CHANGES COMING TO THE 2021 BUILDING CODE

Fine Homebuilding

DESIGN • BUILD • REMODEL

Keep Your Walls Dry

A roundup of reliable water-resistive barriers

PAGE 34

- A modern take on interior trim PAGE 44
- Installing windows in thick walls PAGE 90
- Building for extreme weather PAGE 48

SEPTEMBER 2019 NO. 285
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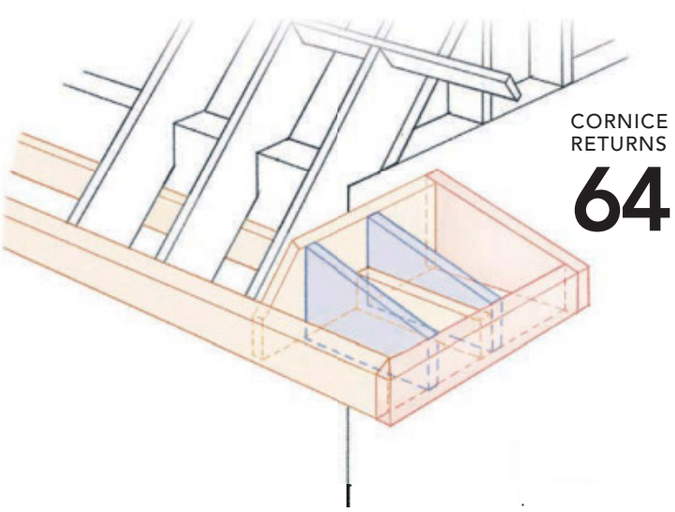
FEATURES



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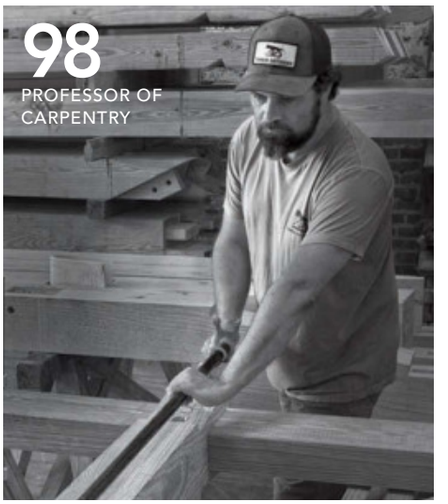
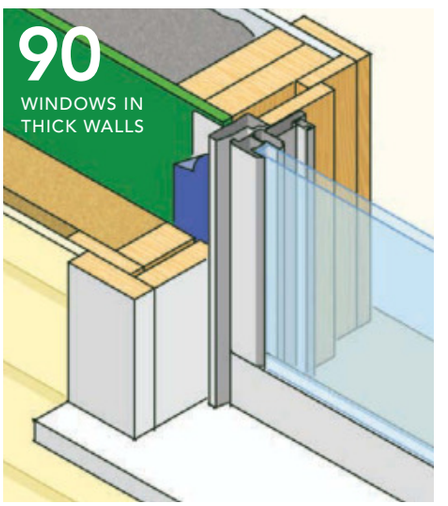
IN EVERY ISSUE

14 NO-MEASURE SKIRTBOARD



98 PROFESSOR OF CARPENTRY

74 STEEP-LOT SOLUTION



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The Taunton Press
Inspiration for hands-on living®

ON THE COVER A builder puts the final layer on a ventilated rainscreen assembly. Read more about keeping walls dry on pp. 34-43. Photo by John Deans, Emerald Builders.

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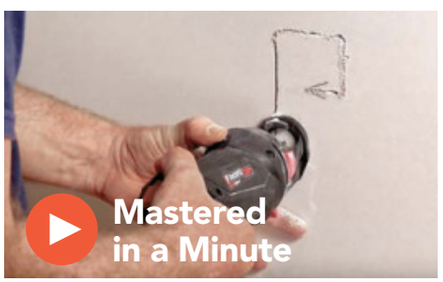

A drywall router makes cutting holes for electrical boxes quick and easy. Give us a minute and we'll show you how to use one.

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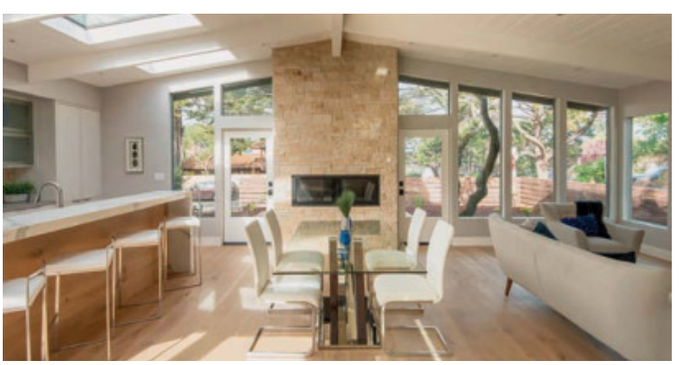
The Fine Homebuilding Podcast

Ep. 180: Insulation and Fuel Efficiency

The editors address listener questions about insulation upgrades, environmentally responsible transportation, and more.

Midcentury Eichler revamped

Lewis Builders balances classic details with modern livability in this complete makeover of an iconic Southern California house. Read more on our HOUSES by Design blog.



Call for entries: 2020 HOUSES awards

We're always on the lookout for homes that showcase craftsmanship, energy efficiency, and smart design. Submit a project and become eligible to win one of our annual HOUSES awards at FineHomebuilding.com/houses.

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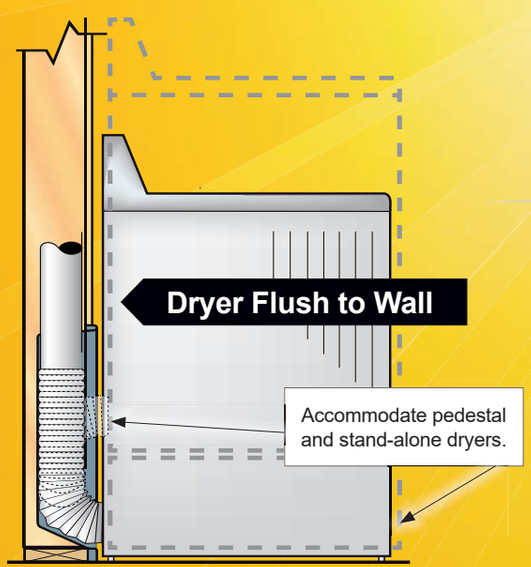

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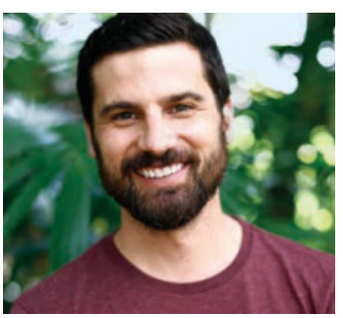
THE VOICES OF EXPERIENCE

TIM HOLTON **("Air-Sealed and On Piers," pp. 52-57) owns and operates James K. Holton, Inc., a residential construction company based in Cochranville, Pa., specializing in custom additions and renovations. Tim's father started the company in 1991, and Tim spent his summers learning from him before studying residential construction and construction management at Pennsylvania College of Technology. He took over the family business in 2015.**

DOUG HORGAN **discovered his passion for building in 1989 when he joined the renovation and custom-home firm BOWA, located in the Washington, DC area. He is currently an owner and vice president of best practices. In this training and troublshooting role, Doug's goal is reducing construction defects through sharing knowledge. In this issue, he and BOWA colleague Tom Johnston write about how to protect a job site from damage (pp. 58-63).**

DAN NELSON **was raised in Washington State and received his Bachelor of Architecture from Boston Architectural College and his master's degree from Columbia University. He joined Designs Northwest Architects in 1990 and is now the firm's principal architect. Dan specializes in the innovative exploration of resilient design and sustainability. His work on the Tsunami House on Camano Island, Wash., is featured in "Built for Catastrophe" on pp. 48-51.**



A degree in professional writing and employment in various home-building trades landed BRIAN PONTOLILO his first job at *Fine Homebuilding* in the early 2000s. He has since held nearly every editorial position at the magazine. Brian relocated to Charleston, S.C., in 2018, and recently rejoined the *FHB* team as the editor of greenbuildingadvisor.com. In this issue, he writes about "The Complicated Role of a Water-Resistive Barrier" (pp. 34-43).

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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READER FEEDBACK

FROM THE EDITOR

A new event, coming this fall

After months of planning, I'm thrilled to share some exciting news. This October, we will hold our first ever **FINE HOMEBUILDING SUMMIT** in Southbridge, Mass. The one-of-a-kind seminar will feature a dozen of the most trusted and respected industry experts in the country. Together we will explore advanced design principles, discuss cutting-edge construction materials, and share trusted techniques. Each speaker will present hours of insight on topics within his or her area of expertise, all in service of the same agenda—helping each other build better homes. The list of presenters includes Steve Baczek, Michael Maines, Christine Williamson, Glenn Mathewson, Mike Guertin, Martin Holladay, and many more. Due to the intimate nature of the venue, availability will also be limited. Don't wait; visit **FineHomebuilding.com/summit** today to sign up. I hope to see you there.

—JUSTIN FINK, editorial director

your safety

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

—JUSTIN FINK
editorial director

Email your own letter to us at FH@taunton.com.

Paint-stripper experience

After reading the short review of Dumond's Smart Strip ("Tools & Gear," *FHB* #283), I thought I'd give a little additional user experience. I stripped the entire exterior of an old-growth redwood lap-sided two-bedroom, one-bathroom house with Safe Strip, and while it is pricey ($200 for five gal.), I can't argue with the results. The house went from multiple layers of peeling paint to an A+ finish that shows each board's unique grain pattern. For a job of that size, I pulled all the filters from my sprayer (a Graco Ultra Max II 695), special-ordered a large-orifice tip frequently used for elastomerics, and sprayed the Smart Strip on the walls. While smaller jobs can be done with the stripper alone, for a job of that size I would recommend covering the applied stripper with plastic sheeting for control and maximum effect—the paint-removing reaction only occurs when the stripper is moist, and once it dries the gooey paint will re-solidify and require another application to soften and remove. It's the only paint stripper I will use.

—PATRICK THOMAS
Santa Cruz, Calif.

Landing requirements for garage entry, too?

I'm reading the June issue and have a quick question on the exterior-door landing requirements from "Know the Code." I am building a detached garage to replace one that burned in the Ventura, Calif., Thomas Fire, and would like to know if the egress-door requirements apply to garage man doors. This specific garage is a single-car design with a separated utility/laundry room, each with inward-swinging single-man doors and threshold-to-grade heights greater than 7¾ in. and less than 15½ in. Thanks, and I always enjoy your magazine!

—PATRICK
via email

Glenn Mathewson replies: The code requirements for an egress door apply specifically to dwelling units, not garages. However, landings or floors are generally required on each side of all other exterior doors as well—the IRC doesn't make an exception for garages. Any landing has to be at least as wide as the door it serves and at least 36 in. measured in the direction of travel, and the floors or landings on either side can't be more than 7¾ in. below the top of the threshold.

There is an exception: A top landing isn't required where a stairway of not more than two risers is located on the exterior side of the door, so long as the door doesn't swing over the stairway. Since your doors swing into the garage, you could either raise the grade a bit at the door's exterior or install a step to be in compliance with the IRC, but check with your local code office first because their rules may differ.

California has amended the model IRC provisions and provides the state amendments and further local ordinance amendments for free viewing online. After a brief search, I could find no California or Ventura amendments to these IRC sections, but I encourage you to explore the state website and confirm for yourself. State and local amendments can be found at dgs.ca.gov/bsc/codes.

Correction

In last issue's "Tools & Gear," we incorrectly identified the cut-resistant work gloves. The gloves are Protective Industrial Products' G-Tek 3GX (model 19-D318).

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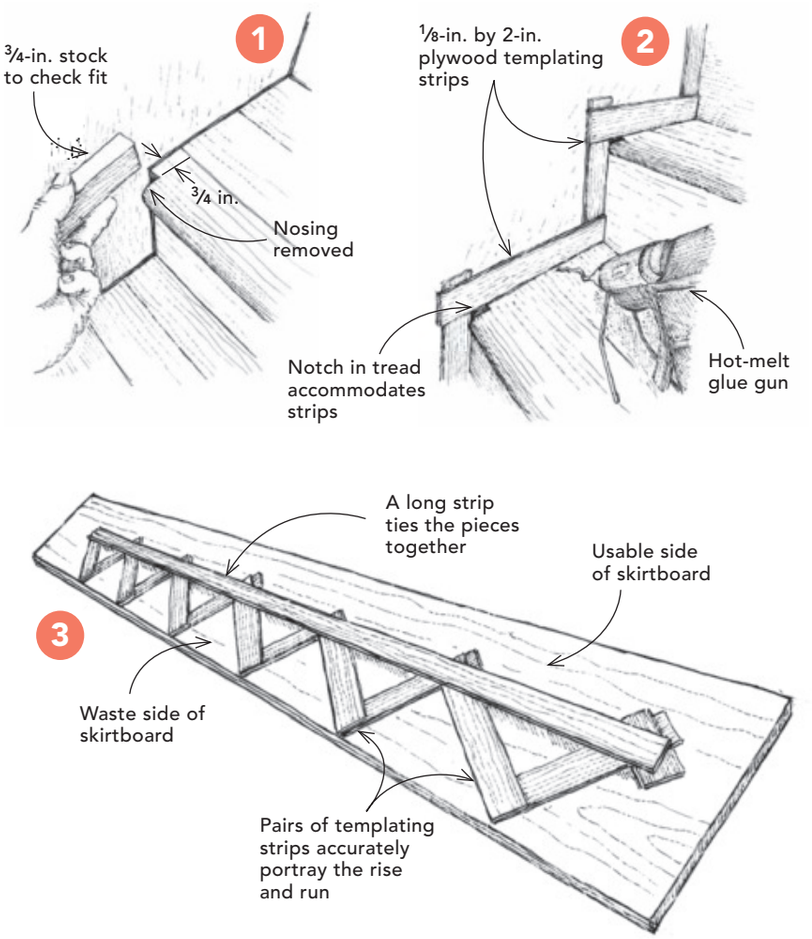
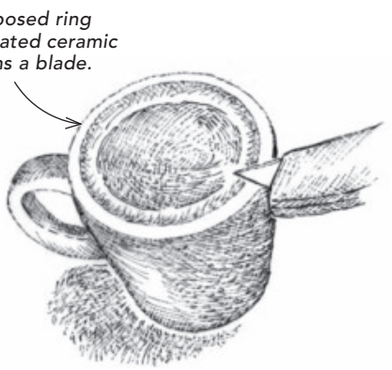


Skirtboard template

When I was asked to fit new skirtboards to an existing staircase, I decided to take my experience templating countertops and apply it to the stairs. The steps were all a little bit off—the risers weren't plumb and the treads were not level. I cut ¾ in. of nosing from each side with an oscillating multi-tool so that the ¾-in. skirt could fit tight to the stairs, as shown in the drawing (1). Then I cut a bunch of ⅛-in. by 2-in. templating strips and hot-glued them together, tacking them to the wall in a few spots (2). Then I glued a long strip to brace all the glued pieces and keep the template from racking. I marked the front and back, set the template on a board for tracing, and cut it (3). The board fit perfectly with no measuring involved.

