnose—that might affect my layout or the appearance of my installation. In doing this, I'm not only able to avoid a callback for a damaged piece or a hearthstone cut into my finished floor—which is bound to reflect poorly on the quality of my work—but it also allows me to control the final appearance of the job. For instance, by using a picture-frame detail around a hearthstone, I'm able to eliminate any awkward rip cuts on either side of the hearth and compose a balanced appearance around this significant focal point. □

Drew Rydingsword is the founder of Franklin Hardwood Floors in Roxbury, Conn. Photos by Aaron Fagan.

RUNNING AND GUNNING

With the first course down, it's faster to trowel glue directly on the subfloor than it is to apply it to individual boards. To reduce waste, trim boards to length by cutting off either less than 2 in. or at least 3 ft. Including pieces shorter than 3 ft. looks awkward with the long lengths we use. As far as patterning, I make sure that ends don't line up or align in a stair-step pattern, even if they're separated by a board.

Once a few courses are in, I remove the starting blocks and reverse direction with the help of a spline. If the last course looks like it will be less than 3 in. wide, I order extra boards that are wide enough to allow me to finish with a solid piece.

Trim to fit. *As floorboards are installed across the front of the picture-frame hearth surround, trim them as necessary to meet tightly. The picture-frame boards have the tongue facing out, so the floorboards meeting it are backcut with a 2° bevel and grooved with the router.*

Starter course. *Butter the first board with glue, and then secure it in place with a flooring nailer loaded with 2-in.-long 15-ga. flooring staples. For ¾-in.-thick plank floors, the nailing schedule is every 4 in. to 6 in. and 2 in. from the ends.*

And they're off. *Production begins with skip troweling glue every 2 ft. or closer. From this point forward, board selection is driven in part by where butts might appear, so as to create the most cohesive appearance possible. To keep things moving, butter ends from a neighboring line of glue, making these joints just as strong as end-matching. Backcutting with a 2° bevel ensures a snug fit.*

Reverse direction. *Purchased separately, spline stock is like a long piece of double tongue that can be cut to length and seated in a board to bring two groove sides together.*

Take it home. *Once the spline is stapled like a regular course, production now can begin in the reverse direction. The next course perfectly aligns with the picture frame.*

Flooring jack. *The flooring stapler won't fit close to the wall, so the second-to-last row of boards is held tightly in place with a flooring jack and then face-nailed sparingly.*

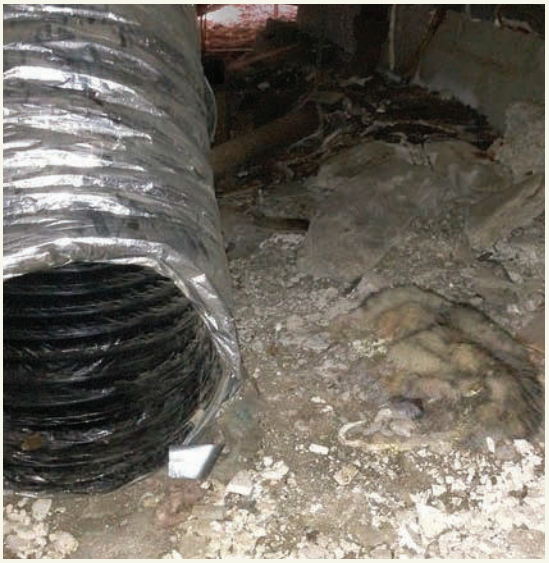
Expansion gap. *Leaving a ¾-in. gap between the flooring and any obstructions allows the planks to expand with moisture fluctuations.*

Bad Ducts = Bad Air

Higher energy bills and lower comfort levels aren't the worst effects of faulty ducts

ALLISON A. BAILES III

It's well known that leaky, poorly designed duct systems cost their owners money and comfort in multiple ways. However, such systems can also make the air inside the houses unsafe to breathe. Indoor-air quality (IAQ) doesn't get nearly as much attention as other green-building concerns such as energy efficiency, but it should be one of the highest priorities for anyone who breathes air and spends time indoors. I grew up with really bad asthma, which was often triggered by indoor pollutants. I know the importance of good IAQ. I've also learned a good bit of building science and know that these issues are interconnected.



It's what's in the air that matters. *A disconnected return duct in most any crawlspace is bad news. In addition to sucking in mold and pesticide residue, this one spices the air with the aroma of dead possum.*

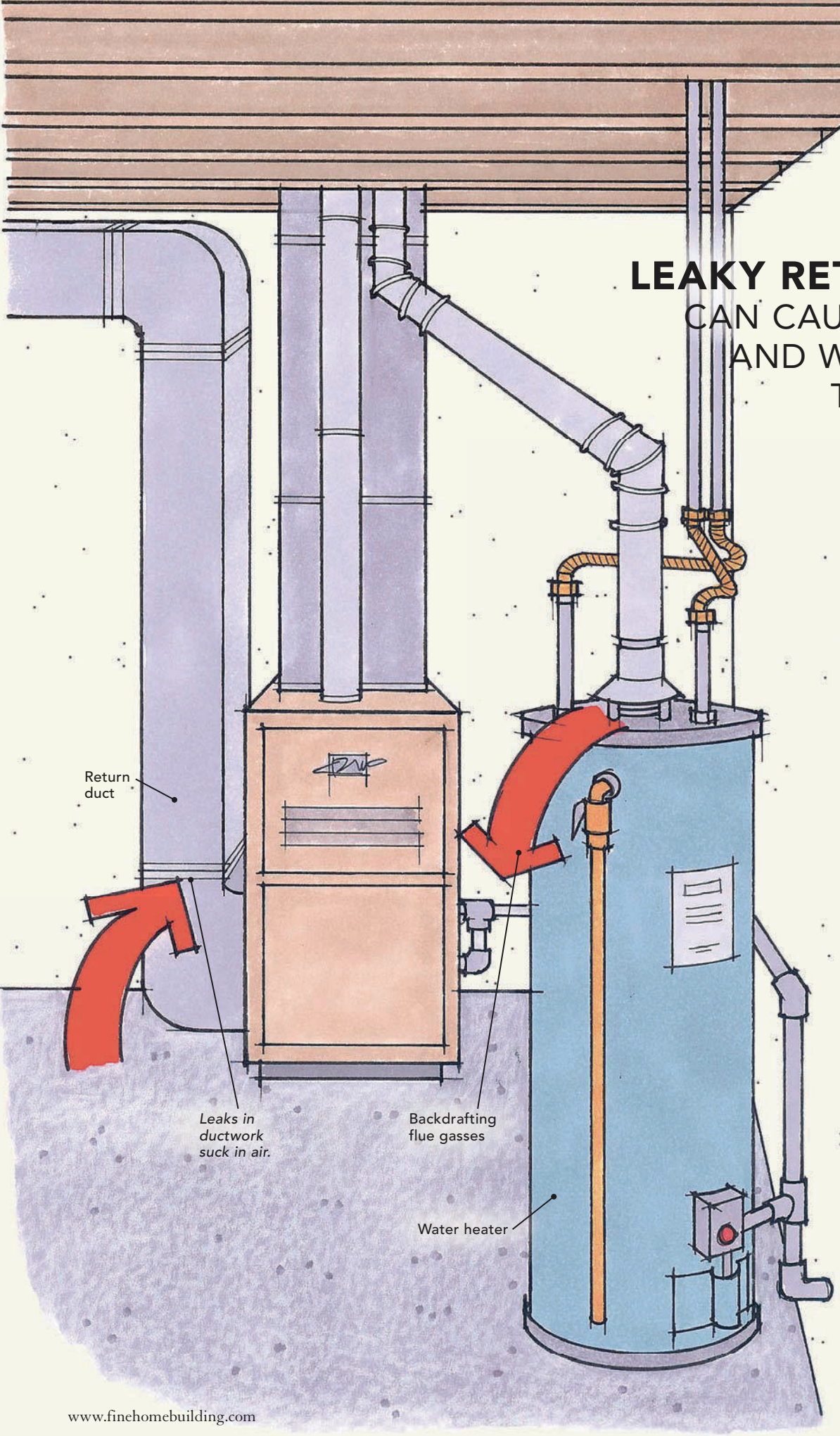
Ducts in forced-air heating-and-cooling systems do one of two things: They either supply conditioned (heated or cooled) air to the house, or they return house air to be conditioned. Both supply and return ducts connect to the air handler, which is essentially a big fan. Supply ducts connect to the side of the air handler that blows air, so they're under positive pressure. Between the air handler and the supply ducts is the furnace heat exchanger and/or the air conditioner's or heat pump's coils. Return ducts attach to the intake side of the air handler and run under negative pressure. Ideally, ducts should not leak. You also want them sized properly and installed well so that air moves through them efficiently. They should also be commissioned—that is, checked and adjusted at initial startup—by an expert to ensure that the system is balanced. In a balanced system, the same amount of air flows through the supply ducts as goes back through the return ducts.

If your duct system is leaky or unbalanced, air from spaces such as the attic, crawlspace, or garage is likely to find its way to your living areas. Think about what's found in those places: insulation fibers, rodent and insect feces (cockroach feces are a major asthma trigger), mold, pesticides, radon, and fuel vapors. In one case, a HERS (home-energy rating system) company I work with, E3 Innovate in Nashville, Tenn., found a disconnected return duct sucking up air in a nasty, vented crawlspace. That's bad enough by itself, but this particular crawlspace also had a dead possum lying close to that open return duct (photo left). Even the best filtration system would be hard-pressed to remove that putrefaction from the air.

Ducts are a critical component in maintaining IAQ. When installing an HVAC system, you'd be much better off getting less-expensive, less-efficient equipment and spending extra to get the tightest, most balanced duct system you can. Your lungs and your overall health will benefit, and you'll still probably win when it comes to saving energy and being more comfortable because your home won't be sucking in cold winter air or blowing out conditioned air.

Allison A. Bailes III, Ph.D., is a GreenBuildingAdvisor.com contributor and an energy consultant in Decatur, Ga.

Photo: Stefan Peter-Contesse. Drawings: Martha Garstang Hill.



LEAKY RETURN DUCTS CAN CAUSE FIREPLACES AND WATER HEATERS TO BACKDRAFT

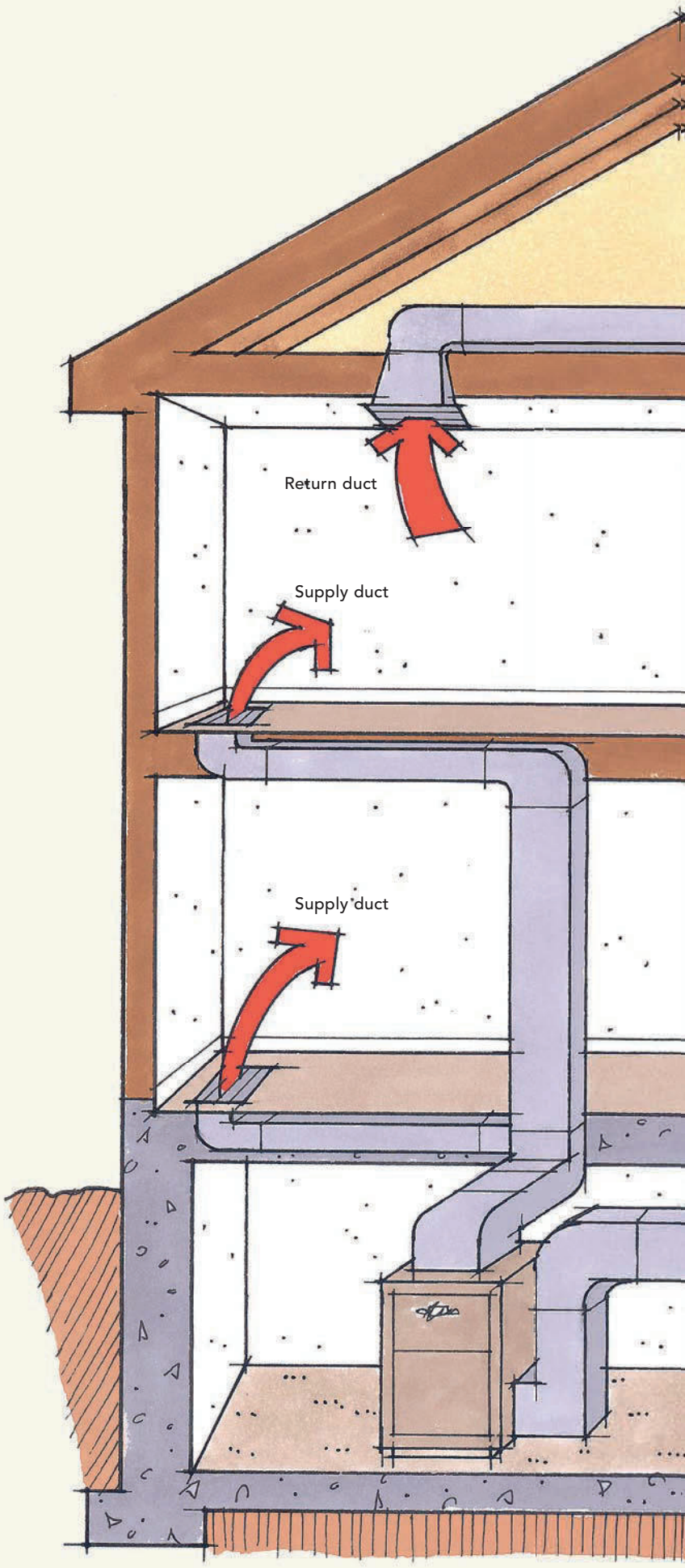
Duct leakage near a fireplace or a combustion appliance such as a water heater, furnace, or boiler can cause enough negative pressure to keep exhaust gases from rising up a flue. When flue gases can't exit, they backdraft into the house's air. Similarly, a clothes dryer (which forces indoor air to the outside by design) in the same room as the combustion appliance greatly increases the risk of backdrafting. Natural-draft appliances are more susceptible to backdrafting than power-vented appliances. Making matters worse, a backdrafting combustion appliance may not burn its fuel efficiently and is more likely to produce carbon monoxide. Carbon monoxide can kill. Lower levels can cause chronic health problems such as headaches and fatigue.

LEAKY RETURN DUCTS
SUCK UP BAD STUFF

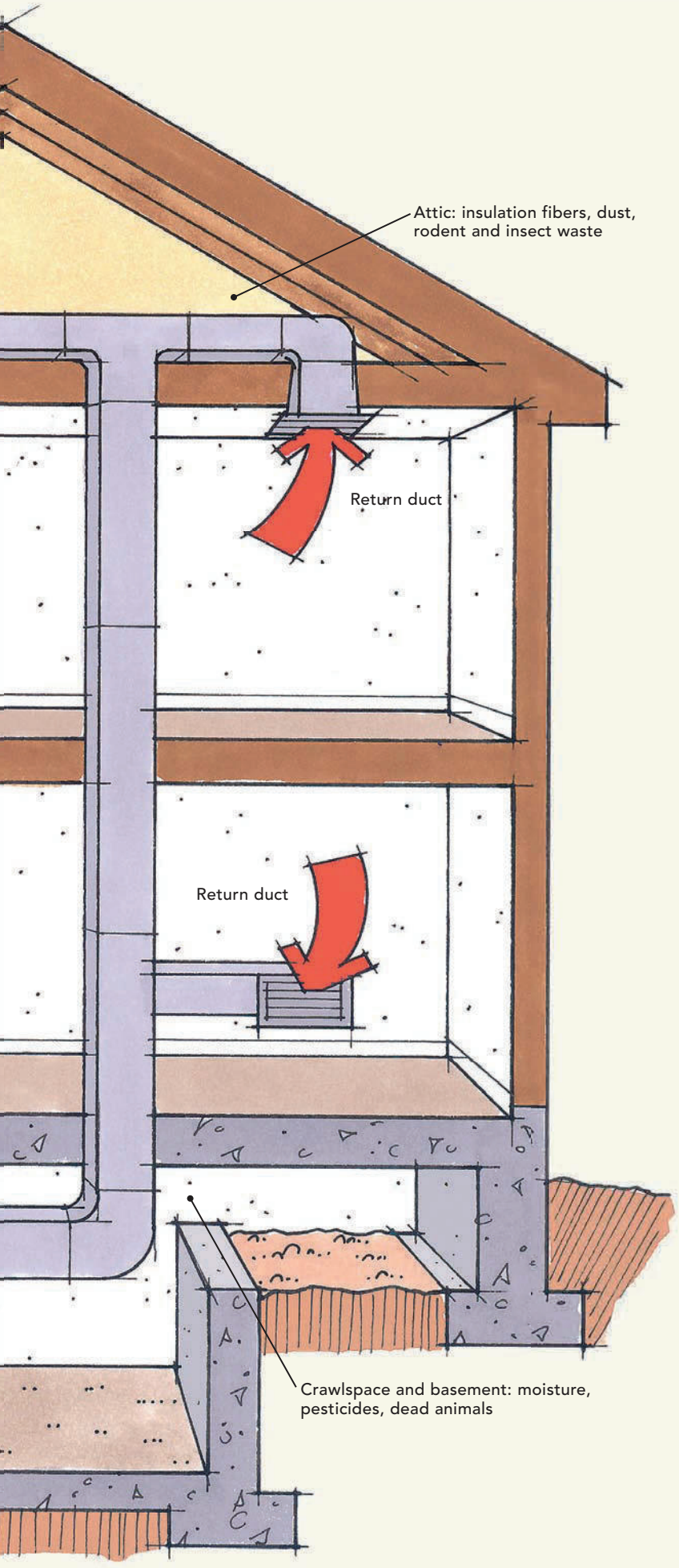
The most obvious way for a duct system to draw in bad air is through leaky return ducts, which often are placed in attics and crawlspaces. Leaks in ducts occur at unsealed joints and disconnected branches. Joints in ducts should be screwed together and sealed with mastic or with UL-181-listed butyl or oriented polypropylene (OPP) tape. Traditional cloth duct tape doesn't last and shouldn't be used. Panned returns, which are created by nailing pieces of sheet metal to the bottoms of adjacent floor joists, are another source of leaks. It's practically impossible to seal the sheet metal to the joists, never mind all the cracks and holes typically found in joists and floors. Panned returns are common in older homes.

Bad air can be pulled in at the air handler or furnace as well. Air-handler cabinets are notoriously leaky and are usually installed in an attic, basement, or crawlspace. Filter housings and filters are often worse. Taping over the seams and penetrations in the air-handler cabinet is an excellent practice that can reduce leakage. Upgrading to a thicker, pleated filter instead of using the standard 1-in. filter also helps reduce leakage because the housing for those larger filters is tighter and has weatherstripping at the door.

High indoor humidity, which can lead to mold growth, is a common consequence of leaky ducts in a damp crawlspace or basement. In humid climates, vented crawlspaces are especially bad places to draw air from, as that air is replaced with limitless quantities of humid outside air. Oversize air conditioners in particular are often overwhelmed by extra humidity. For an air conditioner to dehumidify, it's got to run long enough for the cold coil to condense moisture from the air passing over it. The longer an air conditioner runs, the more humidity it removes. Oversize air conditioners cool the air in the house quickly but shut down before they can dehumidify the air sufficiently. Despite that, oversizing is common. No HVAC contractor wants a callback for a system that doesn't cool the house sufficiently. In my experience, the typical new home gets a heating and air-conditioning system that's about two times too large.



Photos facing page: Allison A. Bailes III



Where ducts leak

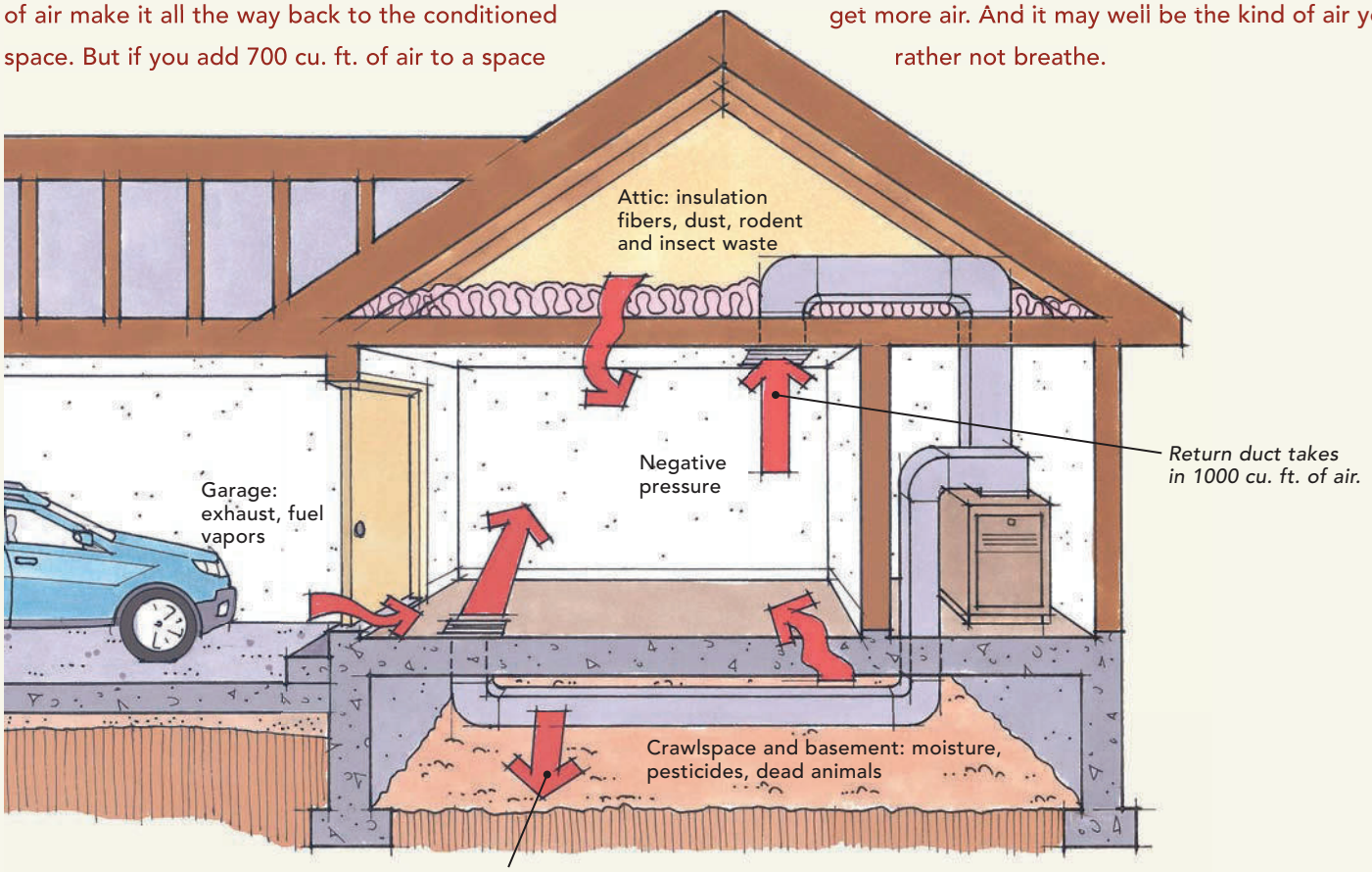
All panned return ducts leak. *Made with sheet metal nailed to the bottoms of joists, panned ducts are common in older homes.*

Standard filter housings leak. *There are usually big gaps around the filter that allow air from the space housing the air handler to enter the ducts.*

Expensive filters can leak, too. *Although they're usually sealed better than the cheap ones, high-efficiency filters can leak when improperly installed.*

LEAKY SUPPLY DUCTS CAN MAKE YOUR HOUSE SUCK

Not all the bad stuff happens in the return ducts; supply-side leaks can create IAQ problems as well. If a system's return ducts pull 1000 cu. ft. of air from the conditioned space, then the supply ducts should put 1000 cu. ft. back in. However, it's common for ducts to run outside the conditioned space in places such as attics or crawlspaces. If the supply ducts outside the conditioned space leak, maybe only 700 cu. ft. of air make it all the way back to the conditioned space. But if you add 700 cu. ft. of air to a space and take away 1000, you've got a negative amount. In this case, the conditioned space will be under negative pressure due to the unbalanced duct leakage. That negative pressure will suck those 300 missing cu. ft. of supply air from outside the conditioned space. The replacement air may be from the crawlspace. It may come from the attached garage. It may come from the attic. Somehow, some way, the house will get more air. And it may well be the kind of air you'd rather not breathe.



Commissioning an HVAC system

To be certain a new HVAC system (including the equipment and the ducts) works correctly, the contractor needs to test it, measure the results, and tweak the system appropriately. From what I've seen, this step is usually skipped. Some special tools and skills are required, so finding a contractor to do the work might be a challenge. A good place to start is with a local HERS rater. Here's a rundown of what commissioning entails.

There's a lot of measuring to be done: the temperature drop across the air conditioner's evaporator coil to be sure it's within the manufacturer's specs; the total static pressure to see if the ducts are too restrictive; the total duct leakage; the airflow from all of the supply vents and the airflow on the return side, which should be equal. In addition to measuring, finding and fixing any big leaks is a key part of commissioning.

If there's a mechanical ventilation system that draws in outside air, be sure there's an electronic damper to prevent the air handler from pulling in outside air when it's not supposed to. Measure the airflow to be sure the system is working as it's designed to.

Commissioning identifies problems, corrects them, and then makes sure the fixes work. Some contractors may object to this step, but they won't live in your house. You will. Protect your health by making sure your HVAC system is properly commissioned.

Gutting One Bath To Build Two

A contractor shares ideas for managing complex design/build projects

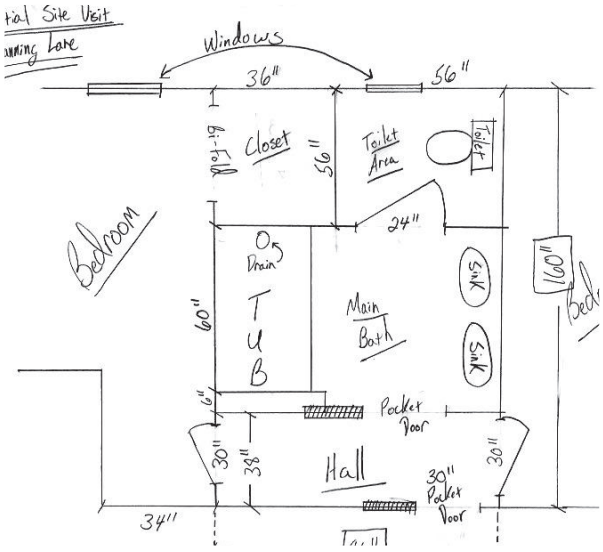
BY TYLER GRACE

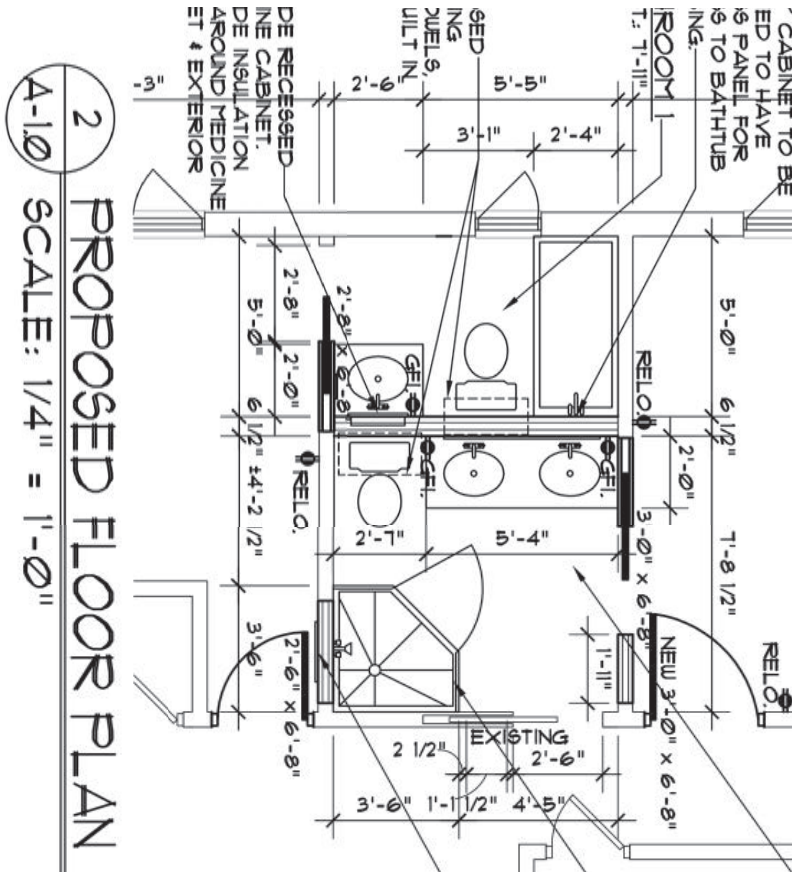
My favorite type of customer is a repeat customer because it typically means that we've had a positive experience working together and that we've already learned each other's habits and idiosyncrasies. So when homeowners for whom I had already remodeled a powder room approached me about reconfiguring their large upstairs bathroom into two bathrooms, I jumped at the opportunity. Due to the complexity of the redesign, I recommended that an architect create floor plans for the new baths as well as plumbing and electrical plans. My interior designer, Rachel Grace—who also happens to be my wife—then worked with the homeowners to select and specify all of the fixtures, finishes, materials, and decor.

Even with qualified help, a project like this can be complex. And remodeling projects are always happy to throw you a curveball; you never know what you might find when

FROM SITE VISIT TO AS-BUILT PLAN

Reconfiguring an existing space requires an iterative process that allows the designer to try ideas on paper and the builder to improvise on site. Here, I made a rough sketch on the initial site visit that allowed me to start estimating the project, but I hired an architect to design the initial plan. Taking into account the budget and site conditions, I then tweaked the architect's drawings to arrive at this as-built plan.





Sketch the existing space

I make a dimensioned sketch of the existing space at the initial site visit, which I use to create an initial quote. The sketch allows me to avoid frequent trips to the site with different subcontractors before even being hired for the job. If the quote is accepted, I will start scheduling separate site visits with subs to refine and finalize pricing and the scope of the work.

Let a designer do the design

I hired an architect on this project for several reasons. First, drawings would need to be submitted to the township in order to obtain permits, and those done by an architect would facilitate the permitting process. Second, sending a detailed schematic to subcontractors would make it easier to bid the project. Finally, it makes more sense to pay someone who designs on a daily basis to lay out the overall flow of a floor plan.

you start opening up walls, floors, and ceilings. I would also need to hire and manage subcontractors for the plumbing, electrical, and tiling. And given that we were designing two baths that would sit right next to one another, they needed to be both aesthetically distinct and complementary.

The existing Jack-and-Jill bath, which served the kids' bedroom as well as the guest bedroom, was worn and outdated. The floor plan was awkward and contained a ridiculous amount of wasted space. We couldn't take any space from the adjacent bedrooms, but by annexing some space from the hall and relocating a few doors, I was sure we could make two baths fit.

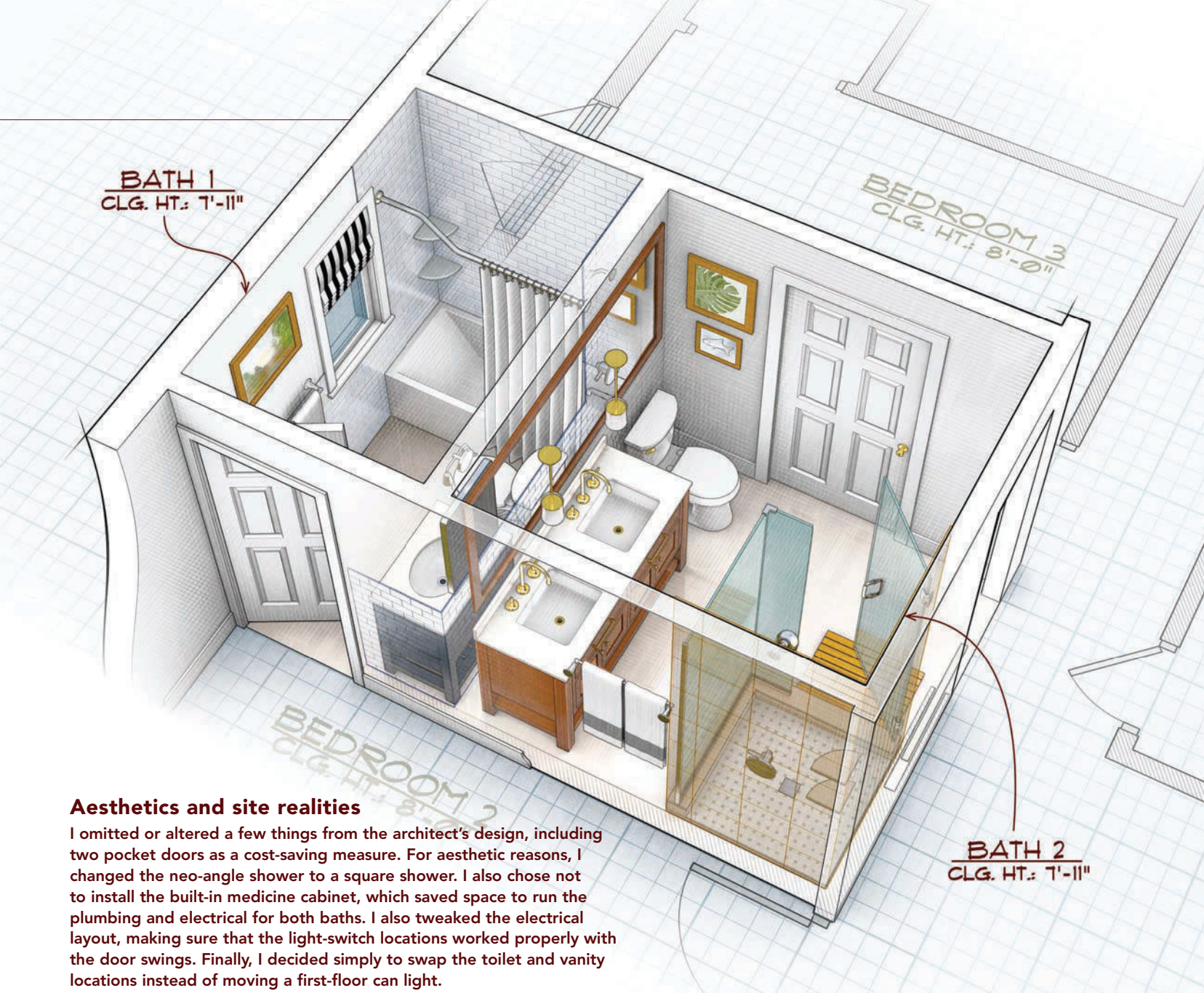
I often find that there are differences between a designer's perspective and a contractor's perspective, so after receiving the initial plans from the architect, I had some minor tweaking to do. Some of these changes were aesthetic, some were out of necessity, and some were to reduce the budget. Fortunately, the homeowners trusted me enough to allow me to make some adjustments to the design without continuing to consult with the architect (drawings above).

One change that we made to the design occurred after I gutted the space. When I removed the floor, I learned that there was a recessed light directly where the drain for the toilet in the front bathroom was planned. Rather than moving lights in the finished kitchen below, we chose to swap the vanity and toilet positions.

Working with others

I like to do the work of all the trades that I am legally allowed to do, including framing, drywall, and finish carpentry. If I am not legally qualified to perform the work, as is the case with plumbing and electrical, I generally decide where I think everything should be located before my subcontractors walk on the job. Then I get their expert opinions, and together we determine a final plan. I try to account for everything I can think of from day 1. Although this may seem over-

Drawings: this page, courtesy of the author; facing page, John Hartman



Aesthetics and site realities

I omitted or altered a few things from the architect's design, including two pocket doors as a cost-saving measure. For aesthetic reasons, I changed the neo-angle shower to a square shower. I also chose not to install the built-in medicine cabinet, which saved space to run the plumbing and electrical for both baths. I also tweaked the electrical layout, making sure that the light-switch locations worked properly with the door swings. Finally, I decided simply to swap the toilet and vanity locations instead of moving a first-floor can light.