—DAN MAUPIN-AHERN
Hidden Valley Lake, Calif.



Coffee-mug knife sharpener

You can thank a Scoutmaster for this tip. On the bottom of most ceramic coffee mugs is an exposed ring of uncoated ceramic. Ceramic happens to be one of the more popular materials used to sharpen blades. While it might not be coarse enough to bring a completely ruined blade back to surgical sharpness, in a pinch this ceramic ring can easily freshen the edge on a knife.

—MATT HIGGINS
New Milford, Conn.

submit a tip

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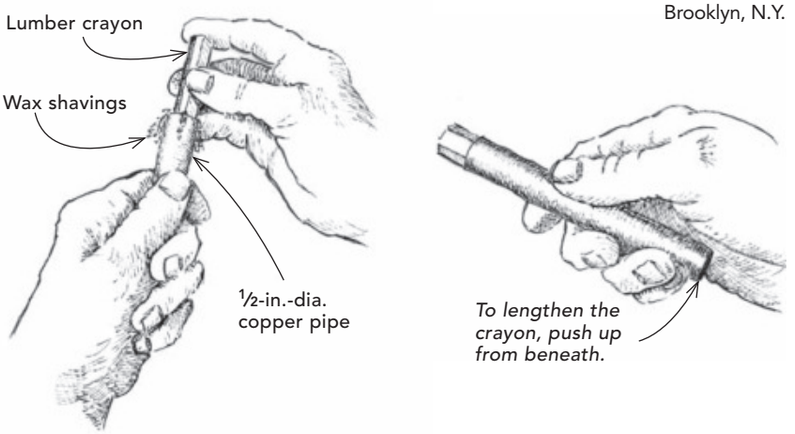
Copper-pipe crayon holder

My lumber crayon in my tool pouch was always destroyed by my other tools. So I decided to make these crayon holders from scrap ½-in.-dia. copper pipe. Cut the pipe slightly shorter than the length of crayon, then take the wrapper off the crayon and insert it into the pipe. It's a tight fit and the pipe may scrape off some of the crayon, as shown in the drawing. As you use the crayon and it wears down, push up from the bottom.

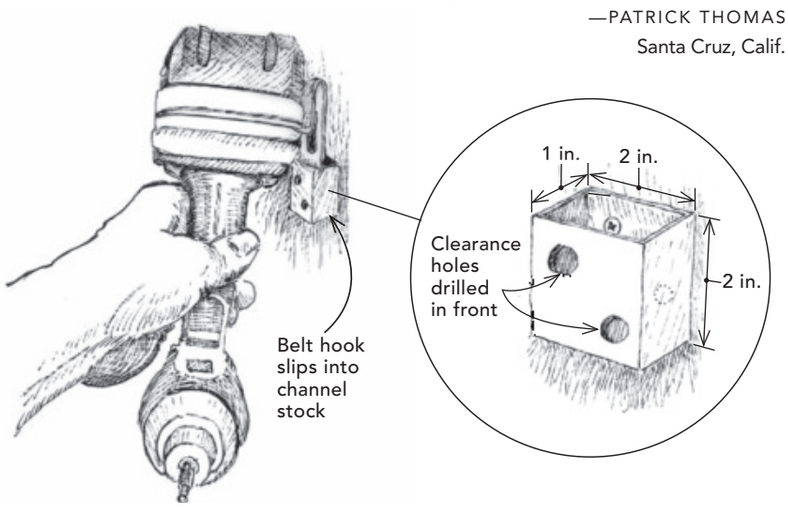
—ELI GLUCK
Brooklyn, N.Y.



Belt-hook tool storage

I was looking at different drill/impact-driver storage methods bandied around on Instagram and Pinterest. They used all manner of building materials, so I came up with the simple idea of using some 1-in. by 2-in. rectangular steel tube I had kicking around. I cut the tube into 2-in. pieces and drilled a pair of clearance holes in the front of each so I could run screws through smaller holes drilled in the back. Then I screwed the tool holders to the wall of my shop. As shown in the drawing, the tool's belt hook slips in with no fuss.

—PATRICK THOMAS
Santa Cruz, Calif.



Another way to store caulk tubes

After using screws and nails to stopper opened tubes of caulk, I figured there had to be a better way. Looking around the shop, I saw some clear ½-in.-dia. tubing. I cut a piece of the tubing about 2 in. long. Then I warmed the end with a heat gun and immediately squeezed it in my bench vise. Allowing it to cool while in the vise creates a sealed bond. I simply twist and push the tubing over the spout of a caulk tube for an airtight seal. The crimped end serves as a handle, since heating and compressing the tubing makes it rigid.

—R. TIMOTHY MADDOX
Lynchburg, Va.

Solo window install

Unless a window is very large, I usually install it by myself. Over the years I've played with a few variations of how to install a window without it falling out of the opening while I move from inside to outside to check its placement. The simplest method I have come up with is to use a quick-adjusting clamp or two on the top jamb

extension with the bar pointing up toward the ceiling. If the window starts to tip out of the opening, the bar on the clamp keeps it from falling. This technique also leaves the window free for leveling in the rough opening before attaching the nailing fins on the exterior.

—CURT LYONS
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[2] Performance solutions require upgrades to triple-pane, AdvancedComfort Low-E and mixed glass thickness. Based on comparing product quotes and published STC/OITC and U-Factor ratings of leading national wood window and patio door brands.

[3] Performance solutions require upgrades to triple-pane and AdvancedComfort Low-E. Window energy efficiency calculated in a computer simulation using RESFEN 6.0 default parameters for a 2,000-square-foot new construction single-story home when comparing Pella Lifestyle Series windows to a single-pane wood or vinyl window. Double-hung windows are not available with triple-pane glass. The energy efficiency and actual savings will vary by location. The average window energy efficiency is based on a national average of 94 modeled cities across the country with weighting based on population. For more details, see pella.com/methodology.

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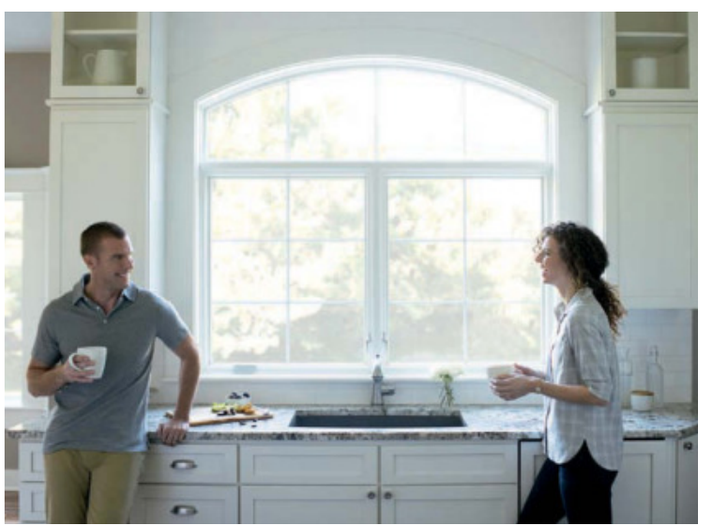

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know the code
MASTER THE RULES OF HOME BUILDING

BY GLENN MATHEWSON

Changes to the building codes

Building codes live in the past, present, and future. Because states and municipalities are slow to adopt codes, the ones you build from today are likely older versions. The ones being taught in classes and described in publications are the ones most recently published. Right now, professionals from all over the industry are working on developing the next code updates, to be published in 2021.

This spring, 302 proposals for changes to the International Residential Code (IRC) chapters one through 10 were presented to a volunteer committee. While the committee voted down many proposals, even items they rejected may reappear for a vote this fall based on public comments. Anyone who's interested can chime in. If you have an idea to assist any of the proposals, you can submit a public comment modification online before the July 24th deadline. For this edition of "Know the Code," I wanted to give a sneak peek at some of the proposals under discussion—some of which will end up in the 2021 IRC in some form or another, and some of which will never see the light of day. Here's a glimpse at a few of the proposed changes that you can weigh in on.

Emergency escape and rescue openings

This topic, more commonly referred to as "egress windows," received quite a bit of attention. The committee approved proposals aimed at maintaining a minimum 36-in.-wide path from the opening to a yard or public way, including when the path is underneath a deck or floor overhang. Another proposed change would limit the weight of window-well covers to 25 lb. This sensible proposal was rejected, though it's likely not dead. Existing code says that window-well covers need to be able to be moved without "force greater than that required for the normal operation of the escape and rescue opening," which is strikingly vague. It's anticipated that a public-comment modification will allow this proposal to bounce back for consideration at the final hearings.

Another proposal that got the thumbs up will set limits on stairs serving area wells, which are essentially large window wells. The current code only offers guidance for ladders, not stairs, ascending an egress window well, yet larger area wells—intended to capture more sunlight and often served by stairs—have become popular. The committee approved a proposal to allow these stairs to be steeper than typical stairs.

Other stairs

A proposal to delete nearly all of the IRC's provisions on stairways and instead refer builders to the National Fire Protection Association's guidance was shot down. So was a proposal to completely exempt uninhabitable attics from the code's stairway requirements—but considering the discussion and the validity of the issue, this will likely come up again at the final hearings. Similarly, a proposal aimed at clarifying which exterior stairs had to be code compliant caught some attention. Do timber or rock "landscape" stairs down a hillside and away from the house have to be built to strict dimensions? What about concrete stairs from a deck? The committee decided that stairways that don't serve a building, porch, or deck don't need code regulation.

Stair geometry is a very wobbly balance between safety and size. Larger tread depths and shallower rises are well-argued as statistically safer, but they also take up more space. Affordability is a key function of the code in keeping the public safe, and thus maintaining maximum floor area with an acceptable level of safety is the goal. A proposal to have the IRC adopt the commercial code geometry of 7-in. rises and 11-in. runs would increase safety, but at the cost of affordability. The committee did not approve it.

> Some of the proposals under discussion will end up in the 2021 IRC in some form or another, and some will never see the light of day.

Bathrooms

Though many mistakenly believe otherwise, the only ventilation required in a residential bathroom is an operable win-

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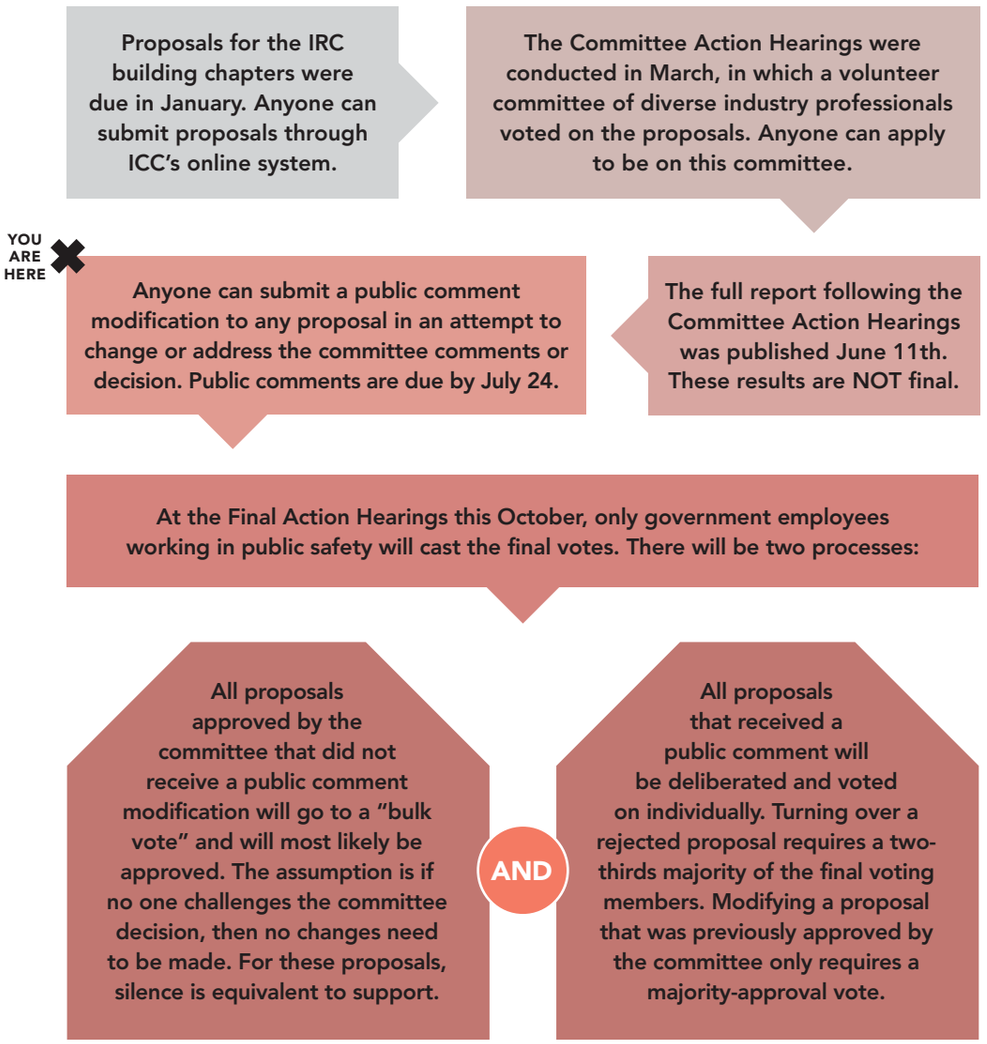
dow (exhaust fans are allowed as an exception to the window rule). Interpretations of pieces of the energy-conservation chapter, the exhaust chapter, and the planning chapter regarding bath ventilation vary, so a proposal to simply require mechanical exhaust in all bathrooms was introduced, but not approved. It seemed that the building code committee wasn't ready to cave to the energy code. A different proposal would mandate grab bars in every shower enclosure, but many thought this was a case of code overreach and it was ultimately shot down.