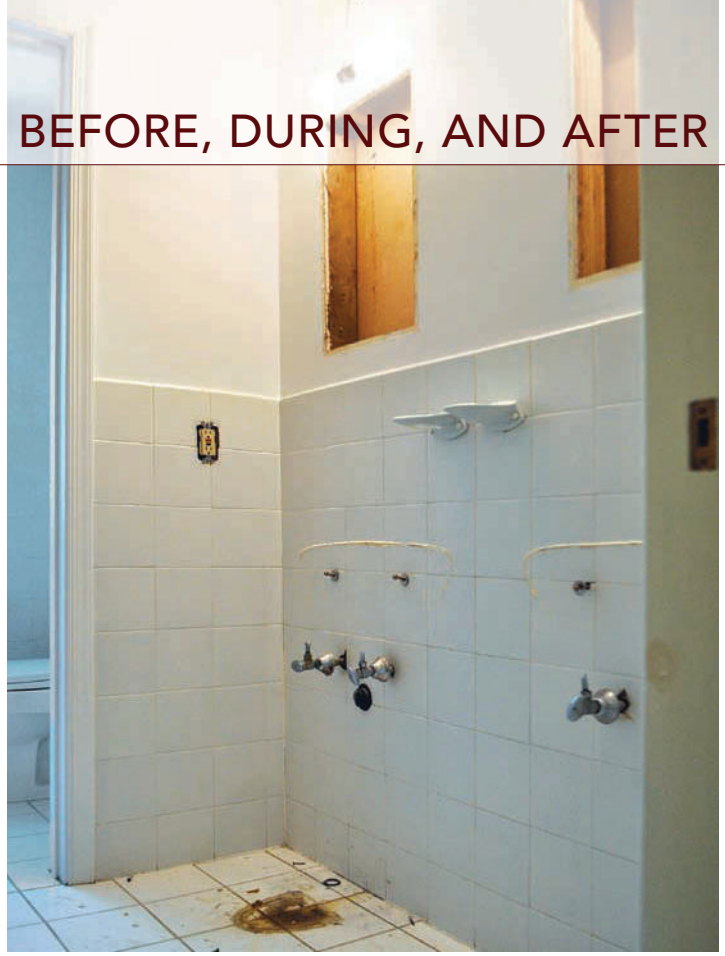
zealous, it saves me an unbelievable amount of time later on, and it yields results that are above average.

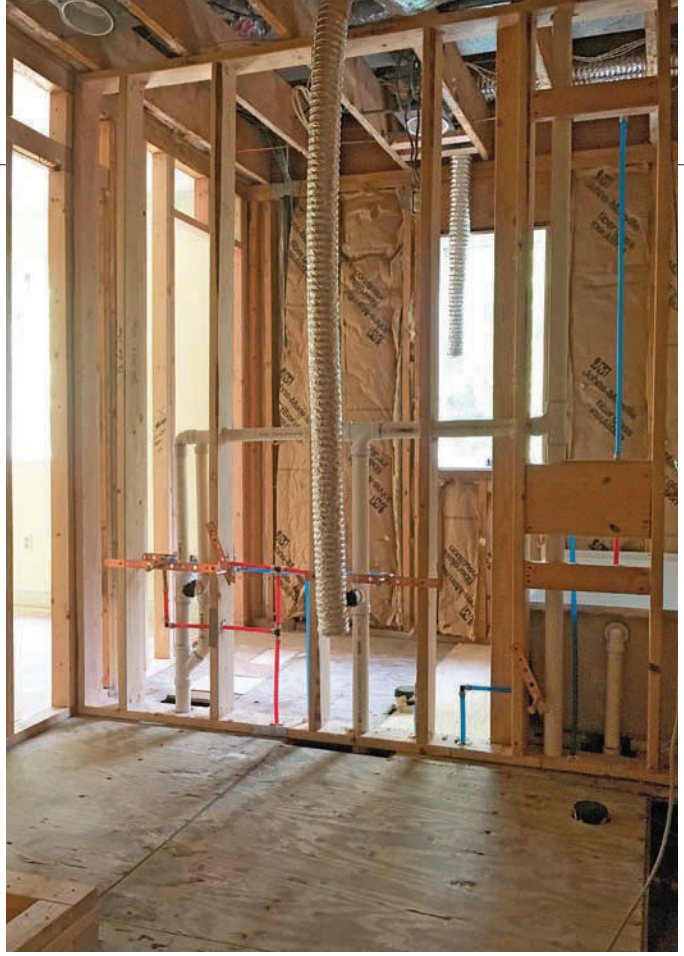
On this project, there was a lot of plumbing going into a relatively small space, so that trade was a priority. We were taking a bathroom with four plumbing fixtures, completely relocating them, and adding three more. When I framed the wall that separates the two bathrooms, I used 2x6 studs to make it easier on the plumber when he roughed in all of his supplies, venting, and drains. I also took the time to locate where the center of every fixture would be on both sides of that wall to ensure that none of the studs would have to be moved to install the plumbing.

Next, all of the electrical had to be relocated to work in the new baths and with the new door layouts. Using a permanent marker, I marked on all of the studs where I wanted boxes and on all of the ceiling joists where I wanted lighting and ventilation. When the electrician came, we went over this in detail. After making some minor adjustments, he got right to work roughing in the wiring.

I also had a tile subcontractor, but after this job and a few others, I realized it is not worth the headache of trying to articulate exactly what I need to be done on each job. I am quite particular about tilework and layouts, and it seems to make more sense just to do it myself. This is an obstacle that I have found when working with subcontractors. You have to be able to trust them enough to listen to your ideas, process your design, retain the information, and then install everything properly. I am on the job working everyday, and I find it difficult to manage my own tasks while managing subcontractors at the same time.

I brought in a floor-refinishing sub at the absolute end of the job so that I did not damage any of the finished flooring. He sanded, stained, and finished both bedrooms' hardwood floors with three coats of waterborne polyurethane, paying careful attention to the transitions where new doors connect the bathrooms with existing floors. After he was





Careful demolition for a clean, safe start

People think that demolition is easy, but if you're not careful, you can create more work than necessary. Floors need to be protected anywhere that people will be walking, not just in the immediate work area. Plumbing needs to be removed carefully to ensure that water does not end up in the living space below. Electricity needs to be switched off so that no one gets hurt. It's also a good idea to remove anything that is hanging on the walls in adjacent rooms. Clean and safe demo reduces the amount of damage and minimizes the mess.

Managing subs is part of the job

Communication is the key to good working relationships with subcontractors. I mark and label the locations of all electrical outlets, switches, and lights, as well as all plumbing fixtures, to make the process as simple as possible and to avoid any mistakes. I write out this information on paper, go over every detail with each sub in person, and tell the members of the team to call if they run into something they didn't account for. Together we work toward a solution that won't cost any of us our profits from the job.

done, I went back in and touched up the paint around the baseboards and doorjambs.

Materials make these baths sing

In the nearly 10 years that Rachel and I have been working together, we've come to appreciate and implement simple designs that allow for the finishes, trims, and fixtures to speak for themselves. This was our goal for these baths, which were designed around the floor material: a light, neutral-colored, faux-wood-plank ceramic tile. Using hues from this floor tile, Rachel created a cool bathroom and a warm bathroom.

Inspired by the cool tones of the saltwater pool visible through the window, Rachel chose a slate-gray vanity and bright polished-nickel fixtures from Restoration Hardware for the back bath. The walls have white beveled subway tile, installed up to the ceiling in the tub area and as wainscoting throughout the rest of the space. Installing the tile in this fashion and then adding crown molding made the small bathroom feel larger. Rachel also selected Mirabelle's Edenton soaking tub for its straight lines and minimal footprint. Minor details such as chrome-dipped lightbulbs in the vanity sconce and grayscale artwork reiterate the cool, simple theme.

Rachel and I have a design bucket list, and pairing brushed brass with walnut was high on that list, so we chose that combination in the front bath. We created a warm space there with the ceramic plank flooring and a custom walnut vanity and mirror. We focused on straight lines and simple proportions to allow the rich wood finish to speak for itself. With its moderately priced slab of white-diamond marble, Schoolhouse Electric brushed-brass hardware, Rohl's satin-gold Michael Berman faucets, and Cedar & Moss brass and stoneware pendants, the room glows.

What I love most about this career is the constant opportunity for growth and self-improvement. On each job, I'm faced with new challenges, from how to interact with clients, to how to manage subs, to how to approach the work once a space is gutted. This was a large project, and I can say that I drove off the job a better contractor and with clients who love their new bathrooms. □

Tyler Grace is a *Fine Homebuilding* ambassador and the co-owner of TRG Home Concepts in Haddon Heights, N.J. (trghomeconcepts.com). Photos by Courtney Apple, except where noted.

Photos this page: courtesy of the author

Interior design completes the process

Remodels like this are the result of a team effort coordinated by the general contractor. With the subs long gone and the final trimming done, it's possible to see the last aspect of a complete project: interior design. For that part of the job shown here, Rachel chose everything from tile and cabinetry, to countertops, to plumbing and lighting fixtures. The design builds upon the floor tile, which is the same in both baths. From there, however, each room has unique colors, fixtures, and materials.

Tool Test

18v Cordless Multitools

Modern batteries make this problem-solving tool even more useful

BY STEVE SMITH

As a remodeler, I use my oscillating multitool to cut, sand, and scrape in places where no other power tool can go. In recent years, modern high-capacity batteries have come to multitools, making them even more useful than the corded versions. Now you can set up quicker and can cut, sand, and scrape while working on ladders and in awkward spaces without having to drag a cord around.

Fine Homebuilding recently asked me to test 10 18v cordless multitools from all the major manufacturers. I used them in a variety of real-world settings: plunge cutting in hardwood, plywood, and melamine; scraping glue, silicone, and mastic; removing grout; and light sanding. I also tested their relative power by timing how long it took them to flush-cut 10 8d galvanized nails. To level the playing field, I used Imperial Titanium Storm blades on all the tools except the Fein and the Bosch, which only accept Starlock blades. On these two, I used Bosch StarlockPlus carbide blades. Both manufacturers' blades cut fast and lasted a long time.

Three tools stood out: the Fein, the Bosch, and the DeWalt, but Bosch's and Fein's proprietary blade-mounting system knocked them out of top billing because I don't like not being able to easily find blades that fit the tool. The DeWalt, which accepts blades from most manufacturers, performed at or near the top in every category, from ergonomics and power to quality of cut and ease of blade changes. It's also a good deal. For less than $200, you get a full kit with plenty of extras, which also makes it my best-value pick. □

Steve Smith is a remodeler in Seattle. Photos by Patrick McCombe.

DeWALT DCS355

BEST VALUE

PRICE $129; kit, $179 (DCS355D1)
WEIGHT 3 lb. 2 oz. **LENGTH** 12 in.

With precise and powerful cuts, fast blade changes, and great ergonomics, the DeWalt is a contractor's dream. Its LED lighting clearly illuminates the cut and stays on for 20 seconds after activation. Its oversize variable-speed trigger allows precise control no matter what your hand position. The kit version includes a depth stop, multiple blades, and twice as many sanding sheets as the nearest competitor.

BLADE MOUNT

DeWalt's pinch-grip blade clamp accepts C-style blades. The DeWalt and the Porter-Cable are the only tools tested that allow you to remove and install blades with only one hand on the tool. The tool also accepts conventional (Fein-style) blades with an adapter.

BOSCH MXH180BL

PRICE $215; battery and charger, $99 **WEIGHT** 4 lb. 2 oz. **LENGTH** 13 in.

This tool is a stellar performer. It has good LED illumination, intelligent controls, fast and efficient blade changes, and decent ergonomics. It's one of the slower cutting tools in the group, although it was faster than the Fein, which uses the same blade-mounting system. Having to use Bosch's or Fein's new blades will be a frustration for many, as the conventional blades made by aftermarket manufacturers won't fit.

BLADE MOUNT

Bosch and Fein partnered to create new blade-mounting systems: Starlock and StarlockPlus. A bottle-cap-looking mold on the blade mates with a socket on the tool head. Its ease and speed is matched only by the DeWalt's. The new blades also fit older Fein-style blade mounts.

FEIN AFMM18

PRICE kit, $349 (71292261090) **WEIGHT** 3 lb. 14 oz. **LENGTH** 13 in.

The only tool with a vibration-dampening housing, the Fein is quiet and comfortable to use. Unfortunately, it was the slowest in cutting through galvanized nails, although this sluggish pace was less noticeable when cutting wood. The tool's lack of a light was frustrating in low-light settings. Paired with Fein's rigid scraper, it excelled at scraping mastic off of plywood subflooring without damaging the surface.

BLADE MOUNT

Fein's Starlock and StarlockPlus blade mount (also found on the Bosch) is very sturdy. When a blade is snapped in, it is truly locked to the tool; there is no play whatsoever. The two tools only accept Bosch and Fein blades, but pricing seems consistent with other brands.

HITACHI CV18DBLP4

PRICE $192; battery and charger, $112

WEIGHT 4 lb. 5 oz. **LENGTH** 12 in.

With its brushless motor and electronic circuitry, the Hitachi provides smooth cutting and ample power. It has an LED, which provides a good view of the cut in low lighting, but it turns off immediately when you stop the motor. The Hitachi is the only tool with an auto mode that boosts power as cutting resistance slows the motor. The feature works well, but Hitachi's toolless blade-mount mechanism is a little frustrating.

BLADE MOUNT

Designed for conventional and C-style blades, the Hitachi has a unique two-step locking system. The mount holds securely, but the process is more tedious than other systems.

MAKITA XMT03

PRICE $119; kit, $251 (XMT025) **WEIGHT** 5 lb. 2 oz. **LENGTH** 14 in.

The Makita is a heavy tool and is solidly built. It provides vibration-free, accurate, and relatively powerful cuts. Its batteries charge the fastest (30 minutes for a 4-Ah pack) of the tools tested. Along with the Hitachi, it is the largest tool in circumference, and this made comfort and control of cuts in tight settings (e.g., inside cabinets) below par. Its lack of an LED and its threaded-spindle blade-changing mechanism were disappointments in a kit priced at $300.

BLADE MOUNT

The Makita accepts conventional and C-style blades. The release lever on the front of the housing locks open for easy blade changes and angle adjustments, but the spindle can be lost.

MILWAUKEE 2626-20

PRICE $99; kit, $300 (2626-22) **WEIGHT** 4 lb. 6 oz. **LENGTH** 14 in.

The Milwaukee makes precise cuts and has ample power. Its conical-shaped handle is the most comfortable of the larger-diameter tools, but its housing is the longest. Its light illuminates the cutting area well and stays on for about five seconds after the motor stops. The spindle-style blade mount is an improvement over hex-key systems, but the loose spindle can still be lost, and switching blades is not especially fast.

BLADE MOUNT

Milwaukee's spindle-style blade mount allows you to use conventional and C-style blades. You don't need to fully remove the threaded spindle when mounting C-style blades, so it's less likely to be lost. The blade-release lever locks open for easier changes and blade-angle adjustments.

PORTER-CABLE PCC710

PRICE $65; kit, $149 (PCC710LA) **WEIGHT** 2 lb. 10 oz. **LENGTH** 11 in.

The Porter-Cable has the same blade-mounting system as the DeWalt, but its kit costs $30 less than DeWalt's similar kit. Short and light, it is great in tight spaces. Given its size, the Porter-Cable is surprisingly powerful, cutting as fast as the heavier tools. Unfortunately, it is loud and transfers vibration directly back to the user. Its LED provides good visibility but turns off when you stop the motor.

BLADE MOUNT

As with the blade clamp found on the DeWalt, you squeeze the lever with one hand, freeing your other hand to remove or insert C-style blades. This style is the fastest, most trouble-free blade-mounting system of those tested. The tool accepts conventional blades with an adapter plate and machine screw.

RIDGID R862004

PRICE $99; battery and charger, $140 **WEIGHT** 3 lb. 14 oz. **LENGTH** 15 in.

In addition to an oscillating-multitool head, the Ridgid's body also accepts a compact reciprocating saw and a right-angle impact driver, both sold separately. As a multitool, it's powerful and precise, but it's also loud and vibrates more than most of the other tools. I appreciate the LED, but it casts a shadow that partially obscures the cutting path. Variable speed is controlled by the trigger only.

BLADE MOUNT

The Ridgid accepts conventional and C-style blades. Notably, both types are mounted without needing to remove a threaded spindle. A pair of magnets holds the blade while the clamp is tightened. After the DeWalt, the Porter-Cable, and the Starlock-equipped tools, this is the best toolless blade change.

ROCKWELL RK2863K

PRICE kit with one battery, $99 **WEIGHT** 3 lb. 2 oz. **LENGTH** 12 in.

Rockwell's Sonicrafter is small and light, but it provides decent power and a comfortable housing. The downsides are that it vibrates more than most of the others and the motor housing gets unusually hot with heavy cutting. This was especially apparent during the nail-cutting test. The twin LEDs provide a good line of sight for cutting. This was the least expensive kit in the test.

BLADE MOUNT

While not especially fast, the Rockwell's blade-change system minimizes the likelihood of a dropped spindle. The rotating lever on the top of the housing provides plenty of leverage and cinches down effectively on the blade. It accepts both conventional and C-style blades.

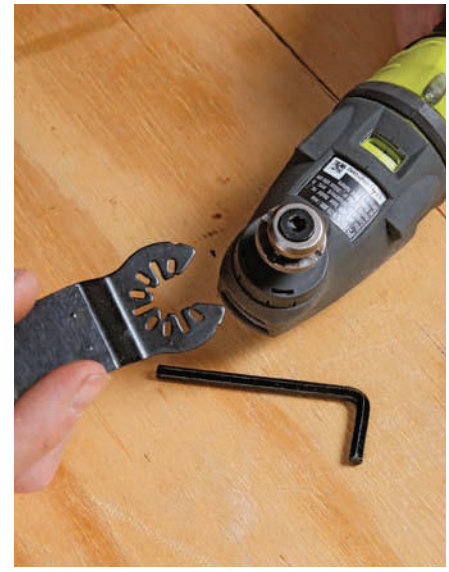
RYOBI P340

PRICE $69; battery and charger, $59 **WEIGHT** 3 lb. 11 oz. **LENGTH** 14 in.