Battery storage

New technology and materials provoked a lot of discussion. With the increase of solar panels and electric vehicles, more battery-storage systems are being installed, and were first addressed in the 2018 IRC. New code subjects are often tweaked and adjusted over the next few code cycles, and this holds true for batteries. Over half a dozen proposals on this single subject came up for argument. Two of them would require that energy-storage rooms be separated from living spaces for fire protection, but both were rejected due to contradictory testimony regarding the fire hazards of these systems. Commissioning, ventilation, clearances, and storage capacity of these systems all came up, but these subjects received mixed opinions from the committee. There is no doubt that these proposals will continue to evolve through the rest of the code-development process. Any proposals that get so much support testimony at the first hearing are certain to come back despite the opposition. No one puts that kind of effort into testifying only to skip the chance to revive a rejected proposal with a public comment.

HOW THE CODE-DEVELOPMENT PROCESS WORKS



Decks

Decks have received a lot of attention in the IRC ever since the first span tables for deck components were introduced in 2015. A coalition of organizations presented a handful of proposals to further standardize basic deck construction.

Current IRC deck-design tables are limited to a 40-psf live load, which isn't useful in regions with greater snow loads. A detailed proposal included revised and expanded tables for joists, beams, posts, footings, and ledgers that include 50-psf, 60-psf, and 70-psf snow-load regions. All other design provisions for house construction in the IRC already include these same snow-load categories, so adding these regions would eliminate the need to engineer a deck attached to a code-built house, reducing construction costs.

Tweaks were proposed to pre-existing tables as well. One proposal revises the joist-span table to provide a better application of maximum allowable cantilevers, and another expands the post-sizing table to account for the different performance of various wood species and provide maximum heights based

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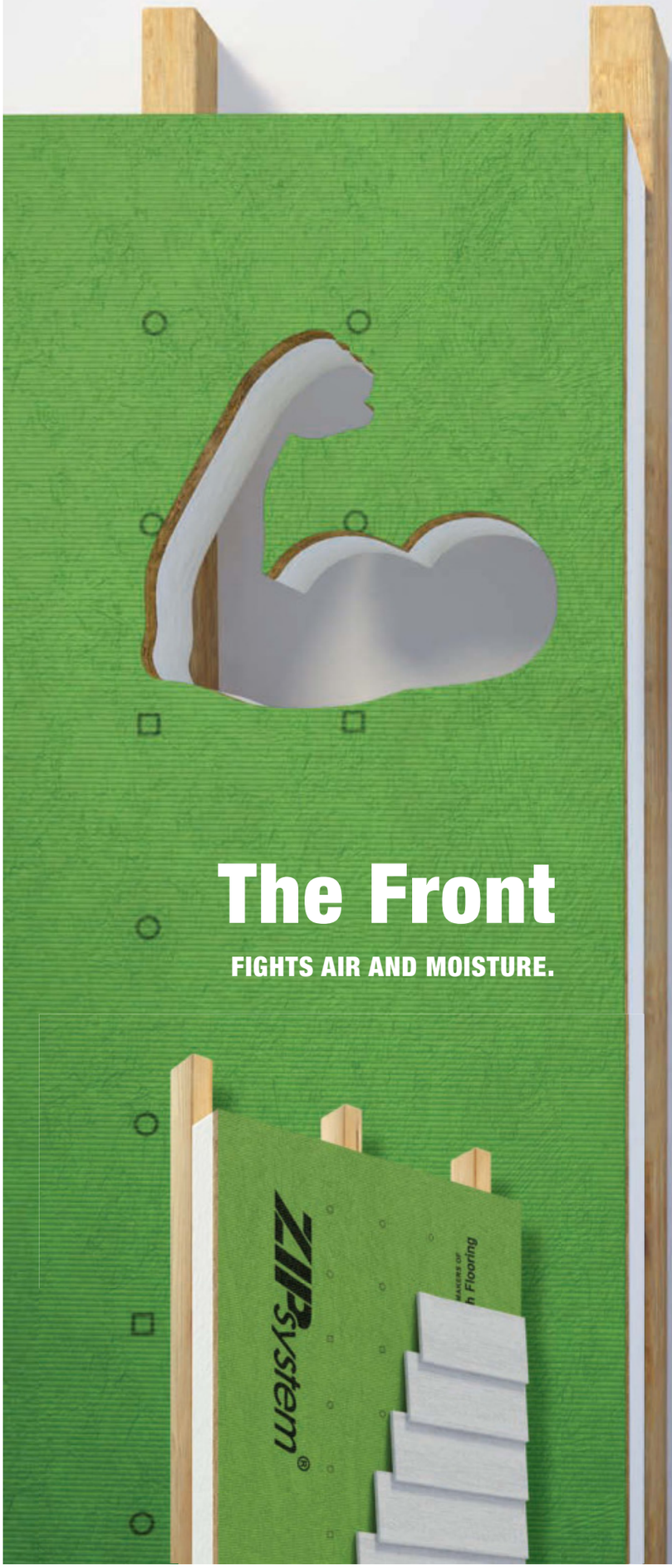

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on the actual load carried by each post.

A deck-footing-sizing table was first published in the 2018 IRC, but the smallest area supported in the table was 20 sq. ft., so the smallest-diameter footing allowed is 14 in. For a small stair landing, this is excessive, so a proposed new column in the table for 5 sq. ft. would allow footing diameters as small as 8 in., depending on soil type and snow loads. A few calculation errors in the proposal were too much for the committee to review on the spot, so it was rejected. No other concerns were raised, so a public comment will likely revive it for consideration and possible approval in the final hearings.

Another proposal brings clarity to the wood-decking span tables, noting that the spans (essentially joist spacing) are based on a "two-span condition" in which each deck board is supported on at least three joists. To allow for creative deck designs, new columns in the table would provide the reduced, minimum decking span when only supported on each end (two joists).

In creating pre-engineered span tables for decks, conservative design limitations have to be established. One such limitation is the beam-span table. The maximum beam spans are based on the length of the joists they support, but the table assumes those joists cantilever their maximum amount beyond the beam. To adjust the maximum beam span for designs in which the joists cantilever less or not at all, a new modifier was proposed as a footnote to the table.

Though most deck-related proposals came from one large coalition, a few came from other sources, including one that would raise the minimum design live load for decks from 40 psf to 60 psf. This proposal didn't include design provisions, but rather pointed code users to the 70-psf snow-load provisions from the previously mentioned proposal. This would have essentially resulted in the entire country building decks for a 70-psf snow load, with significantly reduced spans. While the committee did not approve that one, they did approve one that would allow all houses with code-approved engineered rim joists to receive deck-ledger connections according to IRC provisions. Currently, not all engineered lumber that's code-approved for use as a rim joist is explicitly allowed to have a deck attached.

> That's the great thing about code development: Every idea is welcome.

Guard posts

One proposed addition would require guard posts on wood decks be anchored into the entire framing system, not just the end joists, and prohibit notching 4x4s at this connection point. Other proposals opened a broader discussion on guards and handrails in general. Guards are for protection from falling off a raised floor, while handrails are meant to be grasped and pulled in any direction for support while using stairs or ramps. The minimum design loads for these very different features, however, are under one category in the code and require a resistance of 200 lb. in any direction. Many professionals and organizations involved in code development believe this is too conservative for guards, which shouldn't be required to work the same as handrails. Proposals came forth to separate the two in the design-load table and only require guards to resist an outward and downward force, not an inward and upward force, as would be expected of handrails. Opponents to the proposal cited the American Society of Civil Engineers (ASCE) as the authority on live loads, not the International Code Council (ICC), so the committee was not comfortable making the changes in the loading direction until they are first changed by ASCE. The separation of these two features in the code table was approved, however, and this sets the stage for further edits to this subject.

Some surprises

A few proposals were unexpected, like one approved by the committee to allow a 6-ft. 6-in. ceiling height below beams throughout a house. The minimum ceiling height has been 7 ft. for many decades, yet current design trends call for fewer walls and larger living spaces. To accommodate those designs, it was argued that the reduced clearance beneath beams is necessary.

Another proposal to require a heat detector in every garage was, remarkably, shot down. "It's well agreed that house fires often originate in garages," reads the proponent's argument for the proposal, "thus the drywall separation required between them and the living spaces." The IRC doesn't yet require any kind of alarm in garages—and while smoke alarms sound like a good idea, vehicle exhaust can set them off. Heat detectors would provide a more reliable warning of fire in the structure. Though this proposal was rejected, it's likely to come up again. That's the great thing about code development: Every idea is welcome, and the transparent process encourages contributions from the public.

By the end of the whole process, any provision included in the IRC will have gone through many steps, capturing the experience and knowledge of all willing to share. The ICC has published a full report of the results of the Committee Action Hearing online at cdpaccess.com. If something in these proposals interests you, I encourage you to take a look at the final report from the first hearing and submit a public comment modification. Nothing decided so far is permanent.

For an extended version of this column, visit FineHomebuilding.com/knowthecode.

Glenn Mathewson is a consultant and educator with buildingcodecollege.com.

WHAT IS ALL THIS HARDWOOD DOING IN A PREMIUM FIBERGLASS ENTRY DOOR?

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TWO SAWS ARE BETTER THAN ONE

My first cordless tool was a Makita 7.2v drill I bought way back in 1987. On its first day on the job, my helper scoffed—then he tried the tool. That afternoon, he bought his own.

Lately I've been trying out Makita's modern 18v cordless line, and the new tools are almost as revolutionary as my first cordless drill. In my work as a remodeler, I've been using the 18v XSH06PT 7¼-in. circular saw and the XSH04ZB 6½-in. circular saw nearly every day. Both tools are so good that I almost never use my corded saw.

Andy Engel, a lead carpenter with Hudson Valley Preservation in Kent, Conn.

XSH06PT 7¼-in. circular saw

Max depth of cut at 90°: 2⅝ in.
Max depth of cut at 45°: 1 13/16 in.

This saw is a standout in that it's not a standout—it works like I expect a corded saw to work, but with no dangling cord to accidentally cut (don't ask if I've done this before). It wouldn't be my front-line saw if I were framing a house, but for the remodeling work I do, this saw has become my daily driver. Like the 6½-in. saw (below), the controls and scales are spot on. Despite the added weight of a second battery, I like the balance and it has enough power to get through 1¾-in. LVL with little trouble.

You do have to cut thick material in a straighter line than with most corded saws, but that's because the cordless saw's thin blade leaves a narrow kerf that binds if you wander off your line. That's more a skills issue than a tool issue in my book. The pair of 5-amp/hr batteries included in the kit ($350) spin the blade until lunchtime, then into the two-bay charger they go, and they're raring to go by the time I've caught up on email, drowned my Twinkie in coffee, and strapped the tools back on.

XSH04ZB 6½-in. circular saw

Max depth of cut at 90°: 2¼ in.
Max depth of cut at 45°: 1⅝ in

The 18v, 6½-in. subcompact circular saw only accepts one battery and so its run time is somewhat limited, but this minor flaw is compensated for in two ways. First, the saw weighs practically nothing (6.4 lb.), and second, its balance is perfect. This makes it my go-to saw in those awkward situations when I need to make a cut on installed materials, such as the end of a rake board, or when trimming a deck's worth of boards to length. The bevel and depth-of-cut mechanisms and scales are easy to use and precise—it just feels like a quality tool. The bare tool sells for $180.

Photos: courtesy of Makita

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The SurfPrep sander's foam-backed sandpaper allows it to conform to moldings and other complex profiles.

Specialist sander

Sanding profiles in moldings and doors is tedious and time consuming, so I am always on the lookout for tools that can hasten this process. Last year I discovered the SurfPrep line of sanders with their superflexible foam-backed sandpaper. The setup form fits complex moldings and the soft foam guarantees that the sander won't make flat spots or dips in molding profiles. The hook-and-loop sandpaper comes in 5-mm, ½-in., and 10-mm thicknesses in six grits from coarse to extrafine. I found that most of the profiles I sand require the 10-mm pads. The 5-mm and ½-in. pads are for shallower molding profiles.

I bought the 3-in. by 4-in. Electric Ray orbital sander, which I'd recommend to carpenters because of its reasonable size and its ability to sand into corners. SurfPrep offers several other rectangular and round sizes in both air and electric models.

I've used this sander a lot, and overall I've been very pleased with it. It's not made for rapid material removal—the foam sandpaper doesn't allow you to apply as much pressure as you can with a regular sanding pad, and the internal circuitry slows the motor if it senses you're pushing too hard. This is how it sands effectively without ruining profiles. The ergonomic design, which feels like it was molded to fit my hand, and the variable-speed switch on top make it a pleasure to use. At about a $1 a sheet, the sanding pads are a little pricey, but the abrasive lasts a long time and resists clogging.

Nathan Rinne, a finish carpenter in Roach, Mo.

SurfPrep Electric Ray

3-in. by 4-in. sander: $500

10-mm sanding pads: $29 for 25

½-in. and 5-mm sanding pads: $23 for 25

Hi-tech hard hat

The business of protecting peoples' noggins from the perils of construction is taking a leap forward. The Swedish company MIPS, founded by a brain researcher and a neurosurgeon, has partnered with the Swedish industrial-safety company Guardio to make a safer hard hat. Glancing blows to a typical hard hat's unyielding suspension system can cause damaging rotation to the brain; MIPS's new hat reduces the possibility of damage with their low-friction material that allows the suspension to pivot slightly on the head when the impact isn't directly to the top. This improved protective headgear is already being used in sports as varied as motocross, snowboarding, bicycling, and horseback riding. The first versions for construction debut in January—no word yet on pricing.

Patrick McCombe, senior editor

Photos: courtesy of the manufacturers

Smooth Operator

One of the problems with using jigsaws to cut high-pressure laminate and veneer plywood is the tearout caused by the blade's upstroke. That's why blades designed exclusively for laminate have teeth that point down—but this tooth arrangement makes the saw jumpy and tough to control. Enter the Dual Cut jigsaw blades from Starrett. They have teeth on the top part of the blade that point down and teeth on the bottom that point up, a new arrangement that's meant to eliminate tearout and chipping on both sides of the stock.

At a recent trade show, I was able to try some tight scrolls on a piece of laminate countertop. The cuts were impressively smooth and the saw was easy to control. The company claims the blades work just as well on one- and two-sided veneer plywood and MDF.

Dual Cut bi-metal blades fit both universal and Bosch-style jigsaws. They are sold in packages of two, five, 20, or 100.

P.M.

Starrett Dual Cut jigsaw blades

BU3DC: 3-in. by 5⁄16-in. by 0.60-in.

BU2DCS: 2-in. by 3⁄16-in. by 0.50-in.