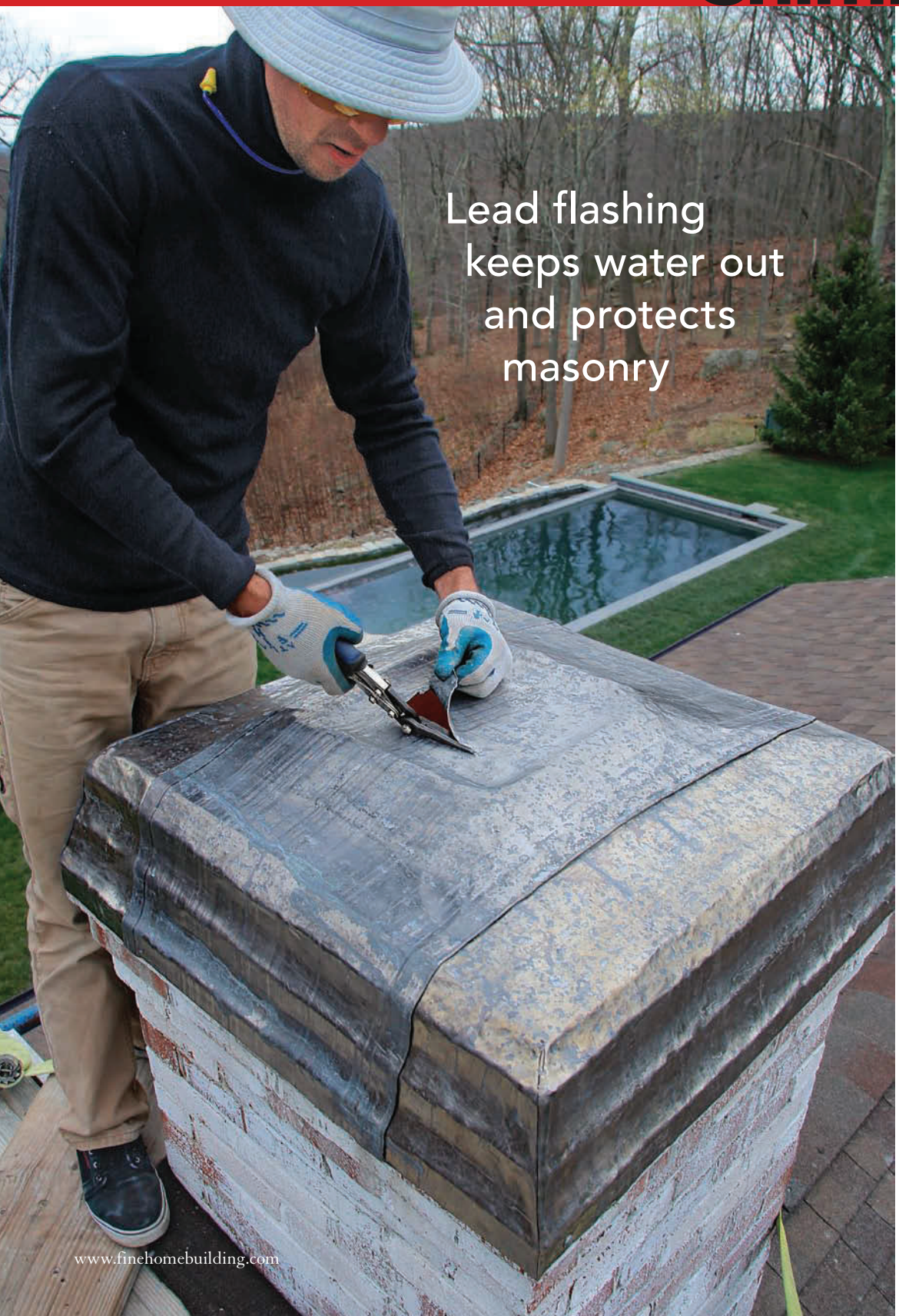
The Ryobi is priced for the contractor who rarely uses an oscillating multitool. It offers relatively precise cuts but has noticeable issues with power and vibration. It especially struggled during the nail test. The tool body is configured much like the Ridgid's and even accepts Ridgid's mini reciprocating-saw head and right-angle impact driver. (Both brands are owned by the same parent company.)

BLADE MOUNT

This is the only tool in the test that still requires a hex wrench for blade changes. The mount accepts both conventional and C-style blades. This tool has the slowest and least user-friendly of the clamping systems—not surprising, since this is the least expensive tool in the test.



Bombproof Chimney Cap



BY RYAN OLIVIERI

After a long winter, I often see the tops of chimneys disintegrating, sometimes to the point where entire courses of brick or stone have been loosened by daily freeze-thaw cycles. Eventually, I'll see towers of staging set up at some of these houses as masons replace half the chimney.

A good chimney cap keeps out the water that causes this damage, thus preserving the chimney top. A piece of bluestone standing on masonry legs is a common way to shield the delicate crown, but an alternative that I use is to cap the crown with sheet lead. Lead doesn't deteriorate meaningfully, so a chimney crown capped this way should have no end to its service life.

Contractor-oriented lumberyards stock sheet lead, and it can be found online. Lead is sold by the pound in rolls of various widths. (I use 2½-lb.-per-sq.-ft. material, which is 0.042 in. thick.) Even when I'm using a wide roll, I usually find it necessary to join two or three pieces by folding their edges together to span the full width of the chimney crown.

I always set up pipe staging for myself and a worktable. It makes the job easier in a way that shows through in the finished product.

Ryan Olivieri is a contractor from Roxbury, Conn. Photos by Andy Engel.

PREP THE CHIMNEY

Before you get the lead out, make any structural repairs the chimney needs. It's common for the mortar atop the chimney to be cracked and spalling, and for the flue tile to need trimming.

Chip off loose mortar. *Freeze-thaw cycles can crack and dislodge the mortar on top of a chimney. Remove anything that's loose, leaving only sound material.*

Cut the flue tile. *Use an angle grinder with a diamond blade to cut back the existing flue, leaving it 1 in. higher than the surrounding concrete cap.*

Parge the top. *Mix successive batches of fast-curing mortar, and apply it in layers to fix damaged spots and create a smooth transition to the top of the flue.*

STEP BY STEP

Flat-lock seams keep water out with no sealant

Flat-lock seams, consisting of several interlocking folds, allow sheets of lead to be joined with a watertight seal and to stay together when handled. Before seaming, cut the lead sheets a little longer than you'll need to drape down the side of the chimney. In this case, about 6 in. was allowed on each end. When considering width, for every two sheets you join, allow 3 in. to make a 1-in.-wide flat-lock seam.

Use hand-benders. *Mark the bend with a straightedge and a permanent marker, then turn up 1 in. of the first edge.*

Bend the second sheet. *Turn up 2 in. of the edge on the second sheet, and bend that over the first sheet's 1-in. up-turn.*

Finish the seam. *Crimp the bends together, and fold them flat. Hammer them together with a series of light blows.*

FIT AND FASTEN THE LEAD

Lead is soft and flexible, making it easy to form around irregular surfaces such as chimneys. The flip side is that it mars easily, so work gently.

Form the lead to the chimney. *Using hands and a no-mar hammer, gently mold the sheet to the masonry. A pin hole or two won't do any harm, but be careful not to tear the lead.*

Trim the corner. *Make a diagonal cut at the corner, then fold one side under the other. Trim the overlapping side, leaving just enough to wrap around the corner.*

Tighten the overlap. *Use gentle taps, trimming excess lead as needed, to snug the overlapping piece down. Cut the bottom edges with a knife and a straightedge, using snips on any seams.*

Fasten the edges. *ITW Red Head Hammer Set anchors driven into holes drilled near the corners and every foot or so along each side hold the lead in place.*

LEAD SAFETY

Lead goes bone deep

According to Mark Miller, a toxicologist with the National Institute of Environmental Health Sciences, lead is associated with a wide range of negative health impacts, with the most serious being neurodevelopmental effects in children. "That means exposure for children is of concern, but so is exposure for women of childbearing age or younger," he says. "Lead is stored in bone and becomes mobilized at the same time as calcium during pregnancy." In short, girls exposed to lead before they're of childbearing age can pass it on to their unborn children years later.

MAKE THE OPENING FOR THE FLUE

While most chimney caps won't have anyone looking at them closely, the work will be there for decades, so take the time to detail the job nicely.

Seat the lead. *Gently tap the lead sheet into the flue so that it laps down about ½ in.*

Cut out the flue hole. *Use snips to make the cut, leaving about a ½ in. of lead inside the flue.*

Exposure can happen not just on the job site but also through lead that's brought home on workers' skin or clothing. Most literature on lead safety focuses on work that creates airborne lead dust or breathable vapors, which working with lead sheets as shown here does not do. Handling sheet lead does call for some common-sense precautions, but mainly that means wearing disposable gloves.

There isn't much information available about any environmental effects from lead flashing. The U.S. Forest Service says in its online Facilities Toolbox, "Generally speaking, lead roofing or flashing that is in good shape may safely be left in place." Scrap lead is recyclable at some community recycling centers and at scrap yards.

An alternative to lead is soft zinc. It may not be as available locally, but you can buy it online (bestmaterials.com).

Double-Duty

This homemade box catches dust and provides power

BY ANDREW YOUNG

Carpentry is a dusty business. To make matters worse, many projects are done in occupied homes. So whether we carpenters set up in a client's garage or on the front porch, or we create a "clean room" somewhere in the house, we have to be as conscientious and proactive as possible when it comes to dust.

There's no question that capturing dust at the source safeguards the health of the workers, allows tools to run more efficiently, reduces cleanup time at the end of a job, and impresses the client. But switching a vacuum hose from one tool to another is about as efficient a solution as having just one extension cord for six separate tools. That constant need both to power our tools and to control the dust they create inspired this homemade vac box.

A combination of a cyclonic dust separator and electrical receptacles housed in a plywood box, this device has become the central hub for my company's on-site workspace. We don't waste time switching out power cords or vacuum hoses each time we want to use a different machine, and the cyclone separates most of the dust and debris before it reaches the vaccum, which extends the life of vacuum bags and filters and ensures that we never lose suction. And because finish carpentry demands a fine point for accurate marking, we've added what has turned out to be a crew favorite: a built-in electric pencil sharpener.

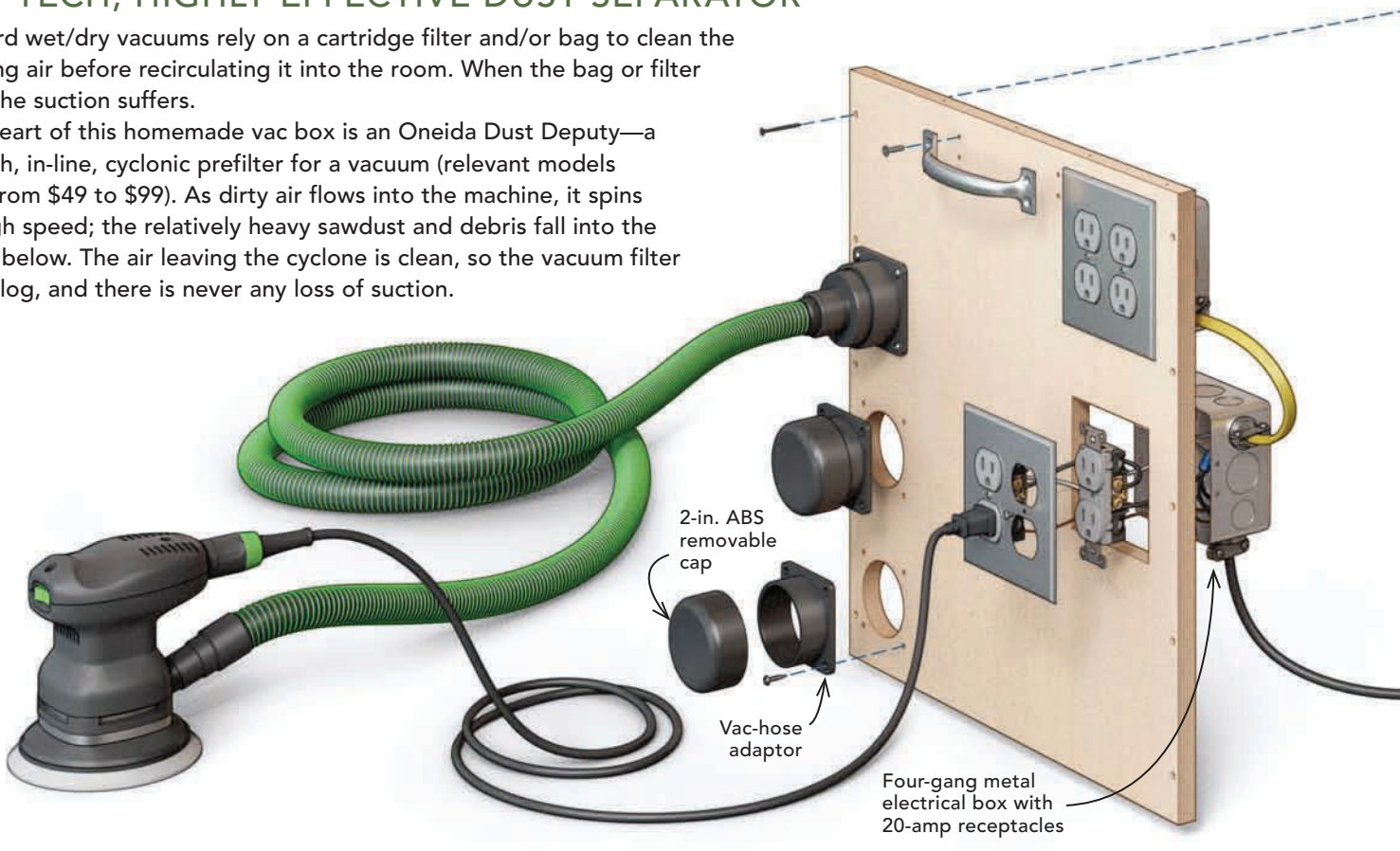
When connected to a powerful tool-actuated dust collector (we like the Festool CT 26), we now have constant power, automatic dust collection, and sharp pencils. What more could a carpenter want?

Andrew Young is co-owner of Young & Son Woodworks in Portland, Ore. Photo by the author.

LOW-TECH, HIGHLY EFFECTIVE DUST SEPARATOR

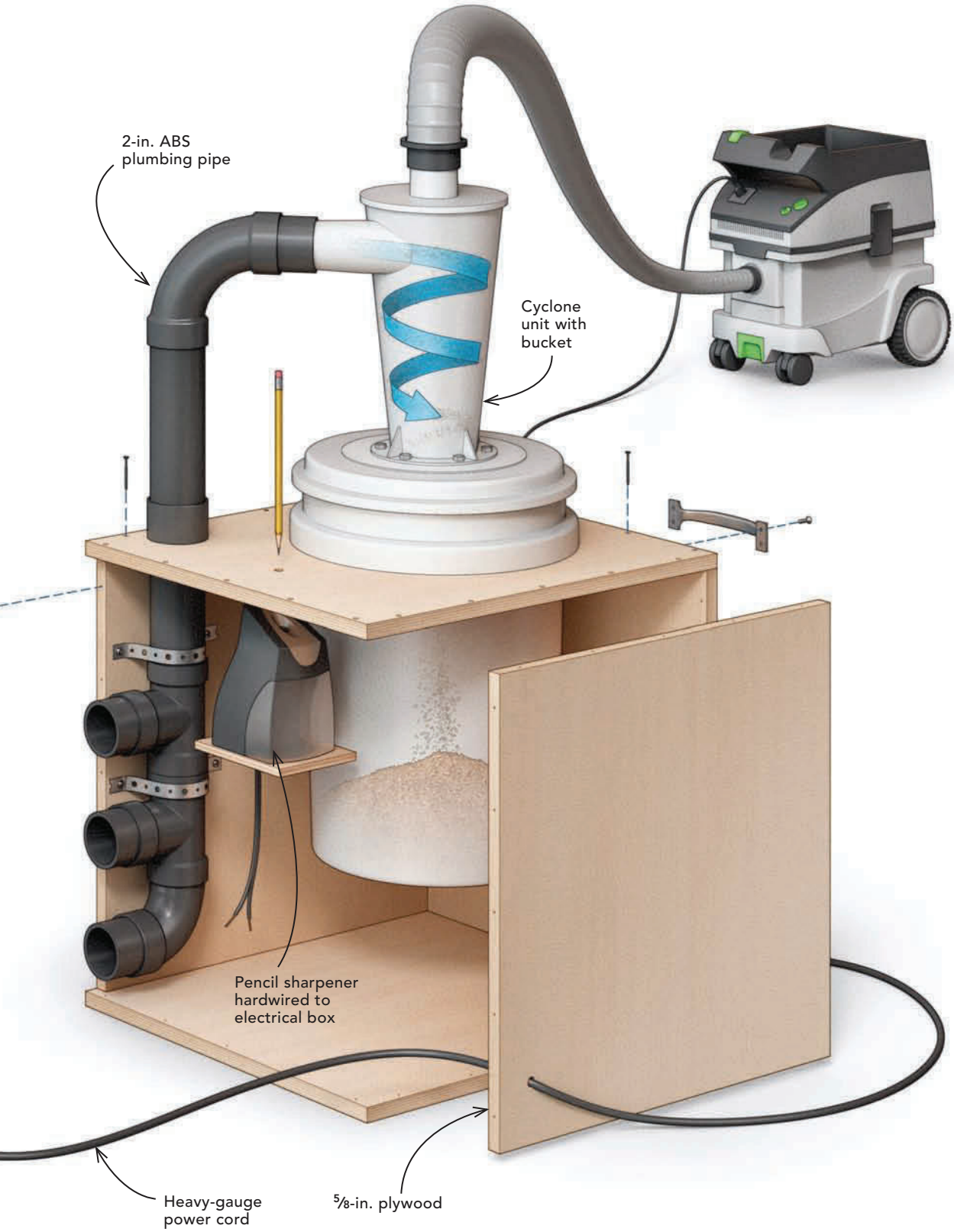
Standard wet/dry vacuums rely on a cartridge filter and/or bag to clean the incoming air before recirculating it into the room. When the bag or filter clogs, the suction suffers.

The heart of this homemade vac box is an Oneida Dust Deputy—a low-tech, in-line, cyclonic prefilter for a vacuum (relevant models range from $49 to $99). As dirty air flows into the machine, it spins at a high speed; the relatively heavy sawdust and debris fall into the bucket below. The air leaving the cyclone is clean, so the vacuum filter won't clog, and there is never any loss of suction.



Drawing: Christopher Mills

Dust Collector



Built from about half a sheet of plywood and some plumbing and electrical parts, this dust collector is light enough to be portable but heavy enough to keep the cyclone unit upright. When plugged into a tool-triggered vac, the box's onboard electrical outlets provide on-demand, centralized power for multiple job-site tools, which can be fed into the multiport vac inlets. When not in use, the cyclone fits neatly into a truck or van. The pipe arm can be removed and stored inside the unit along with the vac hose.

Paint Problems and How to Prevent Them

Knowing why paint fails is the best way to get a long-lasting, problem-free paint job

BY PATRICK McCOMBE

Although you've probably never thought about it, paint manufacturers don't actually make the ingredients that they use in their paints. Instead, they buy the components from chemical companies and combine them to their own specifications. To ensure that the paint companies are getting the best-performing ingredients, the chemical companies employ paint chemists to formulate and test paint in many ways, including real-world scenarios.

I recently had the chance to meet with employees from the Dow Chemical Company and a team of technical experts who test paint for the Paint Quality Institute (PQI) in a complex near Philadelphia. This "paint farm" has more than 40,000 samples and includes painted building materials ranging from vinyl and fiber-cement siding to steel bridge parts and weathered decking. The complex even includes special racking to hold some of the samples upside down to simulate how paints perform under porch ceilings and soffits, where they won't be washed by rain.

Because substrates and field conditions can be all over the map, the testers even apply paint samples to weathered primers and sunburned wood to simulate houses that have taken too long to get primed and topcoated.

Every few months, the samples are photographed with automated equipment and the photos are checked for changes in appearance. The samples themselves also receive regular visual checks for adhesion, fading, cracks, chalkiness, mildew, and dirt.