Price: $7 for 2-pack

Photo: courtesy of Starrett

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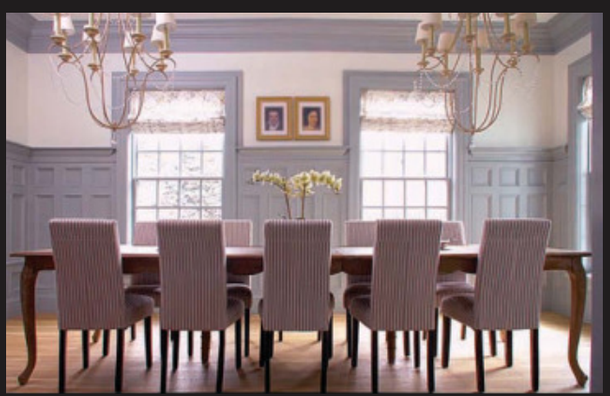


Fine Homebuilding Ambassador John Hourihan tours an elegant country home in Salt Lake City in a new Behind the Build video. Classic, traditional style and the builder's attention to detail are evident in a home that showcases proper proportion and placement of doors and windows. It's worth a look!

Watch the series now: FineHomebuilding.com/blog/behind-the-build

No-compromise cordless grinder

Milwaukee 2780
Wheel size: 4½ in. and 5 in.
Weight: 5.8 lb. **Price:** $340 (kit)

Even with the consistent improvements in power-tool battery technology, I was skeptical that a battery-powered grinder would have enough run time to be useful. I'm pleased to report that I was just plain wrong. I've been using the Milwaukee 18v Fuel Grinder for almost a year now, and it works better than my corded grinder. This was my go-to tool for cutting a patio's worth of bluestone flagstones. The grinder cut the bluestone like butter, and not having to manage a cord made the process faster and easier. The tool is equally adept at cutting threaded rod, steel tubing, and Unistrut. The 5-amp/hr packs provide a good balance of run time and reasonable weight. Admittedly, the process of cutting and laying natural-cleft flags is slow and tedious, but I was able to work for hours before the battery required a recharge.

In addition to its surprising run time, the grinder has modern features that make it easy to like, including a quick-release arbor bolt, padded auxiliary handle, and washable air-intake filter. The housing is comfortable and the large paddle switch makes it easy to grip, and it's not as shrill as some grinders I've used. With this tool, there are only pluses. I wouldn't change a single thing—except I'd get one sooner.

P.M.

Photo: courtesy of Milwaukee

Photo: Asa Christiana

Fine Homebuilding SEPTEMBER 2019 NO. 285

The Complicated Role of a Water Resistive Barrier

Choose the right product and install it well, because if you're not keeping water out, nothing else matters

BY BRIAN PONTOLILO

As a teenager, I worked for a small general contracting company. In between a lot of grunt work and coffee runs, I learned to do some carpentry. On two jobs, I helped install siding. When we installed cedar shakes, the carpenters taught me to offset each seam as much as possible to keep water from getting behind the siding. When installing clapboards, we backed up all of the butt joints with flashing, which has long been best practice.

Fast forward 20 years: I'm working at *Fine Homebuilding*, visiting the job site of a high-performance home that was designed by a well-respected architect and is being built by a high-performance builder. On the coast, where wind-driven rain is a regular event, the crew had just finished installing the "open-gap," or "rainscreen," siding—that is, siding installed over furring strips with an intentional space left between the boards.

How did we get from laying a healthy bead of caulk where siding meets trim to leaving a wide open space between each course? When did we stop relying on siding to keep water out, and start installing it to let water out? Perhaps it was the mold explosion in homes at the turn of the century and the work of architects, building scientists, and educators like Steve Baczek who showed us that even the best siding installation is no match for water, and that every house needs a dedicated and effective water-resistive barrier, or WRB. "Mother nature has a perfect record," says Baczek, "Water is the number one killer of buildings."

The International Code Council agrees. Section R703.1.1 of the International Residential Code (IRC) calls for a water-resistive barrier behind siding and only allows exceptions for some masonry walls and wall assemblies that have been specifically tested to show resistance to wind-driven rain. Regardless of how we got here, the role of the material behind the siding has become of the utmost importance, and manufacturers have responded at warp speed. While you can find code-approved WRBs marketed for every wall assembly imaginable, there's a lot to know to make an educated decision on how best to keep your walls dry.

Performance data is elusive

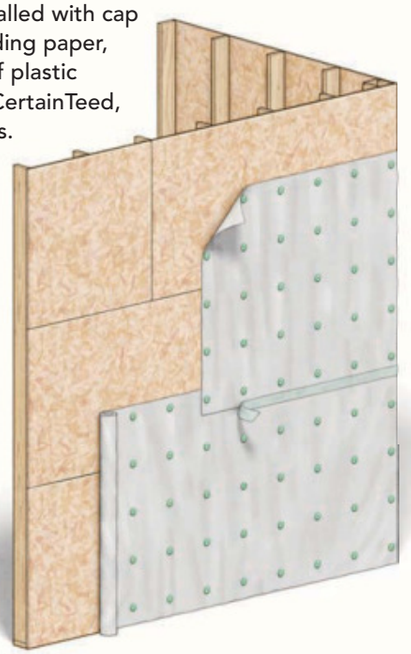
According to Yamil Moya, an engineer at the International Code Council Evaluation Service (ICC-ES), the nonprofit that evaluates building materials for the IRC, Type 1 asphalt-saturated felt meeting ASTM standard D226 is the only WRB prescribed in the code. All other products must be approved through criteria created by his organization. ICC-ES acceptance criteria 38, or AC38, is used to evaluate the durability, water resistance, vapor transmission, air leakage, and other qualities of most housewraps. Other product types have different criteria. Fluid-applied water-resistive barriers, for example, must meet ICC-ES AC212.

To meet these standards, manufacturers submit materials including product specs, test results for water resistance and permeability, and installation guidelines. All approved products have a report available online at icc-es.org. Unfortunately, the reports don't provide test results or evaluate the products,

SIX WAYS TO M

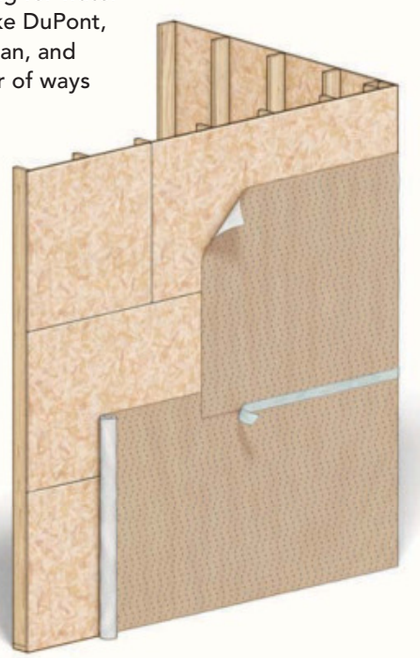
STANDARD HOUSEWRAPS

Water-resistive barriers that come in rolls and are generally installed with cap fasteners include felt, building paper, and numerous variations of plastic housewrap from DuPont, CertainTeed, Barricade, and many others. Though installation is similar, with courses lapped over each other from the bottom to the top of the wall and flashings integrated for drainage, this category of products varies widely in performance, quality, and price. Even with the seams taped, most of these products tend not to be great air barriers, despite manufacturers' marketing claims.



DRAINABLE HOUSEWRAPS

As soon as building scientists spread the word that you don't need much of a gap behind your siding for water to drain, manufacturers like DuPont, Benjamin Obdyke, Kingspan, and Tamlyn invented a number of ways to integrate a drainage plane with their housewraps. There are products with wrinkles, grooves, dimples, and spacers, all designed to keep siding from trapping water. Most of these products install like housewrap, though they are generally a step up in cost. If you are not planning to install your siding on furring strips to create a more robust air and ventilation space, a drainable product is the next best option.



Drawings: John Hartman

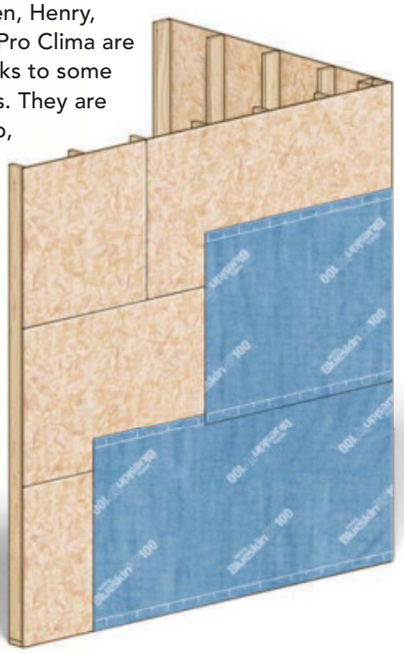
O MANAGE WATER

INTEGRATED PANELS

This style of WRB includes Huber's ZIP System, Georgia-Pacific's ForceField, and LP's WeatherLogic, which are all OSB with adhered water- and air-resistive materials. The benefit is that it takes fewer steps to sheath a house and detail the water and air barriers on the walls. Each company's panels and tapes work as a proprietary system, but install in a similar way. Critics point to the reliance on the tape—and some people are just not fans of OSB. These systems are slightly more expensive than wrapping standard OSB in most houswraps.

SELF-ADHERING BARRIERS

Peel-and-stick water-resistive barriers from companies like Dörken, Henry, VaproShield, Carlisle, and Pro Clima are growing in popularity thanks to some pretty exceptional benefits. They are rolled out like a housewrap, so the seams lap for drainage, and the adhesive creates a gasket around siding fasteners. Because they fully adhere to the sheathing, they share the air-sealing potential of a panel product. Expect to pay a premium and keep in mind that certain products, substrates, and weather conditions may require that you use a primer before installation.



FLUID-APPLIED BARRIERS

Sprayed or rolled on to the sheathing, fluid-applied water-resistive barriers have a long history in commercial construction and are slowly being adopted by home builders. Available from companies like StoGuard, Tremco, and Prosoco, they are among the more expensive options, but have some advantages. They efficiently seal the entire sheathed wall from water and air intrusion. Some products incorporate tape at sheathing seams and as flashings at rough openings; others rely on fluid-applied flashing products to complete the system. Some fluid-applied water-resistive barriers must be installed by certified contractors.

RIGID-FOAM INSULATION

There are a number of good reasons to insulate the outside of a house, and this thermal layer can sometimes be used as the water-resistive barrier. But there are some caveats. First, not all foam is approved. If you search on icc-es.org for AC71, the acceptance criteria for rigid-foam panels as a water-resistive barrier, you will find a relatively small number of approved polyiso, XPS, and EPS products. Another important detail is that you need to bring all of your waterproofing out to the face of the foam, which will likely mean furring out windows and doors and could require some tricky flashing details.

they simple describe the applications for which the products are approved, and give limitations. "Meeting these criteria only means that they comply with minimum requirements," said Moya, who declined to comment on the quality of individual products.

Many experts agree that the tests ICC-ES accepts for water resistance don't necessarily represent installed conditions. In one test for housewraps, the products are shaped into boats and floated on water to see how long it takes for them to leak. Another exposes the material to a specific column of water for a certain amount of time. According to Peter Yost, a high-performance-building consultant, failure is often the result of water being trapped between the siding and the WRB, a phenomenon called "water held in tension." Since products are not tested for this real-world situation, Yost says our best option is to install siding in a way that won't allow it to occur.

More than a product

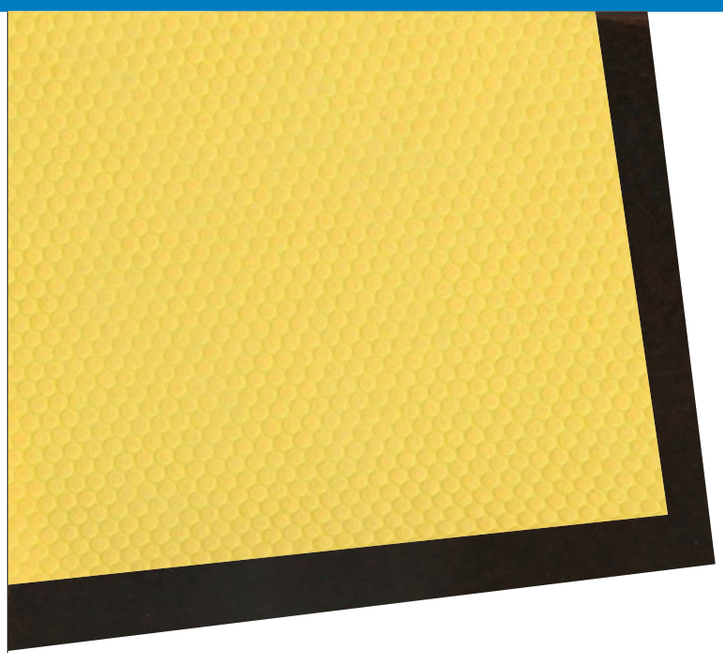
A WRBs primary duty is to keep water from getting into the walls. The product you choose is part of the equation. But as Baczek likes to say, we can set any product up for success or failure with the way we design the rest of the house. He uses roof overhangs as an example: The greater the length of the overhang, the further away we keep rain and snow melt from the walls.

Baczek, Yost, and most other experts agree that the best thing you can do to give your WRB a chance to succeed is to ventilate your siding. In rainscreen siding installations, the WRB is also sometimes referred to as the drainage plane—the surface that water can run down to eventually escape to the ground. Any type of WRB can be used in this application. However, builders who don't use furring strips to create an air space may prefer a drainable housewrap—a product with an integral drainage gap.

It is because we hope the water that gets behind the siding will drain that felt, building paper, and housewraps are installed shingle-style with overlapping seams. To effectively keep water out, there's much more to know about installing a WRB, including how to integrate your chosen product with window and door flashing, how to integrate existing and new products when remodeling, and even how to make repairs when the WRB is accidentally damaged during construction. In other words, even the best products are only as good as the installation.

Air-sealing is possible

The order of the conditions that a wall assembly needs to control is important. Water comes first because everything else is irrelevant if your building starts to rot. Air is second on the list. A tight house is more comfortable and more efficient. And when we control air, we control moisture, because a lot



HENRY JUMBO TEX

In our time of high-tech materials, it seems odd that the only product the IRC lists as a water-resistive barrier for walls—Type 1, #15 asphalt felt—is actually made for roofs. More curious is that today's "felt" is mostly asphalt-impregnated, recycled paper. If you like the qualities that felt has to offer, but want a product designed for walls, you might consider Henry's Jumbo Tex. Made from virgin organic material, Jumbo Tex is asphalt-saturated kraft paper. It meets the IRC's criteria for a WRB, can be used behind any type of siding, and has a higher perm rating than roofing felt. Jumbo Tex is available in 20-minute and 60-minute water-resistive options, as well as two-ply products (shown here). Like other felt and paper products, Jumbo Tex needs to be covered quickly as it is not UV stable. Though prices vary regionally, a 40-in. roll of basic Jumbo Tex that will cover 324 sq. ft. typically costs less than $20.