The insights gained from decades of testing (the oldest samples date to the early 1960s) have improved both performance and workability. The company's research also provides excellent guidance on how to solve most common paint problems, which are outlined on pp. 70-73.

Patrick McCombe is an associate editor. Photos by the author.

Drawing facing page: Toby Welles,WowHouse

WHAT'S IN YOUR PAINT?

4% Additives
Additives improve specific properties, such as mildew resistance and workability.

42% Binder
The binder helps keep the pigment in suspension and helps boost adhesion.

20% Pigments
Pigments are what give the paint its color and hiding ability.

14% Filler
The filler provides additional bulk and acts as a thickener.

20% Carrier
The carrier or liquid component allows the paint to spread onto the surface at the right consistency.

WHAT MATTERS MOST?

Inorganic trumps organic

Pigments can be broken down into two basic types: organic and inorganic. Organic pigments—which include bright blues, yellows, and reds—fade faster and don't cover as well as paints made with inorganic pigments. Inorganic pigments—which are usually mined minerals—make blacks, whites, barn reds, yellow ochers, and dark greens.

You get what you pay for

Additives are the most expensive components in a can of paint and have the biggest effect on its workability. *Rheology modifiers* help paint to go on properly and to resist spattering. *Dispersants* keep the pigments spread out so that they hide well. *Biocides* keep bacteria from forming in the can, and *mildewcides* prevent mold from growing on the paint film. *Defoamers* break down bubbles caused by shaking, stirring, and rolling. *Cosolvents* improve workability and allow painting at lower temperatures.

The more solids, the better

Solids are what's left behind when the liquid carrier evaporates. They give a paint its hiding ability and contribute to its overall durability. Quality exterior house paint has a solids content from 35% to about 45% by volume. Paints on the higher end of the scale cover better and last longer. You can find the exact percentage by checking the product data sheet on the manufacturer's website.

PAINT FAILURES AND

If a budget is tight, it's better to cut costs on interior paint than exterior paint. Rain, sun, and pollution all take their toll on outdoor paint jobs. Shady locations, especially those shielded from rain by porch roofs or overhangs, are also susceptible to mold and algae. All of these challenges play out at the Paint Quality Institute's outdoor test facility.

Alligatoring

Problem: Patterned cracking that resembles the skin of an alligator

Likely causes: Applying a hard rigid coating such as alkyd enamel over a more flexible coating such as latex primer; applying a topcoat before the undercoat is dry; loss of elasticity, which is part of the natural aging of oil-based paint

Solution: Completely remove alligatored paint by scraping or sanding, and then prime the surface with a high-quality oil-based or latex primer. Topcoat with an acrylic-latex paint.

Blistering

Problem: Localized loss of adhesion resulting in bubbles in the paint film

Likely causes: Applying oil-based or alkyd paint over a damp or wet surface; moisture intrusion; exposing latex paint to moisture shortly after the paint has dried

Solution: If the blisters go all the way to the substrate, remove the source of moisture and scrape away the blisters. Prime and repaint with acrylic latex. If the blisters don't go all the way to the substrate, scrape or sand them away and repaint without priming.

THEIR FIXES

Chalking

Problem: A fine powder on the paint film that causes color fading and results from weathering

Likely causes: Using a low-quality, highly pigmented paint; using interior paint in an outdoor application

Solution: Using a stiff brush or a wire brush, remove as much of the chalk as possible, then rinse with a garden hose or a pressure washer on a light setting. Check for remaining chalk by running your hand over the surface. If chalk is still present, coat the surface with a high-quality oil-based or latex primer, and topcoat with a high-quality acrylic latex. If little or no chalk remains and the paint is sound, priming may be unnecessary.

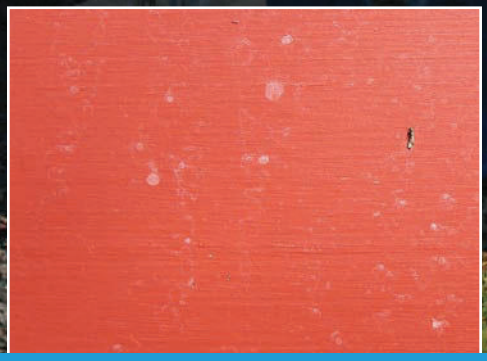
Cracking/flaking

Problem: The splitting of a paint film from aging, which starts as hairline cracks and progresses to flaking

Likely causes: Poor-quality paint with inadequate adhesion and flexibility; overthinning or overspreading; poor surface prep or failing to prime; hardening and brittleness of aged alkyd paint

Solution: Remove loose paint by scraping, wire brushing, or sanding. Feather any hard edges, and prime bare areas before repainting. Use a high-quality paint and primer to prevent recurrence.

PAINT FAILURES AND THEIR FIXES
continued



Efflorescence

Problem: A white saltlike substance that leaches from mortar or masonry as water moves through it

Likely causes: Failing to remove previous efflorescence before repainting; moisture intrusion from interior or exterior sources

Solution: Eliminate sources of moisture, then remove the efflorescence and any loose material with a wire brush. After rinsing the surface, let it dry completely. Cover any bare areas with a high-quality primer before topcoating with a high-quality house paint or specialty masonry coating.

Frosting

Problem: A white saltlike substance on the paint surface that can show up on any color paint but is less noticeable with white and light colors. It forms mostly under protected overhangs and porch ceilings that don't get washed by rain. On masonry, it is sometimes mistaken for efflorescence.

Likely causes: Using dark-colored paint with a calcium-carbonate filler (a common industrial mineral); using dark-colored paint over a primer with a calcium-carbonate filler

Solution: Often a stubborn problem, frosting is best removed by sanding (wood) or wire brushing (masonry). After a thorough rinse, let the surface dry, and then prime with an alkyd-based primer. Topcoat with a high-quality exterior paint.

Mildew

Problem: Black, gray, or brown areas of fungus growth on the paint surface or on nearby caulked areas that form most often in damp places with little or no direct sun, such as north-facing substrates

Likely causes: Using a low-quality paint with an inadequate mildewcide; failing to prime bare wood before painting; repainting a substrate where existing mildew wasn't removed; too thin of a paint film

Solution: You can test for mildew with a few drops of household bleach, followed by rinsing (shown above). If the discoloration bleaches away, it's most likely mildew. Remove the rest with a solution of one part bleach to three parts water. Pressure washing also works. Rinse thoroughly, prime bare areas, and then topcoat with a high-quality exterior paint. Such paints typically have more mildewcide than cheaper products.

Peeling

Problem: One or more layers of paint/primer falling off due to poor adhesion

Likely causes: Seeping moisture from leaks or failed caulk joints; moisture escaping through exterior walls, especially when the paint is oil-based; poor surface preparation; applying oil-based paint to a wet surface

Solution: Eliminate sources of moisture. Prepare the surface by removing all loose paint with a scraper or wire brush, and prime any bare spots. Repaint with acrylic-latex paint, which offers better adhesion and water resistance.

Poor hiding

Problem: The failure of exterior or interior paint to sufficiently cover the underlying paint or surface to which it's applied

Likely causes: Paints mixed with neutral or deep bases, which don't have as much titanium dioxide as paints mixed from light and medium bases and so don't cover as well; using a paint that's much lighter than the underlying surface, or using a paint with low-hiding organic pigments; application of a thinner coat than what's recommended

Solution: Start with a high-quality paint, which covers better than a lower-quality paint. If the surface is significantly darker than the new paint, it should be covered first with a tinted primer. Apply the paint at the manufacturer-specified spread rate, using the recommended spray tip or roller.

Tannin staining

Problem: Brown or tan discoloration caused by tannins within common wood species such as redwood, cedar, and mahogany

Likely causes: Skipping primer; using a primer with insufficient stain-blocking qualities

Solution: Correct any sources of excess moisture. After thoroughly cleaning the surface, apply a high-quality, oil-based, stain-blocking primer. In some cases, a second coat of stain-blocking primer may be necessary to hide the staining. Topcoat with a high-quality acrylic-latex paint.

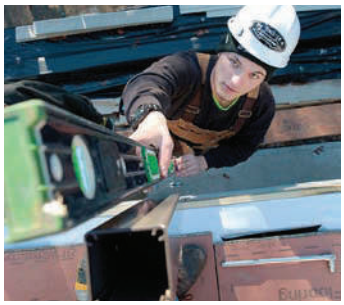
PRO HOME

Elevating the Standard of Building

The build team brings the project closer to completion in preparation for the reveal of the finished home

As winter blankets New England, final work on the ProHOME project in Rhode Island continues. Over the past four issues of *Fine Homebuilding,* we've covered each critical design and construction consideration in detail—from the logic behind the foundation, wall, and roof assemblies to the choices for claddings, mechanicals, fixtures, and finishes. Mike Guertin and his crew of helpers and students from the Warwick Area Career & Technical Center remain hard at work wrapping up the house. As we approach the reveal of the finished project, there is no more appropriate way to celebrate the completed home than by featuring it in our annual *HOUSES* awards issue. Look for the *HOUSES* issue, and its final coverage of the ProHOME, in your mailbox or on the newsstand this spring.

Photos by Brian McAward.



FOLLOW THE BUILD

Beginning with *FHB* #260, we've been exploring the theory and logic behind our demonstration home. Be sure to visit FineHomebuilding.com/prohome regularly to watch the construction of the house unfold and to hear expert insights straight from the design-and-build team.

WATCH our multipart video series highlighting every important step of the project.

GET UPDATES on the build and special events by following us, our project partners, and #proHOME on social media.

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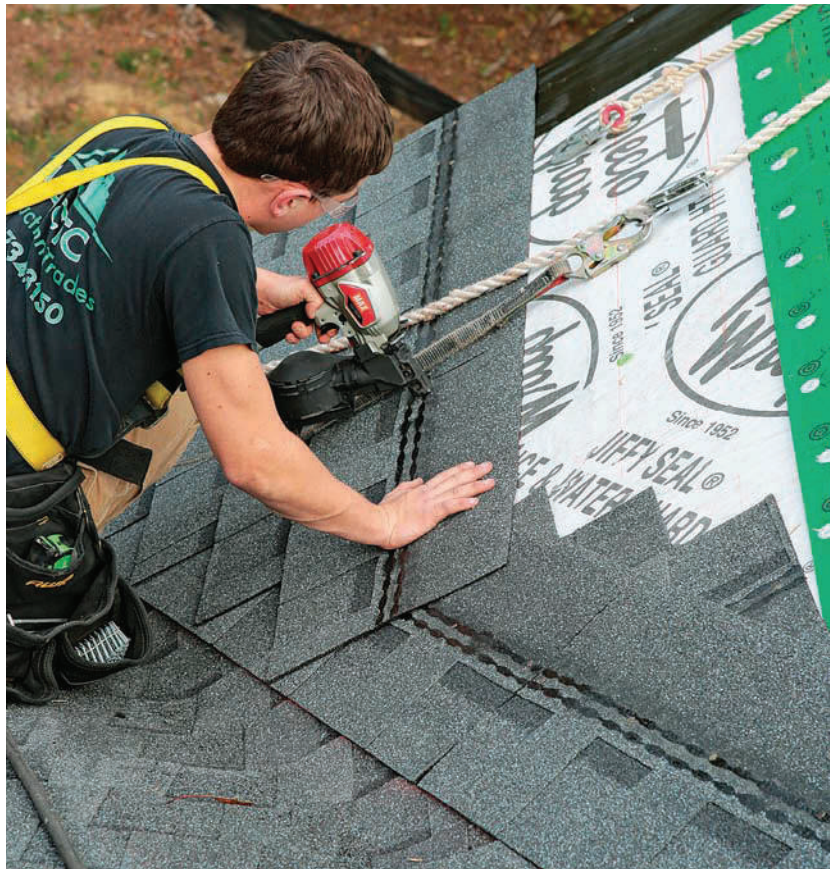
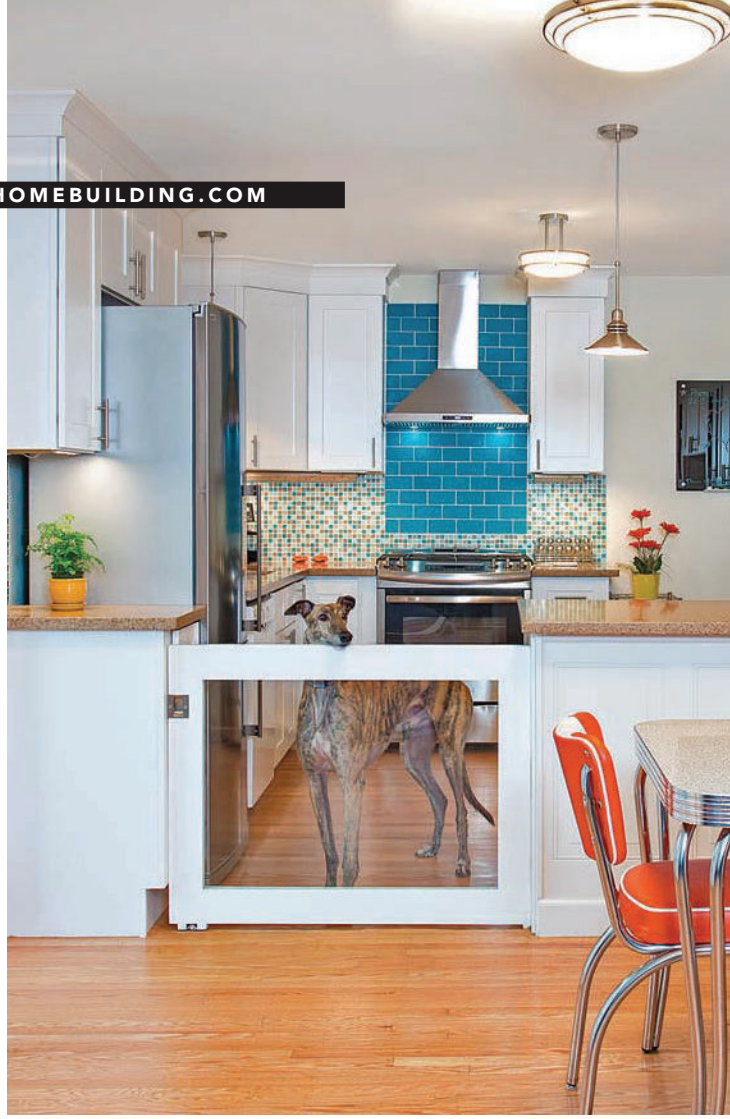


Doggone great kitchens



The most successful kitchen remodels result from thoughtful consideration of the needs and wishes of everyone who will be cooking, working, eating, and relaxing in what is often referred to as the heart of the home. Families with several chefs make sure there is plenty of space for two or more people to cook side-by-side comfortably. Active households appreciate a well-organized adjacent mudroom with plenty of space for storing coats, backpacks, and sports gear. In homes that include one or more four-legged family members, savvy kitchen designers are coming up with some clever accommodations for man's best friend. Here are a few of our favorite ideas from kitchens that have gone to the dogs. *—Maureen Friedman*

Lucky's got a room of his own

A kitchen remodel gave this busy family a much-needed mudroom. Situated between the kitchen and the new back entrance, the mudroom also has become Lucky the goldendoodle's hangout. Designed to accommodate a 2-ft. by 2-ft. by 4-ft. dog crate, Lucky's "bedroom" is tucked away under a set of drawers that hold his food, leashes, and other doggie necessities. A local metal artist designed the custom gate, which can separate the mudroom from the rest of the kitchen. The punched-metal design was inspired by the house's star-patterned hardware, and the same metal pattern was used on some of the kitchen cabinet doors. The gate operates like a pocket door. When open, it slides into the half-wall behind the dog-bed area. When closed, it's secured to the wall with a latch.

Architects Jean Rehkamp Larson and Ryan Lawinger, Rehkamp Larson Architects, Minneapolis, rehkamplarson.com

Contractor Quality Home Transformations, Bloomington, Minn.; qualityhometransformations.com

Photos Andrea Rugg Photography, andrearugg.com

Great gate for the greyhounds

Her clients were delighted when architectural designer Alexandra Immel removed a wall between their tiny kitchen and the adjoining dining room. Now one open and attractive space, the redesigned kitchen and dining area is more welcoming and conducive to cooking and entertaining. But the homeowners still needed a way to restrict the movement of their three large greyhounds. Reluctant to mar the sleek lines of their new kitchen with the plastic baby gate they had used in the past, they added a wood-framed tempered-glass door to separate the kitchen from the rest of the house. Functioning like a pocket door, the gate slides between the base cabinets and the back of the peninsula when not in use. A wheel mounted at the bottom of each end of the gate raises it off the floor, allowing it to glide back and forth with ease. Intended for dogs who won't be trying to open it, the gate is heavy enough that it does not need a latch to stay closed. If the gate were designed to keep small children safe, locking pocket-door hardware could be installed in the leading edge of the gate and where the gate meets the base cabinet.

Design Alexandra Immel, Alexandra Immel Residential Design, Seattle, alexandraimmeldesign.com

Contractor Rod Charlotte, Seattle

Photo Ross Anania, rossanania.com, courtesy of Alexandra Immel Residential Design

A place for the pups

When architect Jeffrey Pelletier remodeled his kitchen, he included some pretty sweet spots for his two small dogs, including an area under the kitchen island for their water bowl and a tilt-out cabinet above for their food.