WRB FAQs

I interviewed a number of manufacturers' marketing folks and product managers for this article. One thing that I asked all of them was, "What are the most common question you get about your products?" Here are some of the most applicable responses.

Product photos: left and middle, Melinda Sonido; right, courtesy of the manufacturer

K AT WATER-RESISTIVE BARRIERS

DUPONT TYVEK HOMEWRAP

For a while it seemed that the brand name "Tyvek" was used synonymously with "housewrap." This is because it was the first synthetic product to hit the market, long before a water-resistive barrier was required by the IRC. Tyvek HomeWrap is nonwoven, nonperforated, high-density polyethelene. It has a perm rating of 56, one of the highest available, and is UV resistant for 120 days. DuPont also offers Tyvek DrainWrap, a slightly less permeable product with vertical grooves that create a drainage plane behind siding; Tyvek ThermaWrap, an insulating water-resistive barrier; and Tyvek StuccoWrap, a water-resistive barrier specifically designed for stucco and EIFS. A 9 ft. by 150 ft. roll of Tyvek HomeWrap costs $150 at the big box stores (you'll also need fasteners, and maybe tape).

HUBER ZIP SYSTEM SHEATHING

Huber Engineered Woods introduced ZIP System sheathing around the same time Apple introduced the iPhone. Both were revolutionary. Huber's goal was to lessen the number of steps it takes a builder to sheath a house, install the WRB, and create an airtight envelope. ZIP panels are OSB with a phenolic-resin-impregnated covering. Seam-sealing and flashing are done with ZIP System tapes and fluid flashing products. The panel coating has a perm rating between 12 and 16 and can be exposed for up to 180 days before siding is installed. Huber has since launched ZIP System R-sheathing, which includes thermal control. The cost of ZIP System panels varies regionally and fluctuates with the price of OSB. At the time of writing, a 4-ft. by 8-ft. sheet of 7/16-in. Zip System sheathing costs $16 in Texas and $30 in Connecticut (a roll of tape, enough for eight sheets, is $27 in Texas and $33 in Connecticut).

Why should I spend money on an expensive housewrap when the siding is keeping most of the water out?

Siding does keep a lot of water away from your wall assemblies, but experts agree that even the best siding installations leak. And there are other ways that water can get behind your siding and into your walls. Brian Kirn at CertainTeed says that the upgrade from CertaWrap—their woven, perforated, more budget-oriented housewrap—to CertaWrap Premium—their nonwoven, non-perforated high-performance product—will only add a few hundred dollars to the cost of a project. Kirn says that you can get away with CertaWrap in drier areas with less intense weather. Everywhere else, the upgrade to CertaWrap Premium is money well spent.

If I overdrive nails when installing ZIP System sheathing, do I create a weak link in my water-resistive barrier?

Chris Clark, the director of technical services at Huber, says this is the number one question he's asked. The answer is: It depends. While a slightly overdriven nail won't affect the performance of the water-resistive barrier or the product warranty, any nail driven more than halfway through the panel should be addressed. From a water-management perspective, this simply means covering the fastener with a small piece of ZIP tape or their fluid flashing product. However, overdriven fasteners can be a structural weak point, so another nail should be added to satisfy your building inspector and allow you to sleep well at night.

of water vapor rides on air. A leaky home will have much more water vapor traveling through the walls than a tight home. According to Baczek, vapor diffusion through an airtight assembly is an insignificant problem in comparison to air intrusion in a leaky home. "If I solve for water and I solve for air," he said, "vapor and thermal are easy."

For this reason, many architects and builders are turning to WRBs that are also effective and easy-to-detail air barriers. Panel products, self-adhering WRBs, and fluid-applied WRBs can be part of a home's air-barrier system. While certain products can make water- and air-management a one-step process, be careful as you consider what WRB is right for your project.

Many plastic housewraps are made of airtight materials and are marketed as such, but it's widely known that they are tricky, although not impossible, to install as effective air barriers. If you plan to go with this type of product, and want your air barrier on the exterior of the wall, a more straightforward option is to tape the sheathing joints and use a combination of tape and polyurethane spray foam to air-seal penetrations.

Walls can still get wet

All WRBs have a listed perm rating that describes how easily water vapor can move through the material. A product with a higher perm rating will allow water vapor to transfer through the material more readily than one with a lower perm rating. Code-approved felt has a perm rating around five when the material is dry, though the perm rating increases to as much as 60 when the felt gets wet. Most WRBs do not absorb water, but that doesn't mean the perm rating is always consistent. Perm ratings are tested in specific weather conditions, namely under controlled temperature and humidity. When those conditions change around an installed material, so does its permeability.

Carl Fiocchi, a building scientist at the University of Massachusetts, looks for a combination of water resistance, durability, and high vapor-permeability when choosing a product. "For my money," says Fiocchi, "the higher permeability I can get, the better." Many experts take this route because even without leaks, walls can still get wet. For example, water vapor from the warm air inside a house can be driven outward during the winter and condense on cold sheathing. In this situation, a more permeable water-resistive barrier won't trap the water inside the wall.

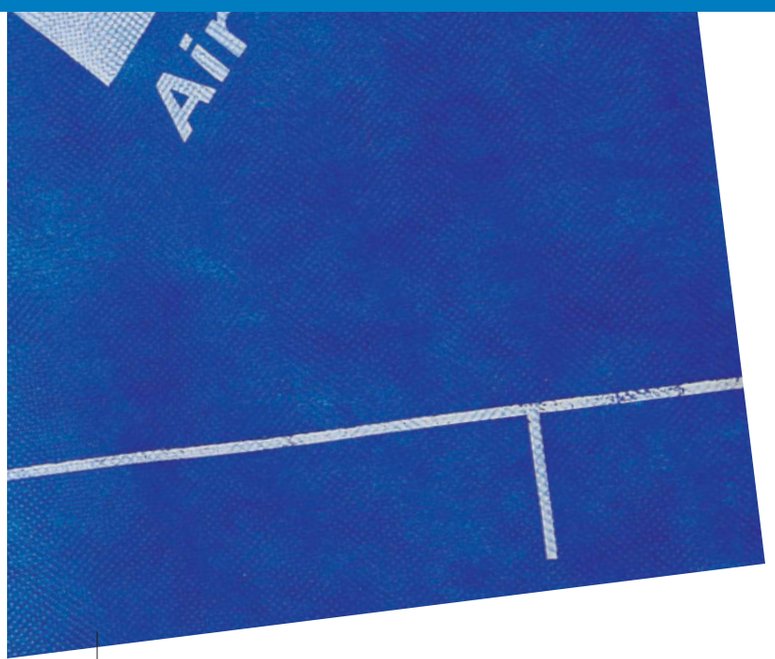
Michael Aoki-Kramer, managing principal at RDH Building Science, points out that it's important to know the general thresholds when it comes to perm ratings. "At the upper end, perm rating doesn't really matter. Above 20, there is no appreciable improvement in drying time. Below 10 perms, you start slowing down the rate of drying in ways that could be appreciable." While a low perm rating may not be desirable in a wall assembly that you are expecting to dry outward, Aoki-Kramer points out that there are situations where you may want a WRB to resist inward vapor drive. He says that homes with reservoir sidings like brick and stucco that can hold a lot of water may be candidates for a WRB with a lower perm rating.

Finally, the perm rating on a product's data sheet only tells some of the story. With panel products, the stated perm ratings apply to the water-resistive coatings, not the OSB it's applied to, and OSB is a pretty effective vapor retarder. How the product achieves permeability matters, too. For example, a plastic housewrap may be perforated or nonperforated. Perforated materials are punched with tiny holes to create permeability while nonperforated materials allow water vapor

BENJAMIN OBDYKE HYDROGAP

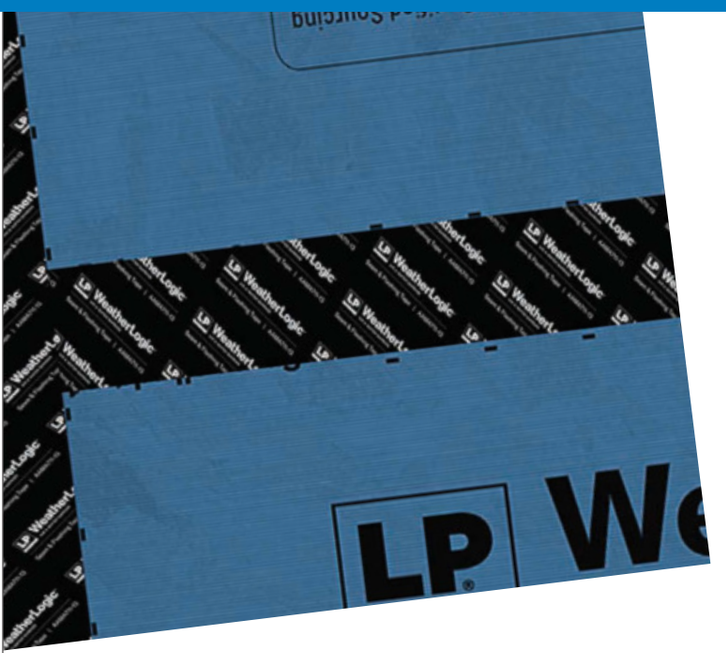
The folks at Benjamin Obdyke pride themselves on using the latest building science to develop their products. When they began to develop their first drainable housewrap, they turned to the research of Building Science Corp. to determine the optimal space. The results of their research and development is HydroGap Drainable Housewrap. Launched in 2011, HydroGap is a laminated product with a waterproof film sandwiched between nonwoven polypropylene layers that provide strength and UV resistance. On the outer surface, HydroGap has rigid 1-mm spacers that create a drainage plane behind the siding. The product is rated at 16 perms and can be exposed for 120 days. You can buy HydroGap direct from Benjamin Obdyke's website. A 5-ft. by 100-ft. roll sells for about $140.

Product photos: left and right, courtesy of the manufacturers; middle, Melinda Sonido



HENRY BLUESKIN VP100

Henry has been making sticky stuff for a long time. The company produces a number of tapes, sealants, and adhesives. These products are generally not breathable, but Henry cracked this code with Blueskin VP100—a peel-and-stick water-resistive barrier with a perm rating of 33. Henry won't give away their "trade secrets" and just says that Blueskin has an engineered film with a patented, permeable adhesive. Some substrates and application in certain temperatures may require a primer, and you must use compatible Henry flashing products to maintain the warranty, so read the product literature carefully. Henry doesn't offer consistent regional pricing. At the time of writing, a 4-ft. by 100-ft. roll costs about $250 in South Carolina.



LP WEATHERLOGIC

To create WeatherLogic, LP Building Solutions applied their SmartSide technology—a water-resistive paper overlay—to OSB panels. When taped and flashed properly, the structural sheathing provides a code-approved WRB. LP's acrylic tape comes in 3¾-in. and 6-in. widths for taping seams and flashing windows, doors, and penetrations. Each roll comes with a squeegee to smooth and bond the tape to the substrate. WeatherLogic is currently only available in 7/16-in. panels approved for walls, but LP plans to release roof sheathing, more panel sizes, and more helpful accessories. The product coating is rated at just over five perms and can be exposed for six months. WeatherLogic is so new that it may be difficult to source, but at the time of writing, a builder in Alabama can get 4-ft. by 8-ft. sheets for $15, and a roll of the 3¾-in. seam tape for $27.

WRB FAQs CONTINUED

Does siding installation compress drainable housewrap, reducing the gap and the ability of the assembly to drain?

It is hard to believe that the small wrinkles, grooves, and spacers in some drainable housewraps actually create an effective space for drainage. However, Chris Yount, senior vice president for residential products at Henry, and Tara Murray, director of marketing at Benjamin Obdyke, both explain that part of their drainable housewrap's design and testing was to make sure that the material will not be flattened or smoothed out when siding is installed. Benjamin Obdyke funded testing of ten drainable housewraps in a chamber mimicking a real-world wall assembly. The results are available on their website.

Do I really need to use a J-roller when installing flashing tape to seal a water-resistive barrier?

Yes. These tapes are generally pressure activated, and according to the folks at both Huber and Benjamin Obdyke, this is a critical installation detail. Run a J-roller over the tape and smooth out any bubbles or wrinkles for the best bond and a more waterproof assembly. If you choose a self-adhering water-resistive barrier like Henry Blueskin, the entire surface must be rolled.

to diffuse through the material itself. Though both types can pass the necessary testing for code approval, and both may be considered permeable materials, perforated materials have shown to be much less water resistant in independent testing. If you're building in an extremely wet area, this may be an important distinction. In a dry area, it may not.

Installation matters

In one simple paragraph, the IRC describes how felt must be installed to meet the requirement for a WRB—horizontally, upper course lapped over the course below by at least 2 in., vertical joints lapped at least 6 in., without "holes or breaks," and continuous to the top of the wall. That's it. The IRC says that any other approved product should be "...installed in accordance with the water-resistive barrier manufacturer's installation instructions."

The best housewrap manufacturers' instructions will include not only how much to overlap the horizontal courses and vertical seams, but also a fastening schedule and how to integrate flashings for many different penetrations. According to Mike Guertin, who has been educating the building industry about WRBs for two decades, reverse lapping is still a common mistake, and builders often integrate the flashing incorrectly too. If you mistakenly put step flashing over the WRB where a wall meets a roof, for example, then any water that gets behind the flashing gets to the sheathing.

When it comes to using air-sealing and flashing tapes with any type of water-resistive barrier, make sure they are compatible. If this information isn't listed in the installation instructions, it's worth a call to customer service to make sure you don't do anything that will fail or void the WRB's warranty. While panel-style products will first be installed as structural sheathing, it's the taping and flashing process that allows them to work as effective water-resistive barriers. The manufacturer's installation instructions specify which weather conditions are acceptable for taping, how much the tape must overlay each side of the seams, the order of taping seams, and methods for firmly seating the tape—a J-roller may be needed.

Self-adhering WRBs combine installation details for housewraps and panels. Though these products can sometimes be installed vertically, manufacturers encourage shingle-style installations—overlapping courses from the bottom of the wall to the top—and specify how much the courses should overlap. Because these products are essentially big rolls of tape, the right temperature and surface prep are necessary. Like tape, self-adhering water-resistive barriers should be rolled out to improve adhesion.