Design Jeffrey Pelletier, Board & Vellum, Seattle, boardandvellum.com

Construction NRC Homes, Seattle, nrconstruction.com

Photos John G. Wilbanks, jwphoto.com, courtesy of Board & Vellum

Safe and secure. *The dogs love sleeping together in their cozy crate, but Pelletier didn't want an ugly metal one sitting in the middle of his nice new kitchen. He designed a custom crate that opens on two sides. During the day, the sliding gate is left off so that the dogs can relax in the crate and observe what's going on in the house while still feeling safe in their own little den.*

ask the experts

YOUR QUESTIONS—PRO ANSWERS

experts

Mike Guertin
editorial adviser

Steve Baczek
architect

Martin Holladay
senior editor

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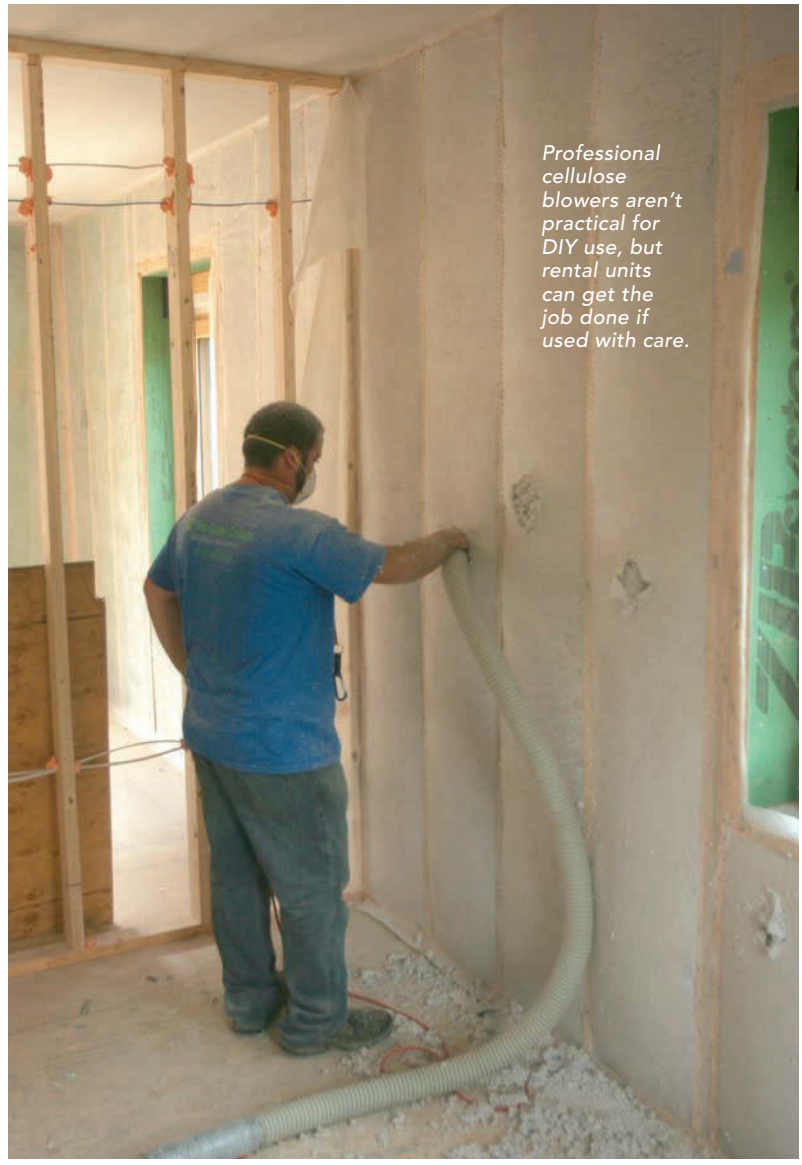
Cellulose blowers

In a recent "FHB Podcast" discussion, cellulose was mentioned as an alternative to foam insulation. As an architect, I've had good results using dense-pack cellulose on projects I've designed. But I'm curious about whether or not there's a DIY version. My understanding is that the blowers you can rent from the big-box stores don't provide enough power to dense pack. Is there a source for nonpros who want to do their own dense packing?

—MATT SEIDEL
via email



Professional cellulose blowers aren't practical for DIY use, but rental units can get the job done if used with care.

Martin Holladay: The cellulose blowers that professional installers typically use for dense packing are powerful, large, unwieldy, and may require a dedicated power source (a large generator). That's why it's hard to rent one. That said, with patience and attention, it's possible to use one of the less powerful rental blowers for dense packing. It's a skill that takes practice, though.

To begin, adjust the slide gate on the blower so that it's almost closed. This is to prevent the machine from bogging down. You'll need a 4-ft.-long, 2-in.-dia. aluminum tube to deliver the cellulose. Insert the tube into a hole in your InsulWeb netting that's about 4 ft. above the floor and in the center of the stud bay. Start in the lower corners of the bottom of the stud bay, and raise the tube slowly as the cellulose fills the bay. To ensure proper density, move the tube around from right to left as you raise it. You want the cellulose to pack so tight that the InsulWeb bellies out. (The bellies are later flattened with a special roller.) Once you reach the hole in the InsulWeb, move your tube to the top of the stud bay, and fill the rest of the bay in a similar fashion, from the top down.

If this process sounds tricky, that's because it is. It's best to learn the technique from an experienced installer. Here's a caveat: Under the best circumstances, using this approach with a rental blower allows you to achieve a density of about 3.2 lb. per cu. ft., a somewhat lower density than the 3.5 lb. per cu. ft. that most dense-pack installations aim for.

Photos this page: left, *FHB* staff; right, Justin Fink

Advanced framing

On a house I plan to have built, I would like to utilize advanced framing. If an architect designs a plan using advanced-framing methods, can a traditional builder follow those plans and build it correctly?

—DOMINIC GARZOLI
via email

Steve Baczek: I commend you on your decision to use advanced framing. I don't see a problem with using a traditional builder as long as that builder is willing to make the necessary adjustments.

Most advanced-framing methods are not a far departure from standard methods. There are some slight layout changes and some attention given to the efficient use of wood, but one of the strengths of advanced framing is that its implementation can be applied incrementally.

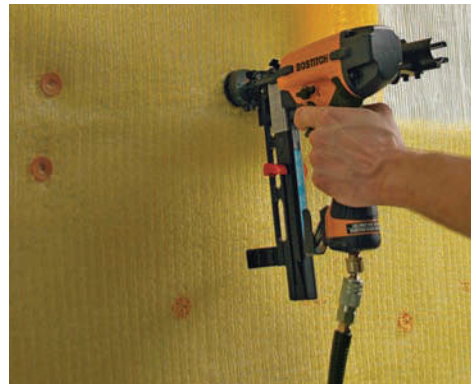
In cases like yours, managing expectations is the key to success. You decide with your architect to use advanced framing. Your architect designs the frame accordingly. Your builder is then tasked with the actual implementation of the architect's concept. As the homeowner, you're expecting that the hard work of the architect and the builder results in a successful, well-performing home. Each party is expecting the next party to be successful, with the circle closing back on you. I suggest at a minimum that the builder and the architect have a meeting or two to clarify concepts and procedures and to manage expectations. It wouldn't hurt for you to jump in on those meetings, too.

Advanced framing can be executed by any competent builder willing to learn and follow the techniques.

Stapled housewrap

I will be attaching housewrap to ½-in.-thick plywood wall sheathing, but my cap stapler shoots 1-in.- to 1½-in.-long staples. Should I be concerned with all the staple legs poking through the sheathing and into the blown cellulose in the wall cavity?

—ADAM PETERSON
via GreenBuildingAdvisor.com



M.H.: I assume you've confirmed that your cap stapler isn't compatible with ½-in. staples, but regardless, I wouldn't worry too much about the protruding staples. If they will bother you, though, it shouldn't be too hard to figure out where the studs are and to place the staples so that they go through the housewrap, sheathing, and into the studs. If you are installing furring strips for a rain-screen gap, you need to know where the studs are anyway.

Fixing a squeaky floor

I live in a four-year-old ranch with a full basement. A loud and worsening squeak has developed in the middle of the master-bathroom floor. The floor is tiled, and the basement ceiling is drywall. I plan to remove a section of drywall to access the bottom side of the floor, but how should I fix the squeak?

—TONY BLAIR
Belmont, Maine

Mike Guertin: Squeaks are often the result of movement of the subfloor sheathing around a nail, but they also may be caused by loose joist blocking or other wood-to-

Photos this page: left, Daniel Morrison; right, Justin Fink

wood or wood-to-pipe movement. This can happen as framing dries out and spaces develop or fasteners loosen.

Pinpointing the squeak is always a challenge. After you've removed the drywall from the bottom of the joists, you can have someone walk on the floor above while you try to locate the precise spot where the noise is coming from. Then you have to fill any gaps, even tiny ones, where the two components making the noise come into contact. I've had success applying subfloor adhesive to the joints between joists and blocks or between joists and subfloor sheathing. Try getting the adhesive to flow into larger gaps. You can help it to do so with a knife blade or other thin piece of metal. Finish with a bead of adhesive along both sides of the joint. When the adhesive cures, it should stop the movement between the building components.

An alternative to using subfloor adhesive is to apply a small bead of two-part high-density spray foam alongside the components suspected of causing the squeak. So that you can test the effectiveness of the repair, wait a few weeks before reinstalling drywall on the ceiling.

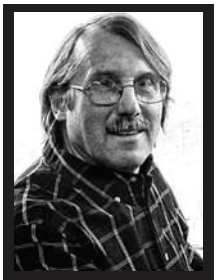
Calculating maximum load

The roof on my 25-ft. by 30-ft. garage has a 4-in-12 pitch, and the rafters are 2x8s spaced at 16 in. on center with 2x8 rafter ties spanning every other rafter running along the 25-ft. dimension. There is no blocking between the rafter ties, and there are no other truss members, collar ties, or stringers for rafter-tie support. There are 4x8 sheets of plywood on the ties. How much weight would this storage area hold?

—MIKE CRAWFORD
Woodridge, Ill.

M.G.: There are many variables—such as the lumber species, the grade of the lumber, and the age of the lumber—that factor into calculating the amount a floor or ceiling system can carry. Regardless of those variables, though, the rafter ties in your garage are too overspanned to carry any loads. Even the most generous span for 2x8 ceiling joists on 24-in. spacing is 17 ft. Also, the rafter ties are typically slash-cut at the ends to fit under the slooped roof ceiling, which may reduce their bearing capacity further.

BY MARTIN HOLLADAY



"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.

How much insulation is too much?

Adding insulation in a house saves energy, but with each extra inch, the savings per inch diminishes. At some point, the cost of adding more insulation becomes hard to justify.

At this year's BuildingEnergy conference in Boston, three energy experts explored two questions regarding high-performance houses: At what point are envelope improvements a waste of money? And what metrics should we use to determine when enough insulation is enough? One point to these questions was to determine whether the thick levels of insulation required by the Passive House standard, an approach to superinsulation developed in Germany that is gaining traction in the United States, were justified. Because of the declining cost of PV, all three reached the same conclusion: They are not.

The three presenters were David White, an energy consultant from Brooklyn; Marc Rosenbaum, director of engineering at South Mountain Company in Massachusetts; and Rachel Wagner, a designer at Wagner Zaun Architecture in Duluth, Minn.

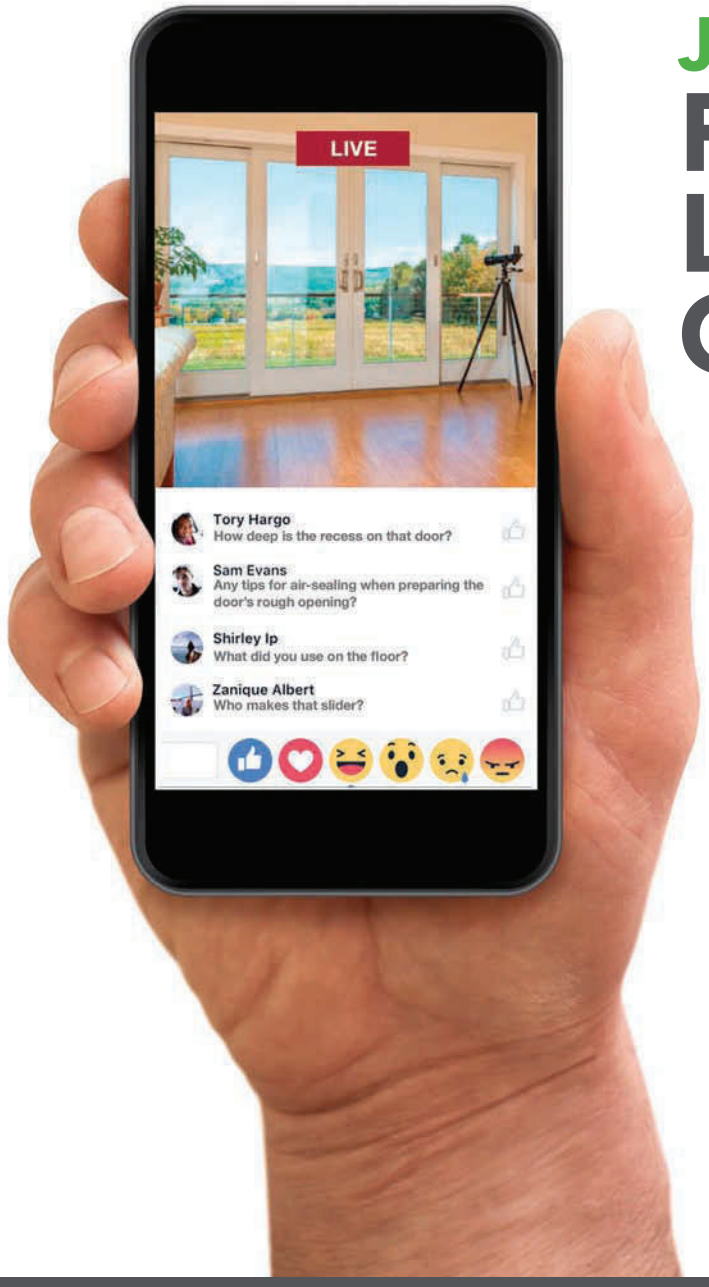
The net-zero approach

White introduced a case study of a new construction project in Huguenot, N.Y., a location in climate zone 5 with about 6000 heating degree days. The owners were aiming for net-zero-energy use, where a combination of insulation and site-produced energy create an energy-independent house. White was a consultant on the project.

White started by comparing the annual energy savings attributable to a proposed envelope improvement—for example, upgrading from 4 in. of subslab foam insulation to 6 in.—with the annual energy production of a PV system costing as much as the proposed envelope improvement. If the proposed envelope improvement would save less energy than the energy produced by a PV system with the same price tag, then the proposed improvement wouldn't be worth it.

In this case study, the criteria were somewhat flexible. "We were aiming for a marginal payback of about 25 years," White noted, "and we chose some measures that had a payback of 25 years even if the measures cost more than PV." While White didn't explain his rationale for choosing the more costly options, typical reasons for such upgrades include providing insurance against future energy-cost increases, provid-

Photos: left, courtesy of Karyn Patno; right, Andy Engel



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ing greater comfort or resilience, acknowledgment that insulation has a longer life than PV modules, and insurance against future changes in net-metering agreements.

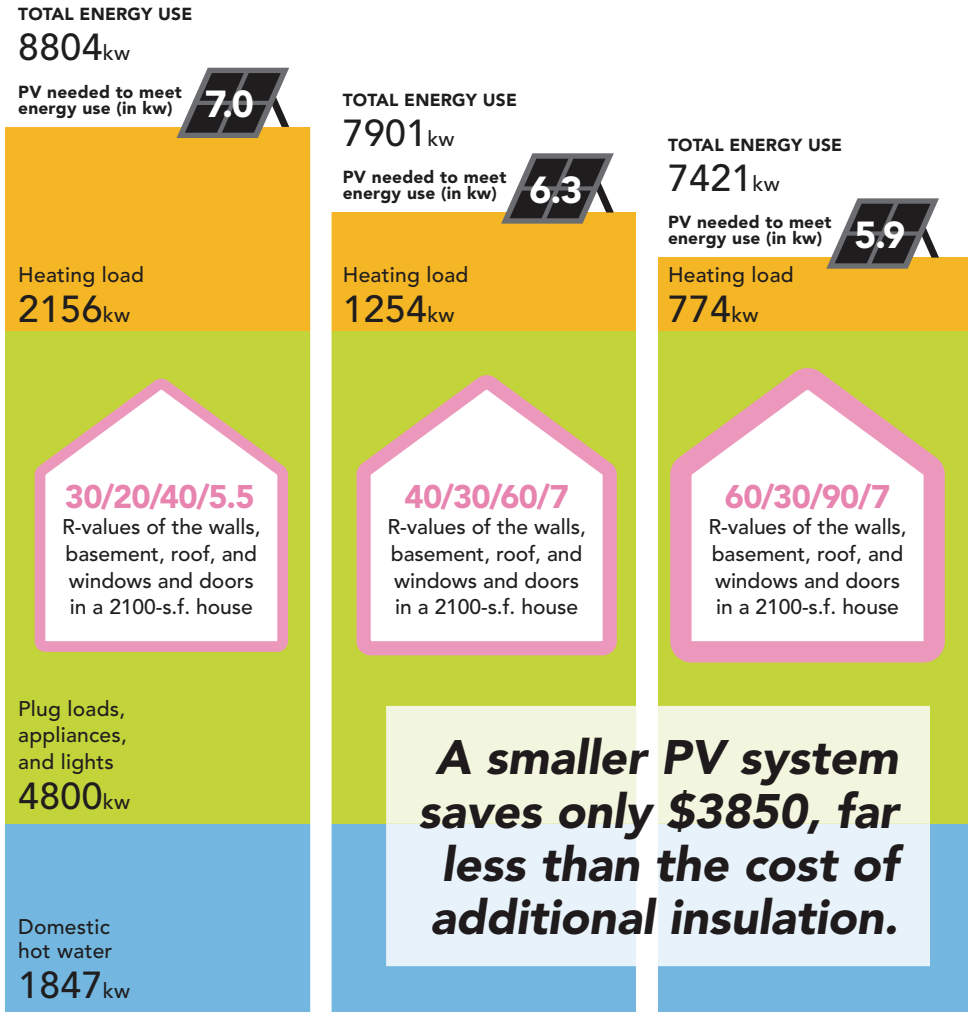
White performed the calculations two different ways, using the unsubsidized PV cost of $4.35 per watt and then with the actual PV cost of $1.26 per watt, which reflects available rebates and tax credits. "Subsidized PV was much cheaper than every [energy] measure we looked at," said White.

After performing these calculations, White's team made a few commonsense adjustments to favor envelope improvements that cost a bit more than PV, settling on the following specifications: 6 in. of EPS under the slab on grade; 8½ in. of mineral-wool batts in the walls; and 16 in. of cellulose above the ceiling.

White's team examined whether meeting the Passive House standard made sense, and concluded it did not. White explained, "Getting this house to the Passive House standard would require doubling R-values on all sides, using the most expensive Passive House windows available in the U.S., installing a Paul ERV [a high-end unit], and creating a tighter enclosure. The energy saved by these measures could be generated by 0.8kw of PV [at an unsubsidized cost of only $3400]." Clearly, the cost to reach Passive House would have been much greater than the value of the energy saved.

ENERGY USE IS MORE THAN HEATING

In high-performance houses, heating actually consumes a relatively small percentage of the total energy used. Improving the thermal envelope only affects heating costs, while those for domestic hot water, lights, plug loads, and appliances remain constant. These three examples are from Marc Rosenbaum's models of possible envelope configurations for a hypothetical house in climate zone 6.



It's not about space heating

The next speaker was Marc Rosenbaum, who noted this about most of the high-performance residential projects that he has been involved with: "The heating load is a small percentage of the home's total energy use. The point is, you think that heating is what you have to deal with. But really, if you are paying attention to heating, you also need to be paying attention to other things—hot water and plug loads."

Although designers of high-performance houses often factor in the heat generated by electric devices, Rosenbaum warned that they shouldn't assume that all of the electricity used by lighting, appliances, and other plug loads reduces the home's heating load. "Clothes-dryer electricity doesn't go to offset heat," he said. "Well pumps don't go to offset heat."