Though some manufacturers of fluid-applied WRBs require training to use their products, these types are among the simplest to install once you understand the process. On the other hand, using rigid foam as a water-resistive barrier, which can be temping if you are planning to use it for exterior installation, can be very tricky to detail well.

Finally, it's important to know how long your WRB can be left exposed. While some products offer up to 12 months, more commonly WRBs must be covered within two to four months. One UV-stable product is Benjamin Obdyke's InvisiWrap UV. Not only is this new water-resistive barrier rated for up to a year of exposure, it's black with no writing on it and meant to disappear behind open-joint siding. The 25-year warranty allows gaps in the siding of up to 2 in., which prompts the question: How long until we don't need siding at all? □

DÖRKEN DELTA-VENT SA

Dörken is a German company that proves how far ahead Europeans tend to be when it comes to innovative home-building practices. Dörken started making finishes in 1892, released their first synthetic roofing underlayment in the 1960s, and had a UV-resistant water-resistive barrier for open-joint siding in 1999. Today, their premium WRB is Delta-Vent SA. This layered product has protective spun-bonded polypropylene outer layers protecting a polymeric water-resistive barrier. It has a high perm rating of 50 and a one-of-a-kind lap-sealing system. Dörken's suggested retail price for Delta-Vent SA is around $565 for a 4-ft. 11-in. by 115-ft. roll, but they also offer "special project pricing." So, it may be worth a visit to their website to find the sales rep for your region before ordering.

Brian Pontolilo is editor of greenbuildingadvisor.com.

Product photos: left, Kevin Nielsen; middle, Melinda Sonido; right, courtesy of the manufacturer

PRO CLIMA SOLITEX MENTO

Germans like to over-engineer everything from cars to, well, water-resistive barriers. Pro Clima is a German company distributed by 475 High Performance Building Supply. Their main line of WRBs includes Solitex Mento 1000, 3000 Connect, and 5000 Connect, all layered products with a polymer blend sandwiched between protective layers and a perm rating of 38. The product numbers represent increasing thicknesses and durability—the 1000 can be exposed for three months, the 3000 for four, and the 5000 for six. When installing a rainscreen assembly over these products, you can use Pro Clima's Tescon Naideck batten tape behind furring strips to create a WRB with no vulnerable fastener penetrations. A 59-in. by 164-ft. roll of Mento 1000 costs $220; 3000 Connect is $280; and 5000 Connect is $350.

PROSOCO CAT 5

Prosoco claims to test their fluid-applied water and air barriers to failure in high-rise commercial construction, so they feel confident in the performance of their entire line. Their most durable product, Cat 5, is a silyl-terminated polyether that is rolled onto the substrate. Because it is moisture-activated and rated at 18 perms, Cat 5 can be applied to wet surfaces. It can be exposed for up to a year. Cat 5 works in tandem with Prosoco's fiber-reinforced Joint & Seam Filler and fluid-applied FastFlash. Many jobs will only require one coat of Cat 5, though two is recommended for OSB sheathing. In Denver, a 5-gal. bucket of CAT 5 costs $560 and covers up to 500 sq. ft., depending on the substrate. A 20-oz. tube of Joint & Seam Filler costs $35 and covers up to 60 linear ft. A 20-oz. tube of FastFlash costs $25 and covers up to 17 sq. ft. Prices may vary regionally.

WRB FAQs CONTINUED

Do I need to tape the horizontal laps of my housewrap?

More than one manufacturer told me that this is a commonly asked question. However, their answers differed. From a water-management perspective, the folks at Benjamin Obdyke would rather you didn't tape horizontal seams. As long as your housewrap is lapped appropriately, water will drain. Tara Murray told me that any surface-mounted tape will only create a reverse lap and a place for water to potentially hang up. Brian Kirn at CertainTeed feels differently, and says that taping horizontal laps provides extra waterproofing protection. And of course, if you're trying to use your housewrap as an air barrier, you'll have to tape all of the seams.

Is it really a good idea to make my house airtight?

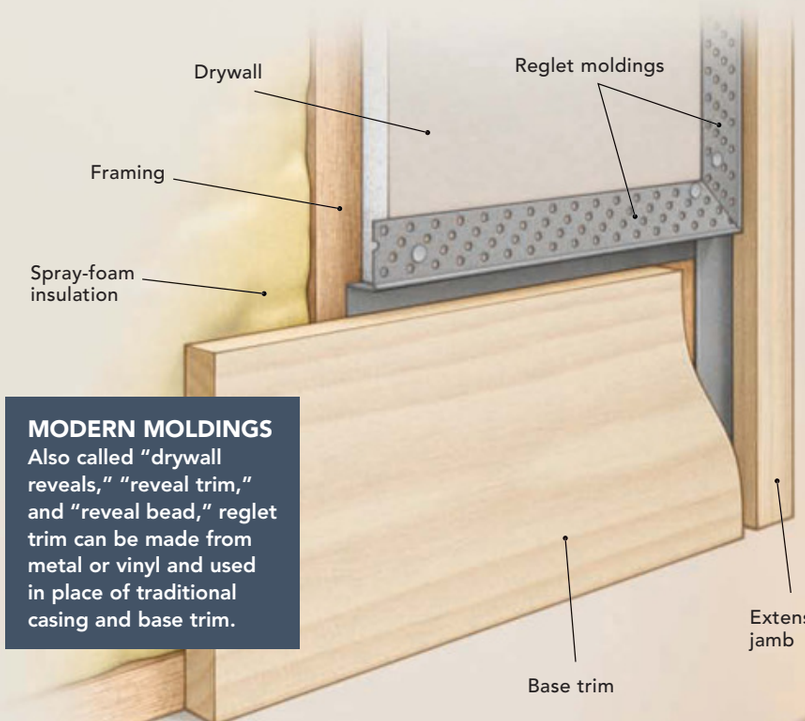
Johnny Rezvani, a certified Passive House consultant and the director of communications at 457 High Performance Building Supply, the North American distributor for Pro Clima, told me that this is still a very commonly asked question. The answer, of course, is yes—but you need to know what you are doing. He says that his company is always willing to help their customers design building assemblies that are airtight and vapor-open, and they are building a free library of details on their website to help. They also sell a number of ventilation appliances for tight homes.

Installing Reglet Trim

BY JOE MILICIA

How to pull off this tricky detail without callbacks

My company has focused on high-end finish carpentry for 25 years. Recently, a general contractor and regular customer approached us after he was unable to find a drywaller to install Fry Reglet trim in a modern home. It's not surprising that our customer couldn't find a drywaller—it's fussy work, and I've heard other contractors complain of callbacks related to cracks around doors and windows. Reglet trim challenges the traditional construction sequence because unlike normal trim, it's installed before the drywall is finished. It's also a much more finicky process than most



MODERN MOLDINGS
Also called "drywall reveals," "reveal trim," and "reveal bead," reglet trim can be made from metal or vinyl and used in place of traditional casing and base trim.

Drawings: Christopher Mills

WORKING WITH REGLET

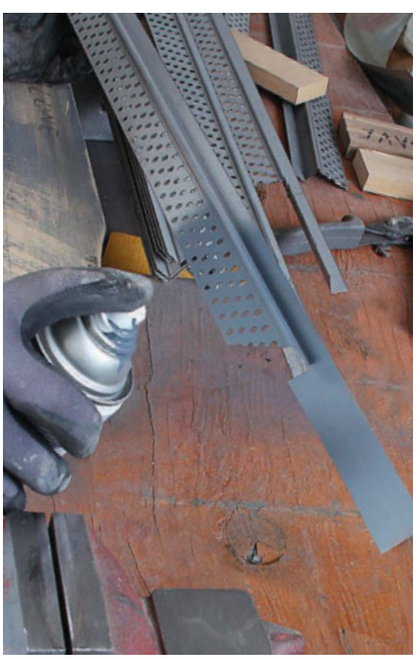
The term "reglet" comes from masonry and refers to the groove cut into a mortar joint to receive counterflashing. The clean lines and minimalist look of reglet trim originated in commercial buildings. Here we used Fry Reglet moldings (fryreglet .com). The company manufactures the trim in steel and aluminum—in unfinished and prefinished versions—for use with drywall, plaster, stucco, and fiber cement.

Use a miter saw for crosscuts. *Cut metal reglet with a 100-tooth metal-cutting blade. Lube the blade with paraffin for smoother cuts, and add a piece of stock to the saw table for uniform support. Use your old miter saw; cutting the reglet is messy.*

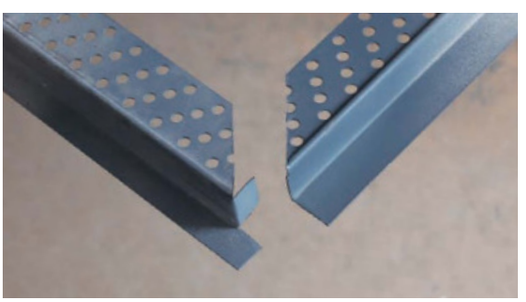
Use a grinder for rip cuts. *An angle grinder with a steel-cutting abrasive blade is best for removing flanges and making stopped cuts. Remove burrs with a file or wire brush so joints are tight.*

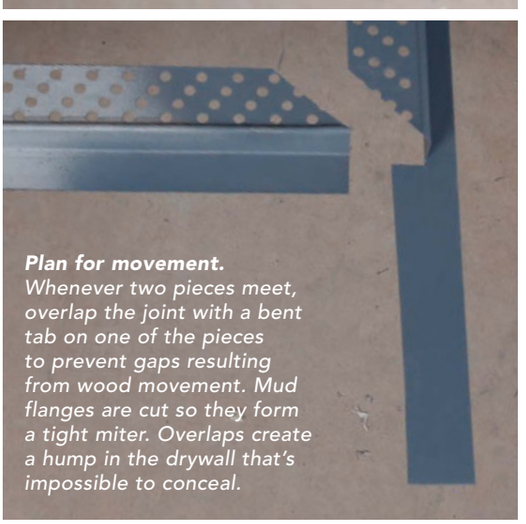
Use snips for small cuts. *High-quality aviation snips also work for cuts. Wear gloves when handling the pieces because even the factory-cut edges are razor sharp.*

Metalwork. *A small bench vice, a smooth-faced hammer, and hand benders help with fabrication. This piece of reglet intersects with a piece of base trim; we flatten the "L" so the poplar base can overlap without gaps.*



Prime cuts. *Spray cut pieces with gray primer so you can see the joints better when dry-fitting miters and transitions. The primer also makes the installation look more finished.*





Plan for movement. *Whenever two pieces meet, overlap the joint with a bent tab on one of the pieces to prevent gaps resulting from wood movement. Mud flanges are cut so they form a tight miter. Overlaps create a hump in the drywall that's impossible to conceal.*

drywall contractors want to get involved in, and requires tools they're not used to.

As you can see in the photos, a reglet detail often eliminates the casing around doors and windows. On this house, it's also used as a transition above the baseboard, recessing the ¾-in.-thick boards so they are just slightly proud of the wall. The biggest problem when you use reglet trim in a residential setting is cracked joint compound, especially around interior doors. To prevent cracks, you have to control the movement of the trim pieces and ensure that door and window jambs are rock solid. Any flexing of the jambs will show up as cracks in the compound.

Get the right pieces

Reglet trim requires a layout that minimizes splices and inconspicuously overlaps the horizontal and vertical pieces at corners and transitions. Make sure the trims selected by the designer match the drywall thickness. There are dozens of commonly used sizes and it's easy to get them confused. For this project, we ordered the trims in 8-ft. and 10-ft. pieces to minimize splices. We followed the same principles of a good crown layout—never have a crown splice in a visible area, and always add blocking behind the joint.

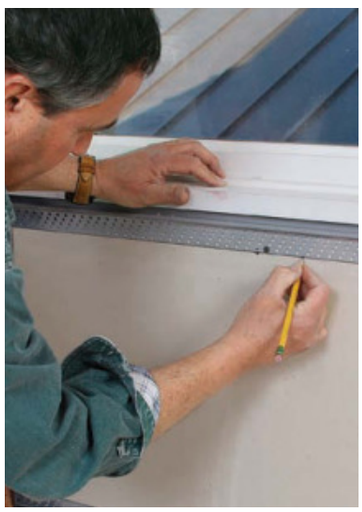
An important difference from wood casing is that reglet trim is strictly decorative. So unlike casing, the trim doesn't provide any structural support for the door. On this particular job, the 1¾-in.-thick solid-MDF interior doors were extremely heavy, so we convinced the contractor to use 1-in.-thick solid-stock jambs to handle the doors' weight.

After the doors were hung with 15-ga. finish nails, we screwed the jambs to the framing with structural screws and plugged the holes. Then we added blocking—cut from scrap plywood and solid stock—to the jambs, attaching them with screws and construction adhesive. We held these pieces back from the edge of the jambs so they would align with the back of the reglet. The blocking is a key element of a good installation because it prevents the trim from flexing and stiffens the jambs. We followed the same steps for the home's floor-to-ceiling windows. The finished project looks great—and nearly a year later, there have been no cracks. □

Joe Milicia is owner of Hobart Builders in Fairfield, Conn. Photos by Patrick McCombe.

INSTALLING REGLET

The secret to a successful reglet-trim installation is ensuring the pieces don't move, which can lead to cracks in the joint compound that conceals the nailing flange. It's also important to overlap the exposed part of the reglet in corners and transitions or you'll end up with gaps that are impossible to conceal with caulk or filler.



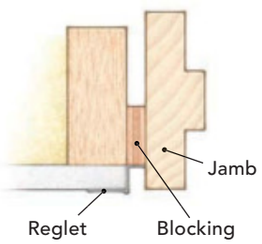
Dry-fit first. *After cutting, dry-fit the reglet parts using drywall screws to temporarily hold them in place. Adjust the fit until all the miters are tight and then mark the inside perimeter to guide the placement of construction adhesive.*

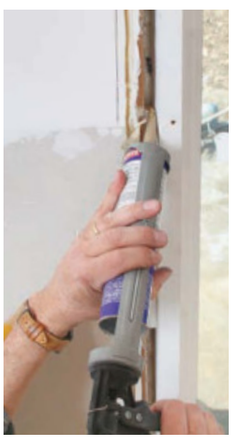
Use glue too. *High-quality solvent-based construction adhesive holds the reglet trim better than nails alone. This helps prevent the movement that can cause cracks in the joint compound applied on top of the trim. The pencil lines from the dry fit show where to put the adhesive.*

Nail it up. *In addition to construction adhesive, the reglet trim is held with ring-shank nails made for exterior stucco trims like weep screed and outside corners. They have a thicker shank and deeper rings than drywall nails.*

Making transitions. *Although reglet offers no structural support, it often acts as an important visual transition between different materials. On this house it replaces casing, acts as the transition from wall to baseboard, and transitions between stone veneer columns and the walls.*

Case, then base. *Once the window trim is complete, we install the trim for adjacent baseboard. When all the reglet is in place, we sand and finish the hardwood floors before the baseboard is installed.*





Glue everything. *In addition to gluing the nailing flange to the wall, glue the back of the reglet to blocking behind it to prevent flexing and cracked drywall.*

To see more photos showing how this house uses reglet trim to achieve a modern look, visit FineHomebuilding.com/magazine

Nail the bottom later. *When the window or door trim intersects the base trim, don't nail the bottom of the door (or window) trim until the base trim is in place. This allows you to make the tightest possible joint and eliminates gaps that can lead to cracks later.*

Finish the drywall. *Once the reglet is in place, the molding is finished similar to conventional corner bead or J-bead. Tapers should use heavy-duty taping compound or setting-type compounds for the first two coats. All-purpose or topping compound is okay for the final coat.*

AT ONE WITH THE WATER The living room is lined with 85-mph impact-rated aluminum-clad windows with insulated glass, yielding 180° views of Skagit Bay. The prow sitting area is meant to give the sense of being on a boat; the wave-patterned Modular Arts wall panels fit the ocean theme.

POLISHED AND PROTECTED Garage doors from Overhead Door in the lower level open to a south-facing patio and an entry courtyard. Steel and concrete materials were chosen for their ability to withstand flood waters. All of the building materials on this level are completely waterproof.

Built For Cat a

t astrophe

This coastal Washington home is built to stay upright, even during weather events that would destroy the average house

BY KILEY JACQUES

Dan Nelson, principal of Designs Northwest Architects, is regularly hired to design and build houses ready to withstand major weather events. Much of that has to do with his firm's location in Washington State, where seismic risk runs high. He is an expert at designing homes in preparation for wildfire and earthquake scenarios. His Tsunami House is so named for the high-velocity wave walls it could withstand.

The project was a remodel of an aging fishing cottage on Camano Island in Puget Sound. Because the soils are sandy and prone to liquefaction, Dan designed a concrete floating slab. Code mandates that all new construction in a high-velocity wind and flood zone be built on piers, so the house sits on 9-ft. concrete columns, which are tied into the slab with a significant amount of rebar. The lower-level walls include custom industrial-style overhead garage doors and aluminum wall panels, operated with a plastic fastener system that enables them to break away if a tsunami hits. A steel moment frame is tied into the concrete slab, creating a hybrid structural system designed to withstand the impact of high-velocity

waves up to 8 ft. and 85-mph lateral winds, as well as a magnitude-7.8 earthquake. In the event of seismic activity, the entire structure will move as one unit.

The height of the piers allows for additional living space; the lower level functions as an open-air space, while the main living spaces sit above in case of flooding. The "Flood Room" on the lower level features water-resistant materials including buffed concrete floors with hydronic radiant heat, tiled walls, and a burnished steel staircase.

Of the style, Dan says: "We are working more and more with low-maintenance materials that perform better under severe conditions, and those materials naturally lend themselves to modern design." He also notes a shift that occurred about six years ago in his region, when clients began moving away from the rustic charm of the classic Northwest Craftsman style and toward modern forms and materials. He regularly specs standing-seam metal cladding, Hardie fiber-cement siding, VIVIX Lap siding, and Trespa phenolic panels, which he describes as akin to pressed-resin sheets.

Dan notes that modern design is often thought to be sterile, which doesn't resonate with the idea of home. For this project, he warmed the upper-floor interiors with wood-grain porcelain-tile flooring and clear western red cedar on the ceilings and walls—a nod to the former cottage's cedar panelling, which could not be salvaged.

Having a lot of glass to maximize views is one of the challenges when designing a vulnerable waterfront property. Dan used Fleetwood fiberglass aluminum-clad windows with thermal break and insulated glass, which are extremely durable and comply with Washington's stringent energy code.

On the south side of the small lot, a terraced courtyard separates the house from the road, and a deck disguises the septic system. Had it been left as is, it would have been an eyesore. The concrete frame for the sand-filter system protrudes 3 ft. above grade and runs nearly the entire length of the house.

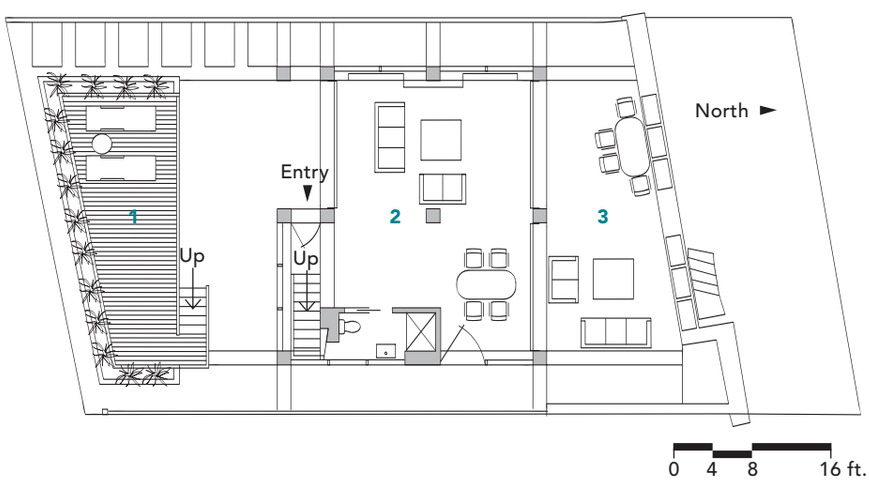
Asked about residential building in the face of climate change, Dan responds: "There's a lot architects and builders can do to start thinking about these issues up front. That will lead to advanced design strategies that we are just starting to explore." □

Kiley Jacques is design editor. Photos courtesy of Designs Northwest Architects.

SIMPLICITY BELIES THE BUILD The open-air "Flood Room" on the lower level is both a tsunami solution and a peaceful respite. The walls and overhead garage doors are designed to break away if a tsunami hits, allowing water to flow through.

SHELTER FROM THE STORM

The main living space is located on the second level in case of storm surges and flooding. It's oriented to protect against excessive sun exposure and optimize shade potential for maximum occupant comfort, while letting in light and views from the north.



SPECS

Bedrooms: 2

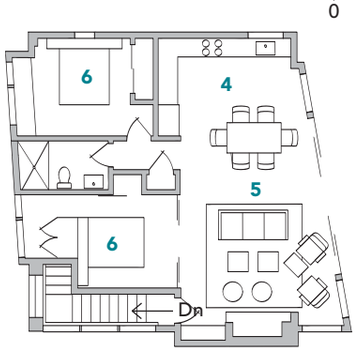
Bathrooms: 2

Size: 900 sq. ft.

Location: Camano Island, Wash.

Architect: Designs Northwest Architects, designsnw.com

Builder: J.P. Land Builder, jplandbuilder.com

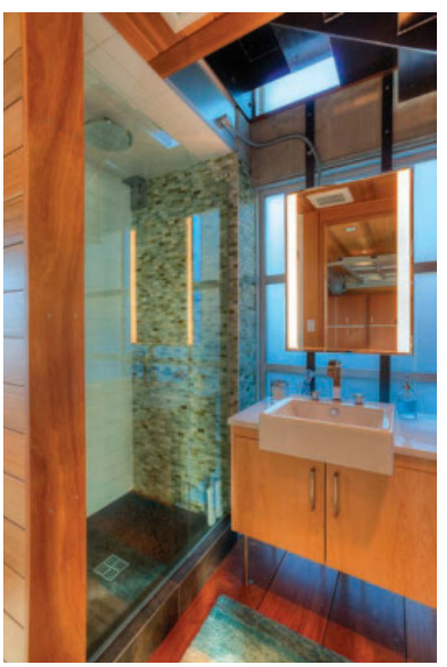


1 Raised deck
2 Flood room
3 Patio
4 Kitchen
5 Dining/living
6 Bedroom

Floor-plan drawings: Patrick Welsh

LIFTED AND LOFTED The 30-ft. structure stands 9 ft. above grade, which contributes to the second story's lofty feel. Despite its modest square footage, the space feels voluminous and accommodates three living zones, a bedroom, and a sleeping loft that also houses mechanicals and a storage area.

WEATHERPROOFED The main floors are connected by a steel-plate stair with sapele-wood treads. All electrical recepticals, switches, and controls are located high up on the walls in case of flooding.



SMART STRUCTURE A translucent aluminum and frosted-glass wall allows for privacy and natural light.

Air-Sealed and On Piers

An up-in-the-air solution to sealing an elevated floor

BY TIM HOLTON

As a remodeling contractor, I often find myself with unique projects that take some outside-the-box thinking, and this job was no different. My customers wanted to add a 12-ft. by 16-ft. sunroom to the back of their home, and property lines, patios, gardens, and a septic system made it near impossible to get excavation equipment and concrete trucks to the location.

After some research and talking with inspectors and other respected contractors, I decided to build the addition on deck-style footings and a subframe of built-up pressure-treated beams. This is not the standard foundation for sunrooms in our area, but the pros greatly outweighed the cons in this situation. We were able to hand-dig each footing 42 in. deep and place 18-in. concrete forms in the holes, then wheel the concrete around from the driveway to fill the forms. By forgoing excavating machines and distributing the soil from the footing holes to the gardens, we minimized damage to the yard and surrounding areas.

Since the addition is a conditioned space without a crawlspace or base-

ment, we had to come up with a way to seal the floor from air and moisture. We placed a 6-mil polyethylene vapor barrier and stone on the ground under the floor system to help prevent ground moisture from wicking and diffusing up through the bottom. We kept the floor approximately 6 in. above our stone and vapor barrier to allow some airflow under the space.

That just left air-sealing. After many hours of figuring, we devised a way to build a standard floor, raise it up, sheathe and tape it, and lower it back down. We rented two manually operated material lifts, each with a 1000-lb. load capacity, from our local supplier and used them to raise up the floor frame. Once it was up at a comfortable working height, we could sheathe it from below—similar to hanging drywall on a ceiling, albeit nailed as in normal wall construction. Once the underside was sheathed and the seams were taped, we lowered the structure back into place, nailed it off, insulated it, sheathed the top side, and continued with our wall framing just as if we were building on a standard floor system. (We didn't tape the perimeter of the sheathing to the floor frame, but it wouldn't hurt to do so.)

To fully insulate the floor, we placed strips of 1½-in.-thick rigid foam in each joist bay and along the rim joists, and sealed the perimeter of the strips with spray foam. Fiberglass-batt insulation fills the remainder of the joist cavity, and ¾-in. AdvanTech subflooring caps the floor system. Wire mesh attached to the perimeter framing and buried 2 in. deep in the soil around the perimeter will help keep rodents out.

This method of construction is an unorthodox approach and presents some challenges, but on a tight site such as this, it can be a better and more cost-effective option than a traditional foundation. □

Tim Holton is a carpenter based in Cochranville, Pa. Photos by Matthew Millham.

BRACE AND LIFT

The floor system sits on a pressure-treated 2x foundation attached to concrete piers. We build a standard floor frame on top of that—but we don't nail it until we've lifted it and sheathed the bottom. This floor was small, so a couple of doubled-up 2x4 strongbacks secured with long structural screws into each joist were enough to hold its weight; for larger floors, calculate the load and size your strongbacks, screws, and lifts accordingly.

BUILD AND BRACE

Build a standard floor frame, then square it up and cross-brace with 2x material screwed to the tops of the joists. Center the lifts on both sides of the floor system to balance its weight.

PREPARE FOR LIFTOFF

Screw a pair of double 2x4 strongbacks over the lift's forks and into the floor framing. Blocking screwed to the floor frame can bridge large gaps between the strongbacks and the framing. Drill pilot holes to prevent splitting.

RAISE THE FLOOR

Crank the floor frame up to a comfortable height to sheathe it from beneath, keeping it close to level to evenly distribute the load between the lifts.

SEAL THE UNDERSIDE

STABILIZE FOR SAFETY

Nail 2x material to the four corners of the floor frame to stabilize it in place. The lifts have the weight; this adds a layer of safety and rigidity while sheathing it from below.

DOWNSIDE UP

For safety and accuracy, have at least two pairs of additional hands hold full sheets of sheathing tight to and in line with the floor framing. Fasten starting at one end of the panel and work across its length to prevent buckling.

TAPE AND ROLL

Tape the seams with high-quality flashing tape, and roll the tape with a J-roller to ensure good adhesion.

BRING 'ER DOWN

Lower the bottom-sealed floor back onto the foundation, making sure to keep it level to keep the load evenly distributed on the lifts.

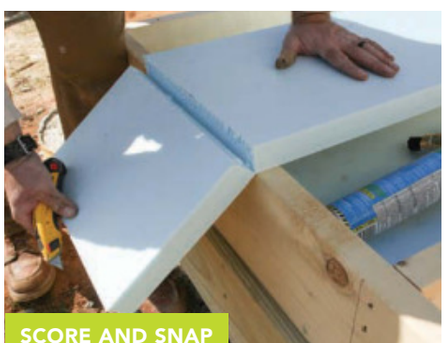
NAIL IT OFF

Secure the floor frame to the foundation with 3-in. galvanized nails 12 in. o.c. and 4-in. structural screws 2 ft. o.c. Don't step on the sheathing when fastening to midspan beams below.

INSULATE AND CAP

RIP TO STRIPS

Use a track saw or tablesaw to cut rigid foam to fit in the bottom of the joist bays and up the inside faces of the rim joists.



SCORE AND SNAP

To quickly cross-cut rigid foam, use a utility knife to score it as deep as the blade will go, and snap it on a straight, hard edge.

FOAM THE GAPS

Use spray foam to fill any gaps around the perimeter of the rigid foam to close off potential thermal bypasses and bolster the air-seal.

FILL WITH BATTS

Fill the remainder of the framing cavities with additional insulation, like the R-19 kraft-faced batts used here, to maximize thermal performance.

HANG IT LONG

Install wall sheathing so it overhangs the full depth of the floor framing.

FINAL SEAL

Seal the wall sheathing to the PT foundation with flashing tape.

Job-Site Protection

Products and methods to keep your clients' stuff clean and safe

BY DOUG HORGAN AND TOM JOHNSTON

There's a very important reason to do a great job with dust control, cleanup, and surface protection during a remodel: our clients. Dust, mess, and damage to their homes makes them crazy, and they judge us for failures. Proper protection is also less expensive and much faster than repairing stuff we weren't there to fix. No contractor wants to sand floors two weeks after a project has finished. Over the years, we've made enough mistakes that by now we have a good set of techniques and materials for protecting our clients' homes and belongings when we're remodeling.