As a case study, Rosenbaum looked at a hypothetical house in Concord, N.H. (climate zone 6) measuring 24 ft. by 36 ft., with 2½ stories and a full basement. He assumed the use of a heat-pump water heater with a coefficient of performance (COP) of 2.5—meaning that the heat pump produces 2.5 times as much energy as it consumes—and the use of minisplit units with a COP of 2.5 to provide space heat. He also assumed that the occupants would use 400kwh per month for plug loads, lights, and appliances, with 50% of the electricity use offsetting the space-heating load. Rosenbaum explained that 400kwh is low but not unreasonably so for a homeowner who wants to get to net zero and so is paying attention to electricity use.

Rosenbaum then looked at nine high-performance scenarios, beginning with R-30 above-grade walls, R-20 basement walls, R-40 roof insulation, R-5.5 windows and doors, and an air-leakage rate of 0.66 ACH50. Seven more scenarios led up to an extremely well insulated envelope, with R-60 above-grade walls, R-30 basement walls, R-90 roof insulation, R-7.0 windows and doors, and an air-leakage rate of 0.33 ACH50.

The most remarkable thing about the annual energy use of these very differ-

ent houses is how little difference there is between the worst house and the best house. "Energy used for hot water is constant, and energy used for plug loads, lights, and appliances is constant," Rosenbaum noted.

If a homeowner wanted to add enough PV to achieve net zero, the worst house would require a PV system rated at 7.0kw, while the best house would require a PV system rated at 5.9kw. The smaller PV system required for the super-duper house would save only $3850 compared to the cost of installing the larger PV system needed for the code-minimum house. Needless to say, the cost to install R-60 wall insulation, R-90 roof insulation, and low-U-factor windows would be far more than $3850.

Same results in the coldest climate

The last expert to speak was Rachel Wagner. Wagner designs houses for climate zone 7 (the coldest climate in the lower 48 states). She has designed more than 40 low-energy houses over the last 15 years. Most of her homes have R-5 to R-6.25 windows, R-27 to R-35 underslab insulation, cavity insulation in the walls ranging from R-21 to R-34 plus continuous exterior-wall insulation ranging from R-11 to R-28, roofs with R-70 to R-80 insulation, and air-leakage rates of 0.23 ACH50 to 0.80 ACH50.

Wagner adds between 40% and 60% more insulation than required by code, which reduces future energy bills, of course, but also increases construction costs. In climate zone 7, these very high (and expensive) insulation levels make sense, but they still fall short of Passive House requirements.

Wagner noted that these houses have a peak heating load of 7.5 Btu/hr to 8 Btu/hr per sq. ft., which is roughly half that of a code-minimum house, but a far cry from a Passive House. The Passive House standard requires a peak heating load of no more than 3.17 Btu/hr per sq. ft. The energy savings that would flow from hitting this target are too low to justify the extremely high cost of the insulation needed to achieve it.

Wagner advised, "Recognize that the cost of building the enclosure is going up, but the cost of PV is going down." She also noted that efficient technologies like heat-pump water heaters and air-source heat pumps are getting better. Because of these trends, she advised not to overinvest in initial systems: "Design so that equipment and systems can be upgraded."

BY ANDY ENGEL

Laying out and cutting common rafters

Although trusses dominate new construction in most parts of the country, traditional cut rafters are still the go-to approach to roof framing in some areas. They're also common in remodeling work and in small jobs such as entry-porch roofs.

Laying out rafters involves some math, but only for the first one. After it's been laid out and cut and its fit has been checked, it serves as a pattern for the rest. The two starting points for any rafter are the roof pitch—that is, the rise and run—and the building width. The run, or horizontal part, is always 12 (except in the case of a hip rafter), but the rise, or vertical part, varies. For example, an 8-in-12 (or *8-pitch*) roof angle would rise 8 in. for every 12 in. of run. The second starting point is the building width. Even when you're working from a set of building plans, which list this dimension, always verify it by measuring between the top wall plates, from the outside face of the sheathing on one side to the outside face of the sheathing on the other.

When you have these two pieces of information, you can then deter-

STEP BY STEP

1 ***Mark the ridge plumb cut.*** *Hold the pivot point of the rafter square on a straight piece of rafter stock. Using the "common" line, align the number corresponding to your pitch with the edge of the stock, and mark the ridge cut. Flip the square to the other side to complete the mark.*

2 ***Make the ridge plumb cut.*** *Use a sharp blade in a circular saw to split the layout line. Cutting up from the bottom of the rafter leaves a splinter-free edge that you'll appreciate when using this rafter as a template later on.*

3 ***Mark the length.*** *Hook a tape measure on the point of the ridge cut, and pull the tape along the top of the rafter. Mark both the calculated rafter length and the overhang.*

4 ***Lay out the bird's mouth and bottom plumb cuts.*** *Using the same technique as for marking the ridge cut, mark plumb lines for the bird's mouth and the bottom of the overhang.*

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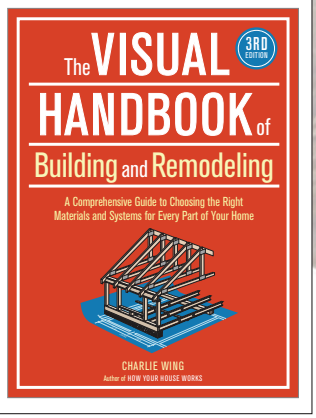

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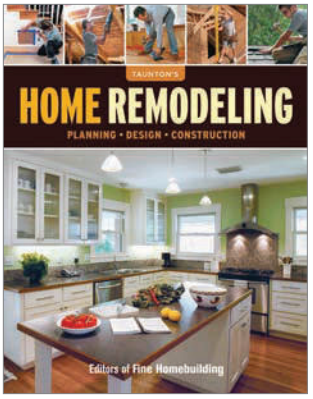

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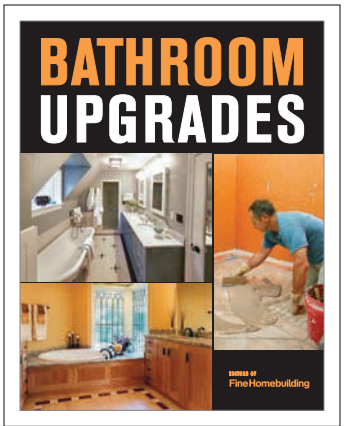

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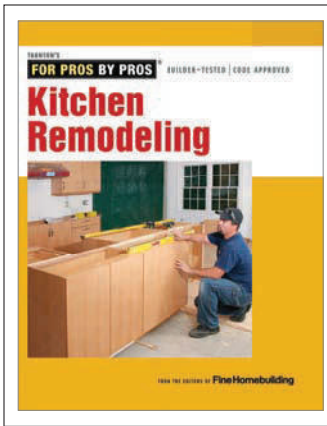

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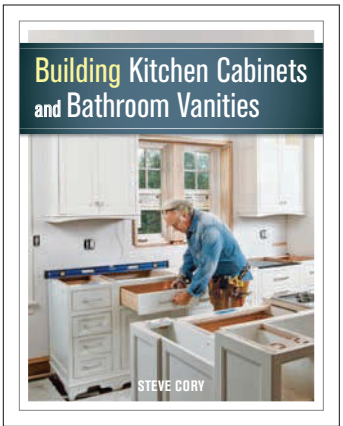

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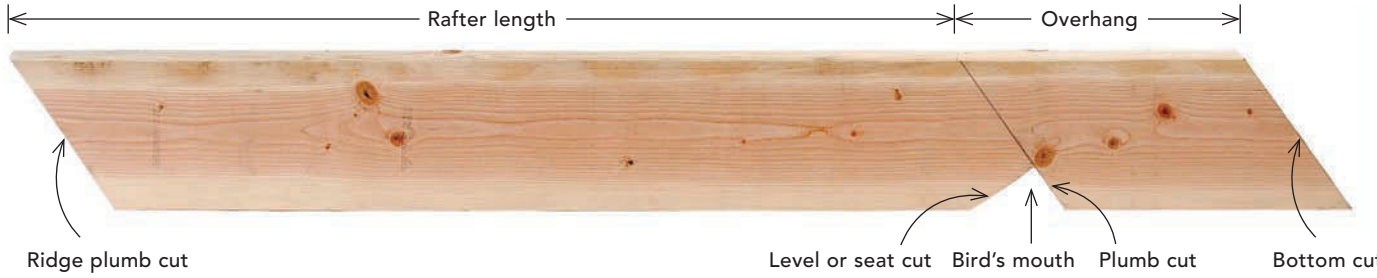


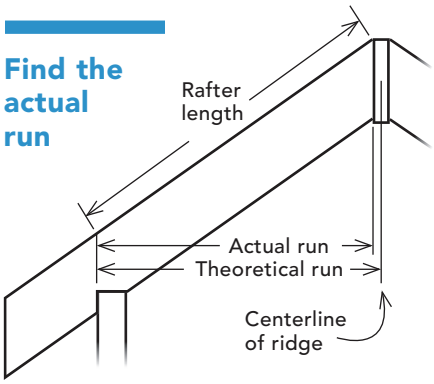
mine the rafter length and lay out the cuts.

Doing the math

Let's say that the measurement between the outside of the plates for an 8-in-12 entry-porch roof is 6 ft. Each rafter spans half that distance, so the theoretical total run (the horizontal distance the rafter spans) is 3 ft., or 36 in. From that, you have to deduct half the thickness of the ridge board to find the actual run. In most cases, a ridge board is a 2x that's one or two sizes deeper than the rafters (to provide enough depth for the full cut end of the rafter to bear on the ridge, a code requirement). The actual width of a 2x ridge is 1½ in., so deduct half of that, ¾ in., from the theoretical total run of 36 in. Actual run: 36 in. – ¾ in. = 35¼ in.

The rafter length is the diagonal measurement along the top edge of the rafter from its tip to a point directly above the outside of the wall plate. There are two simple ways to find it. The first is to plug

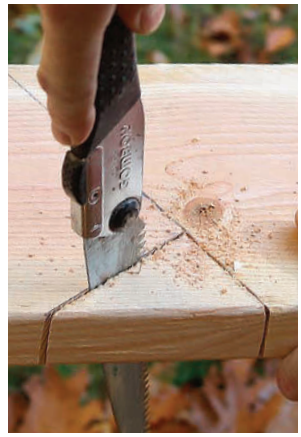
Find the actual run



STEP BY STEP

5 ***Mark the level cut.*** *Align the inside of the square's flange with the plumb cut, and align the number corresponding to the combined width of the wall plate and the thickness of any sheathing with the bottom of the rafter. Mark the cut.*

6 ***Cut the bird's mouth.*** *Make both the level and the plumb cuts, splitting the lines and stopping at the corner. Many carpenters overcut the corner so that the scrap drops out, but this weakens the rafter.*

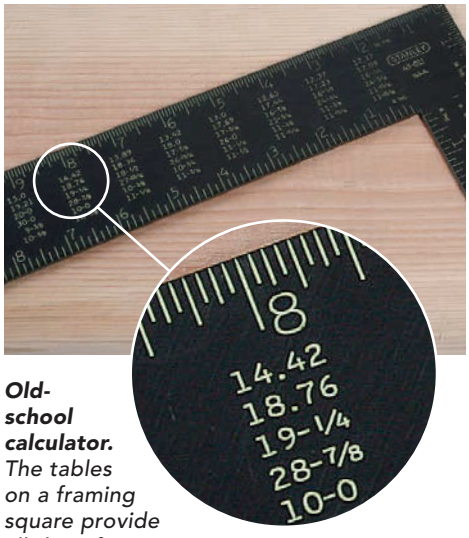


7 ***Finish the bird's mouth.*** *Use a handsaw, reciprocating saw, or jigsaw to complete the plumb and level cuts.*

8 ***Mark the rest of the rafters.*** *The first rafter serves as a template for the others. Stop blocks screwed to the top of it speed placement. Cut two rafters, and then check their fit before cutting the entire roof.*

the numbers into a construction calculator or app. For the example of an 8-in-12 roof, enter 8 Pitch, then 35¼ in. Run. Press the Diag key to get the rafter length.

Alternatively, you can use the table on a framing square and some fourth-grade math. Most framing squares have a line labeled "Length of common rafter per foot [of] run." Follow that line to below the number that represents the roof pitch (here, 8), and find the rafter length per foot of run—in this case, 14.42 in. Because it's



Old-school calculator. *The tables on a framing square provide all the information needed to lay out any roof. Building this roof required only the rafter length per foot of run, which is found under the number that corresponds to the roof pitch.*

easier to do the math in inches rather than feet and inches, I convert the length per foot of run to length per inch of run.

Find the rafter length per inch of run by dividing the length per foot of run by 12:

$$14.42 \div 12 = 1.2 \text{ in.}$$

Find the rafter length by multiplying the length per inch of run by the actual run:

$$1.2 \times 35.25 = 42.3 \text{ in. } (42\tfrac{5}{16} \text{ in.})$$

You also need to find the rafter length for any overhang beyond the outside of the wall plate. The process for that is essentially the same as finding the rafter length, except that there's no ridge. Deduct the thickness of the fascia from the actual run. Once the rafter length is dialed in, it's time to lay out a rafter.

Senior editor Andy Engel learned to frame houses from several old-school carpenters. Photos and drawing by Rodney Diaz.

BY PAUL DEGROOT

Balustrades

There are two different types of balustrades: the level balustrade at a landing or along an open hallway or game room, and the pitched balustrade that protects the side of the stair. Many stairs have both, and both are opportunities to display some architectural detail while allowing light to filter down the stair.

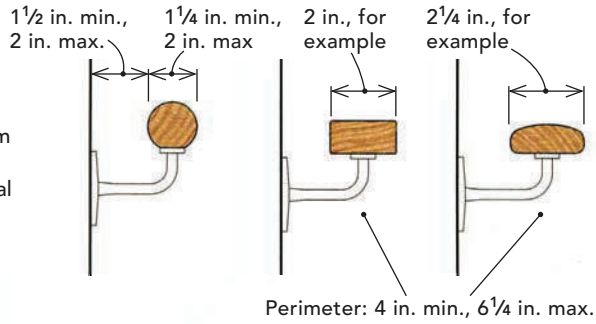
From the designer's perspective, the sloping balustrade is the one that's harder to plan—and no doubt harder to build. The way I see it, if you can solve the geometry, spacing, and proportions of the balustrade along the rise and run of the stair, then the design for a level balustrade is a piece of cake.

Folks use terms such as *railing* or *guardrail* to mean balustrade, but it's important to know that *handrail* and *balustrade* are two separate things in code parlance. A handrail is the part that you hold onto as you go up a stair. Often it is mounted to the wall with metal brackets. A balustrade is the entire assembly—newels, balusters,

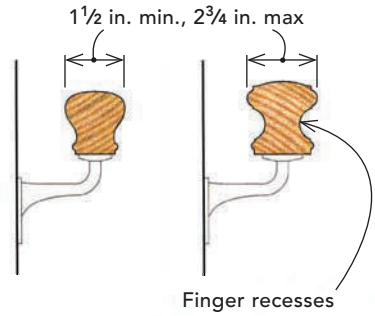
Continued on p. 94

GET A GRIP **The IRC groups handrails into "Type 1" and "Type 2." In both cases, the details are all about making the shape easy to grip.**

Type 1: A circular cross-section with a minimum diameter of 1¼ in. and a maximum diameter of 2 in., or another cross-sectional shape with a total perimeter of 4 in. to 6¼ in.

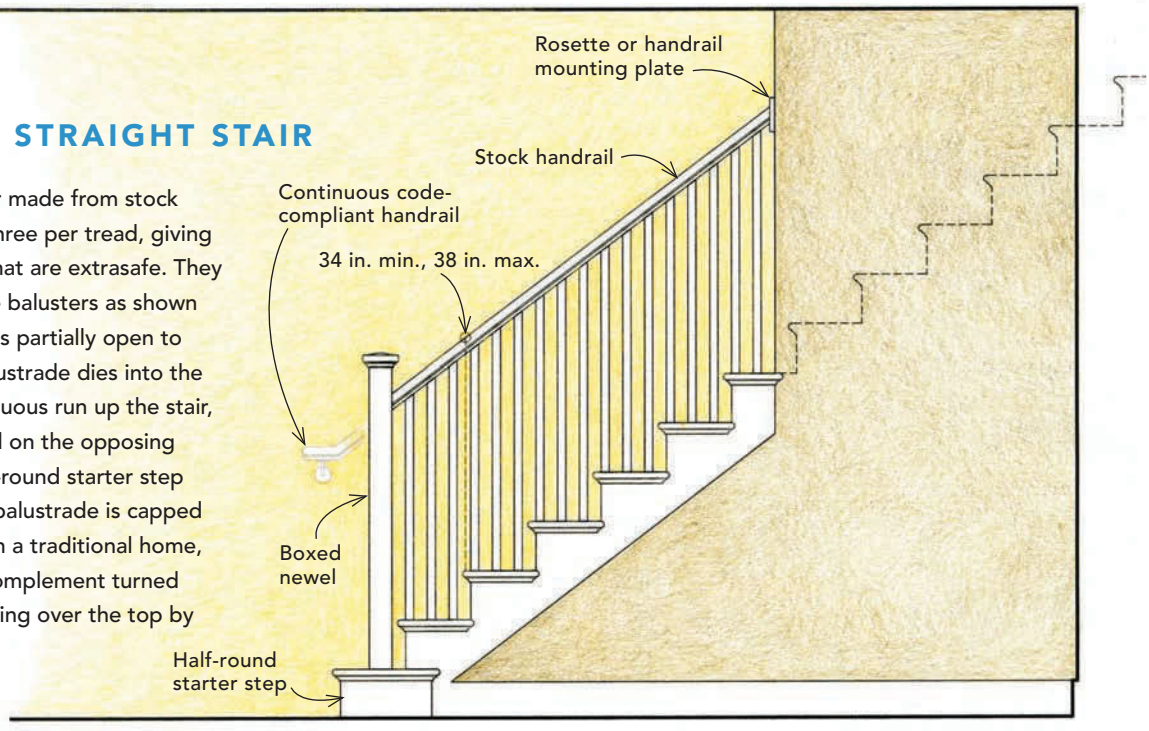


Type 2: Any cross-sectional shape with a perimeter exceeding 6¼ in. This handrail must have graspable finger recesses on both sides.



AN OPEN-STRINGER, STRAIGHT STAIR

This balustrade can be custom-built or made from stock stair parts. Slender balusters are set three per tread, giving a dense appearance of narrow gaps that are extrasafe. They can be turned spindles or plain square balusters as shown here. This example shows a stair that is partially open to the room below, so the top of the balustrade dies into the end of a wall. Since this is not a continuous run up the stair, the code-required handrail is mounted on the opposing wall. The newel post is set atop a half-round starter step for a bit of extra design flair, and the balustrade is capped with an off-the-shelf handrail profile. In a traditional home, the newel likely would be turned to complement turned spindles, with the balustrade cap running over the top by way of a volute fitting.



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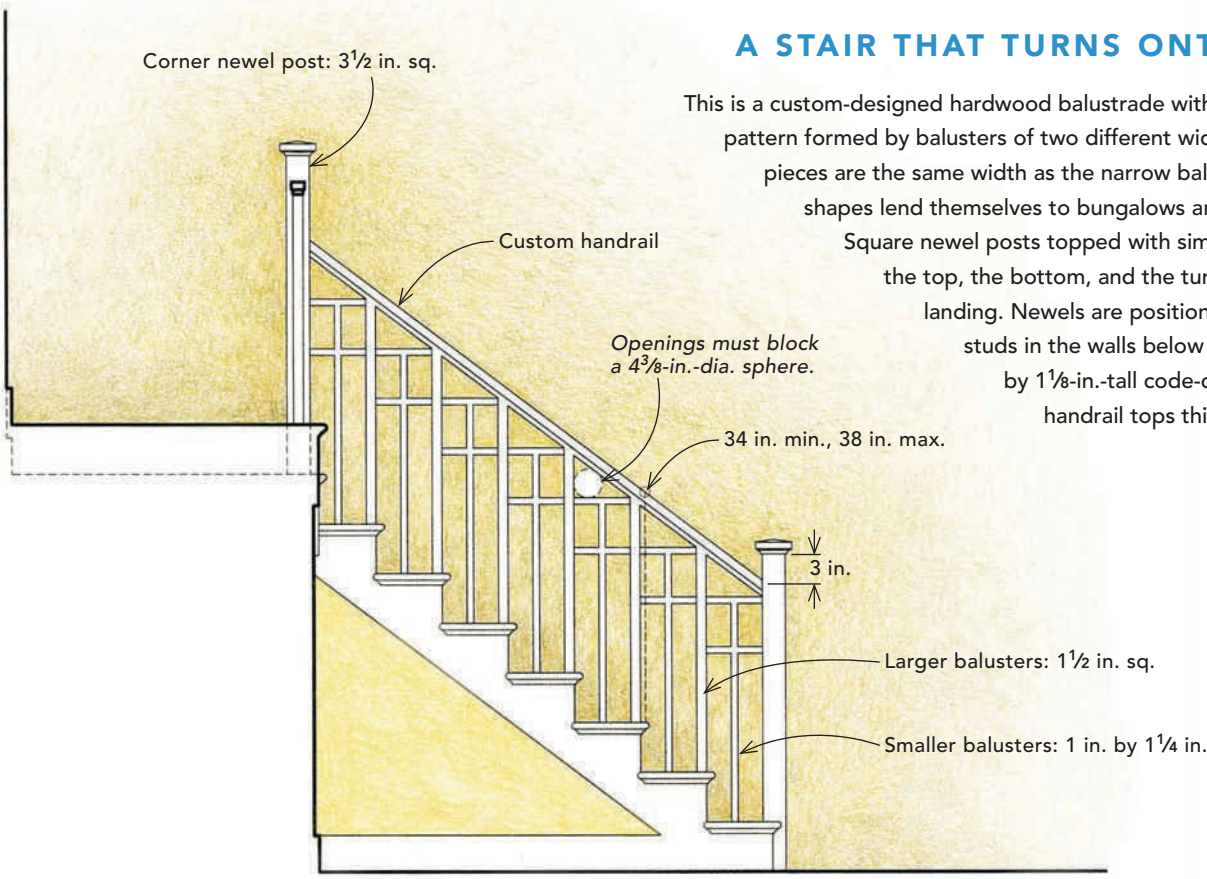
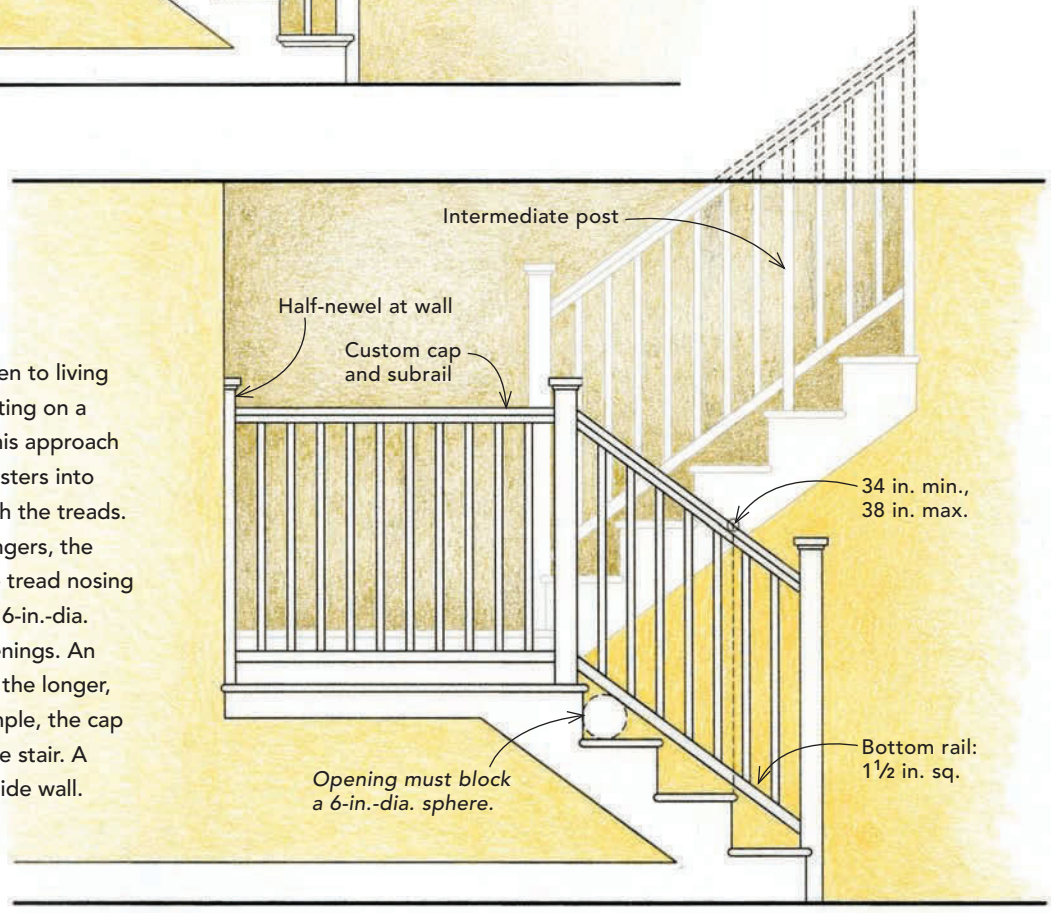
A STAIR THAT TURNS ONTO A LANDING

This is a custom-designed hardwood balustrade with a pleasing geometric pattern formed by balusters of two different widths. The horizontal cross pieces are the same width as the narrow balusters. The rectangular shapes lend themselves to bungalows and Craftsman-style homes. Square newel posts topped with simple cap moldings define the top, the bottom, and the turn in the balustrade at the landing. Newels are positioned to align with the 2x4 studs in the walls below the stair. A 2-in.-wide by 1⅛-in.-tall code-compliant Type 1 wood handrail tops this balustrade.



AN OPEN-STRINGER, SWITCHBACK STAIR

Designed for a switchback stair that is open to living space, this guardrail features balusters sitting on a bottom rail that follows the stair slope. This approach eliminates the need for doweling the balusters into the treads or for coordinating spacing with the treads. However, because this stair has open stringers, the bottom rail must be located very near the tread nosing in order to meet a code stipulation that a 6-in.-dia. sphere be blocked in these triangular openings. An intermediate post adds extra strength on the longer, second flight of stairs. As in the first example, the cap rail terminates at a wall near the top of the stair. A continuous handrail is mounted on the inside wall.



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ENERGY STAR

Continued from p. 90

and rails—that protects the open side of a staircase or a balcony area open to the floor below. Depending on how the handrail code requirements are met on a particular project, a balustrade may or may not have a code-approved handrail attached to it or atop it (see "The minimums and maximums of balustrades," below).

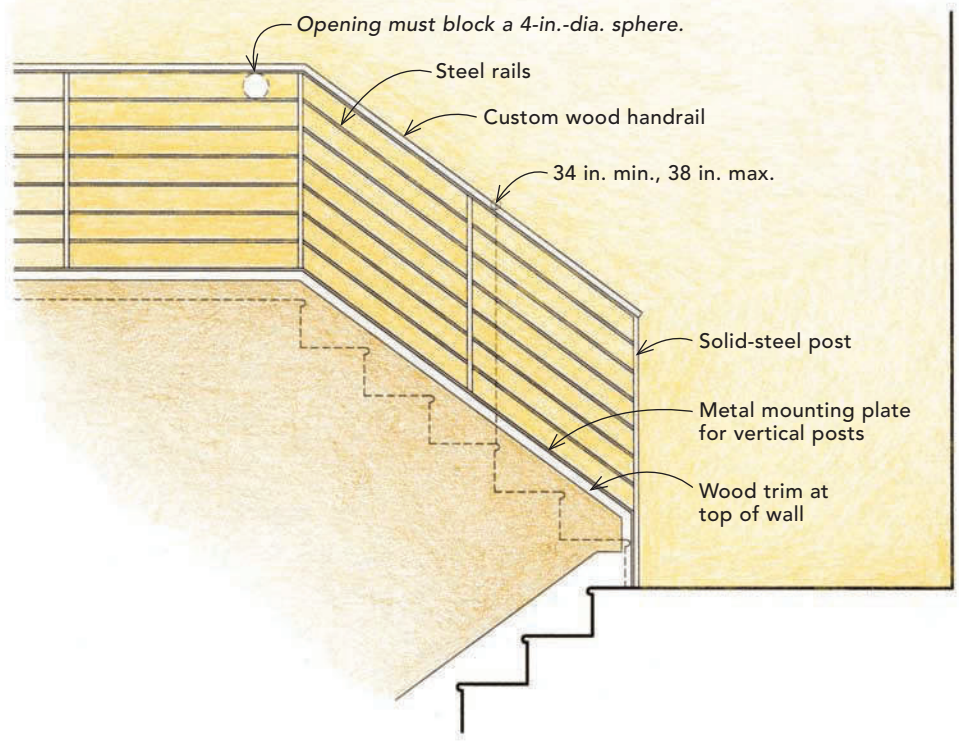
Accidents occur frequently on stairs, so building codes have strict rules regarding stair design and installation. Ascending and descending a stair safely requires a sure grip on a handrail and a strong balustrade to keep people from falling over the edge. In Austin, Texas, we use the 2012 IRC, so those are the rules I cite here. Your local code may be different, so be sure to talk to your building official if you have any questions about what is safe and acceptable.

Here are some examples of handrails and balustrades that make style statements while keeping safety the first priority.

Paul DeGroot is an architect in Austin, Texas, and a frequent contributor to Fine Homebuilding. *Drawings by the author.*

A STEEL BALUSTRADE FOR A MODERN HOME

Closed stringers and steel balustrades are fitting for contemporary homes. The thin parallel lines bring a cool, airy, industrial vibe. Welded guardrails comprised of steel bar stock are mounted to the tops of the stair walls. Thick, wide, bottom mounting plates with many pairs of countersunk screws transfer the railing loads to the walls. These mounting plates turn downward at the ends of the stair runs, giving firm welding purchase for the solid-steel posts. A maple rail cap, matching the treads, is screwed to the top of this balustrade from below. Intermediate steel posts help support the rail cap and limit the deflection of the parallel steel rails. In this example, the rails are flat steel bars, but they also can be round steel rods or stainless-steel cables.



The minimums and maximums of balustrades

• Minimum 34-in. height for a balustrade at the open side of a staircase. Height is measured directly above the leading edge of the tread nosing.

• Minimum 36-in. height at level balustrades. Tall folks and those afraid of heights may feel uneasy with a 36-in.-high guardrail, especially if the drop is particularly high. In these cases, go a few inches taller for extra safety.

• Minimum 34-in., maximum 38-in. height if the top of the balustrade also serves as the required handrail for the staircase. This might occur when the inside stairwell wall is punctuated with windows or display shelves, making a continuous handrail impractical at this location.

• Baluster (aka spindle) spacing must block the passage of a 4⅜-in.-dia. sphere at the open side of a stair and a 4-in.-dia. sphere at a level balustrade.

• Handrails at stair flights must be continuous and must extend over every riser from top to bottom. Handrails are not required on both sides of the stair. As long as there is a code-compliant handrail along one side, the balustrade may not need a compliant handrail.

• When the top of a balustrade has the code-required continuous handrail, newel posts are allowed at the top and bottom of the stair and at turns. These posts can be taller than the handrail and can therefore interrupt the handrail continuity.

• Traditional balustrades are often topped with continuous handrail profiles that pass over the top of turned newel posts. Various fittings such as volutes, turnouts, and gooseneck transitions allow the handrail to sweep gracefully along the full length of the balustrade. For vertical transitions that are abrupt—at landing turns and winder treads, for example—the code allows for extratall handrail heights in order to maintain continuity.

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CELEBRATING PASSION FOR BUILDING

"If I'm given a task in my shop, **I solve it**…

…If I need a tool, **I make it**"

MONICA COYNE,
BLACKSMITH

Modern industry may have removed the necessity of the blacksmith, but for Monica Coyne, the craft is as much alive and breathing as the fire fueled by the bellows.

This California artisan's thick apron—its light-brown leather stained black with coal dust, rust, and the oil that comes off of new steel—is decorated with lines and shapes that were burned into the leather as she used the apron to shield herself from hot metal, scale, and flying wire-brush fragments. For Coyne, there is incredible beauty in the brutality of this pursuit.

Just as they did in the first century, blacksmiths in the 21st century move metal. At 2000°F, steel and iron become like clay. They go from rigid and lifeless to supple and malleable. But metal is never truly relaxed. The speeding atoms are trying to melt the very bonds that make the material what it is. When Coyne is blacksmithing, she is playing with the tension of this contradiction.

Like all blacksmiths throughout history, Coyne is resourceful and interested in finding her own solutions: "If I'm given a task in my shop, I solve it. If I need a tool, I make it." Her work ranges from contemporary art to functional elements for the home, such as railings, fireplace doors, racks and hooks, curtain rods and towel bars, chandeliers and range hoods, and even decorative timber brackets.

Coyne believes that blacksmithing is the timber-framing of metalwork. "The raw materials convey the human energy used to make a functional piece," she says. It's that very energy that attracts her clientele. "My process is evident in my finished work. I work for clients who want that look," she explains.

Although trained as a fabricator, these days Coyne considers herself a blacksmith in the purest sense of the word. So while she follows the techniques and skills of blacksmithing—forging, forge welding, and joinery—her work focuses on shaping the metal in order to make creative connections that interest her. However, her design process is collaborative. "I encourage my clients to give input into the design. I want to know what their interests and tastes are because I want to make pieces that fit well into their lives."

For Coyne, the process of blacksmithing is driven by two things: thinking and efficiency. She likes to lay out a project to scale, and from all angles, before forging anything. "I often do experiments with joinery in modeling clay, using my hammer and tools in the clay just as I would with the steel." Within this process, she is always mindful of the flow and balance achieved in the design phase.

Like many who are devoted to their craft, Coyne finds deep joy and solace in her work. "When I am struggling with a profound question, or frustrated and saddened by the news of the day, I can always feel better by making things. In this harsh environment, when the metal is yellow hot, I get the feeling that if I hit it hard enough and pay close enough attention, I can find the answers."

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Photo: robgenolio.com, courtesy of monicacoyneartistblacksmith.com

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Arts & Crafts and automobiles

Elegant exterior. *Subtle curves and the use of organic materials make it seem as if the building has grown up out of the ground along with the surrounding beech trees. The exterior is pebble-dash stucco—traditional cement stucco with aggregate, or pebbles, literally thrown at it while it's still wet—trimmed with mahogany.*

Located in a suburb of Philadelphia, this elegant garage was designed by architect Peter Archer. His concept for the overall building came from an appreciation of the English Arts & Crafts movement, but he found inspiration for the timber-frame configuration on a visit to the Liberty of London department store. Archer developed the model for the garage—a hybrid system of trusses connected by steel plates and bolts along with support beams using mortise-and-tenon joinery—and he executed the concept with assistance from timber framer Hugh Lofting. The beams are Douglas fir from the Pacific Northwest, and the interior walls are finished in northeastern white pine. Doors and windows in each wall allow an abundance of natural light to enter the space. At 30-ft. by 30-ft., with a 24-ft. ceiling height from the stained and sealed southern-yellow-pine floor deck to the apex of the clerestory, this inviting space is also used as the location for warm-weather dinner and dance parties. —*Maureen Friedman*

ARCHITECT Peter C. Archer, Archer & Buchanan Architecture, West Chester, Pa.; archerbuchanan.com **TIMBER FRAMER** Hugh Lofting Timber Framing and High Performance Building, Kennett Square, Pa.; hughloftingtimberframe.com **MAHOGANY TRIM AND DOORS** David Dougan, Media, Pa.; ddougancabinetmaker.com **PHOTOS** Tom Crane, Tom Crane Photography, tomcranephotography.com

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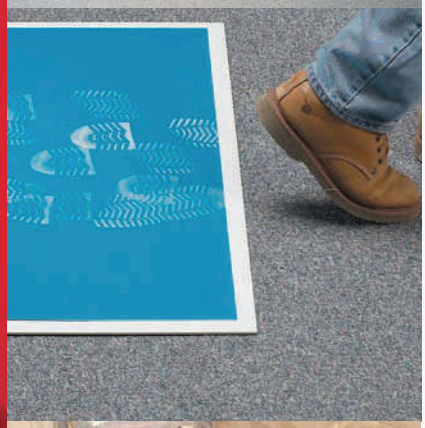

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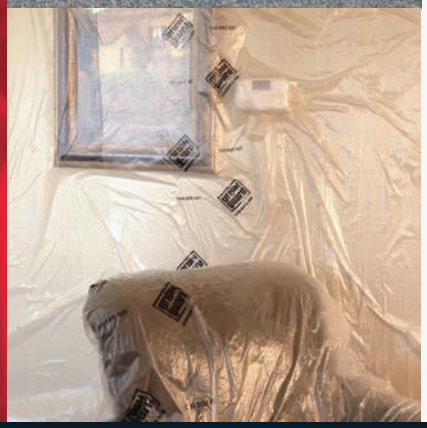

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