The list of tricks and products is always evolving. When we present this information at trade shows, we always learn something new we can use. This article can't possibly cover all of the scenarios, so visit FineHomebuilding.com/magazine to see some additional techniques and a menu of our favorite products for protecting almost anything you'll come across on a residential site. □

Doug Horgan and Tom Johnston work for BOWA, a design firm in McLean and Middleburg, Va. Photos by Patrick McCombe.

COVERING ASSETS

Our clients are often living in the homes we're remodeling, so we have to protect and show respect for their possessions. Before a job starts, the project manager walks the entire area affected by the proposed construction and identifies all the objects to be left in the space and those that must be removed. We also identify what trim or other building materials are to be saved and which are to be donated or disposed of. Different colors of tape or spray paint identify different categories.

Control access. *The first step to protecting a client's home and belongings is preventing someone from just walking onto the job site and stealing from the home or pilfering materials outside. We make visitors check in with the project manager and we train our subs to introduce new workers to the project manager as well.*

FURNITURE

We cover the furniture in spaces adjacent to the construction zone with draped 3-mil poly. The temporary wall in the background separates a wall of patio doors destined for replacement from the rest of the living room.

ART

Clients will remove furniture and decorative objects from work areas, but we have to protect pieces in adjacent spaces too. We cover artwork and wallpaper with 3-mil poly secured with painter's tape. Don't apply tape directly to art, wallpaper, or any other surface that's impossible or difficult to repair.

CLOSETS

Belongings can often be left in closets, if the space is fully closed off with taped 4-mil poly. We use two layers of tape on most surfaces—we put a layer of painter's tape on the wall or painted surface, and then we tape the poly to that tape with duct tape.

HVAC

Cover return-air grilles with washable fibrous furnace filters to prevent dust from being blown through the house and clogging HVAC equipment. Use high-flow economy filters and clean them often to ensure HVAC equipment has enough airflow.

PROTECTING SURFACES

We shield floors and flat surfaces from foot traffic, dropped tools, spilled paint (or coffee), and a host of other hazards with improvised materials and specialty protection products. We tape edges and seams to prevent dirt and liquid from getting in. Avoid taping to expensive surfaces like faux finishing or wallpaper.

ENTRANCES

Protecting the path to the primary entrance with sheets of OSB or plywood prevents foot traffic and debris from damaging porch floors, stair treads, decks, and hardscaping.

FLOORING

Hardwood flooring is first covered with Econo Runner, a felt material with a very light adhesive. On top is Masonite (hardboard) for maximum protection, or Ram Board (rolled cardboard), which is less expensive and easier to clean, but not as tough. We tape all seams with Ram Board Seam Tape.

Reuse carpet. *Salvaged carpet is great for protecting floors and other surfaces. It traps dirt and it's free. Here it protects a stone mosaic while other tile work in this master bath continues.*

STAIRS

We use Econo Runner on wood stairs. For carpeted stairs, Protective Products sells a backward-rolled version of their Carpet Protection that makes it easier to cover the risers. For long-term jobs, we make tread covers of plywood or hardboard. Foam sill sealer or old carpeting (soft side facing in) protects railings.

Condo considerations

Condominium and apartment complexes come with the added hassle of having to protect common areas in addition to the owner's space. If we damage something, we're on the hook for repairs. Most buildings we work in require us to remove the protective materials every Friday so they're gone over the weekend. A few buildings want us to pull them up every day.

DOOR JAMBS

It's critical to protect the door jambs on condo and apartment front doors. They're considered part of the common space and repairs are expensive and difficult because any new materials must blend in seamlessly with all of the other units' doors and jambs.

THRESHOLDS

Sticky walk-off mats keep any construction dirt inside the unit from being tracked throughout the hallways. We recently started buying ones that feature our logo. It lets neighbors know who's doing the work and shows that we care about our clients and the space where we're working.

COMMON AREAS

We've used miles of Protective Products Carpet Protection. It's easy to apply, creates a safe walking surface without a trip hazard, and protects better than drop cloths. Plus, it can be cleaned with a vacuum or wet cloth. This product is so good that many of the condominium buildings we work in require it as part of their standard renovation protocol.

LONG-TERM WALLS

For long-term projects, we build temporary walls from 2x4 studs spaced 3 ft. to 4 ft. on center and covered with poly sheeting to separate construction areas from the rest of the house. Foam sill sealer on the top and bottom plates protects the ceiling and floor from damage. Every stud is individually fit so it compresses the sill sealer, and if we expect wind pressure we put some screws through the top plate into the ceiling joists.

Strips of cardboard floor protection under hand-driven T50 staples.

ZIPPER DOORS

Self-adhesive ZipWall zippers allow access to containment areas while keeping in dust. For areas that require regular access, we install a weatherstripped interior door.

Drawing: Christopher Mills

CONTROLLING DUST

When we ask prospective clients about their concerns with the remodeling process, dust often tops the list. It's comparatively easy to protect surfaces and furnishings from physical damage, but dust goes everywhere. Whenever possible we use enclosures placed under negative air pressure to prevent dust from traveling outside the construction zone.

Close the openings. *A piece of foam insulation reinforces poly sheeting to resist the pressure created by wind or a floor sander's fan. XPS works fine, but tape sticks better to foil-faced polyiso. We use painter's tape for short-term (up to two weeks) adhesion to walls and trim. We use 3M No-Residue tape for longer projects, and for adhering to sturdy surfaces like metal or trim with semigloss paint.*

SHORT-TERM WALLS

Taping plastic directly to the ceiling and walls without a temporary wall or support poles works for a day or two, but it won't hold in windy conditions. For shorter projects and on stairs we use spring-loaded poles designed to hold plastic to the ceiling. Fancy versions hold the plastic to the walls too, but we generally tape the plastic on the sides instead—and even across the ceiling to help with wind.

NEGATIVE PRESSURE

A technique developed for hazardous work like asbestos and lead remediation, blowing air out of the workspace so it's under negative pressure prevents dust from migrating into other areas of the home. If we keep windows and doors closed, a typical window or box fan can keep one or two rooms under enough negative pressure to control dust. A cardboard or foam shroud around the fan to keep it tight in the opening will boost efficiency. For larger spaces, use a variable-speed floor dryer.

Two styles of Cornice Return

Framing this classic detail is easier than you think

BY JOHN CARROLL

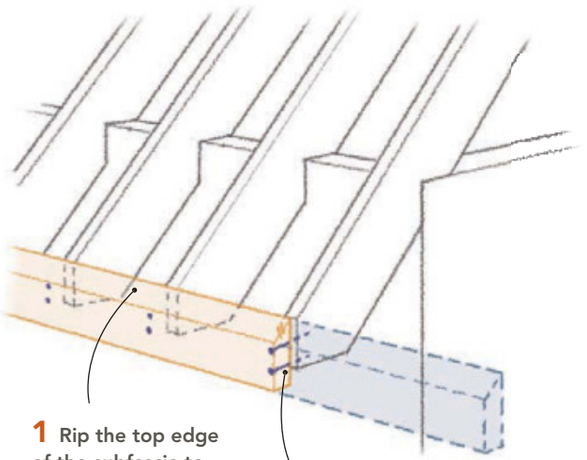
It's been said that the building of traditional cornice returns is a lost art. Also called an eave return, a cornice return is a graceful way to transition the eave and the main fascia board around the gable end of a house. This can be challenging because the returns are located outside the corner boards, which means they require additional structural support. But there are ways to ensure they are sound. Anchoring the ledger and subfascia several feet into the length of the eave is key. You will also want to make sure the ledger and subfascia extend to the end of the rake; this can be done by installing them long and cutting them in place. It's also smart to build the return before you install the barge rafter.

All of this involves more work than framing a basic rake or a pork chop return, but the results are worth it. Once you get the hang of the underlying cornice structure, you have some options for how to finish it. Here, we'll walk through two different styles. □

John Carroll is author of *The Complete Visual Guide to Building a House* (The Taunton Press, 2014).

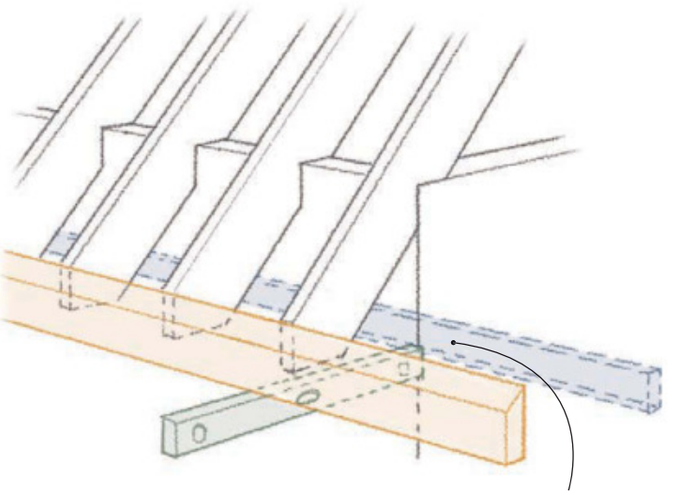
Both designs start with structural support

Whether you are framing a cornice return capped with a hip roof or a shed roof, the first step is to install the subfascia and the ledger. Run both boards long and cut in place.

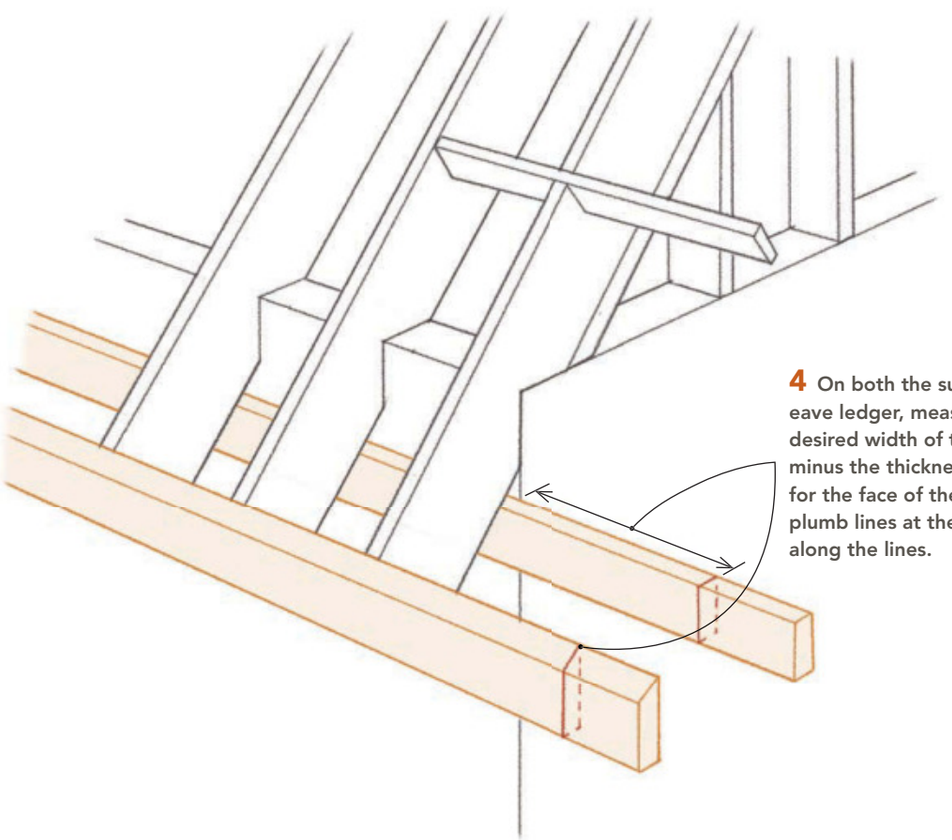


1 Rip the top edge of the subfascia to match the slope of the roof.

2 Secure the subfascia with two 12d or 16d nails at each rafter.



3 Level over from the bottom of the subfascia and mark both ends of the wall. Strike a chalkline between the marks, then nail the eave ledger along the line.

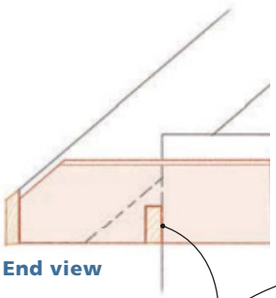


4 On both the subfascia and the eave ledger, measure and mark the desired width of the rake frame, minus the thickness of the subfascia for the face of the return. Scribe plumb lines at these points and cut along the lines.

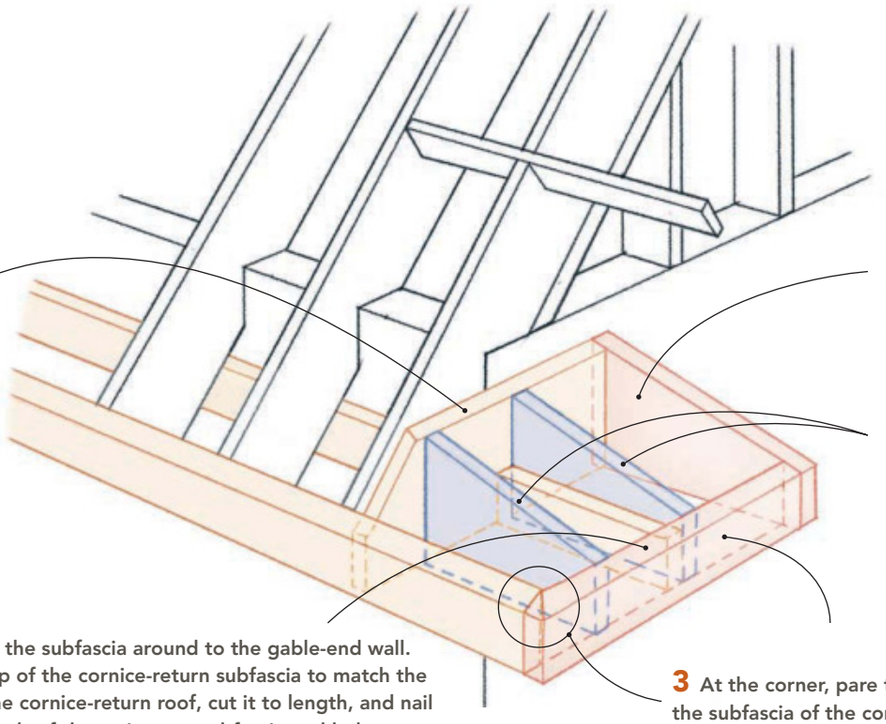
Drawings: Chuck Lockhart. Photo: John Gruen.

Shed-capped cornice return

A shed-capped return starts with both the ledger and the subfascia in place before the rafters. Installing these members level is critical to prevent headaches with trim.



End view



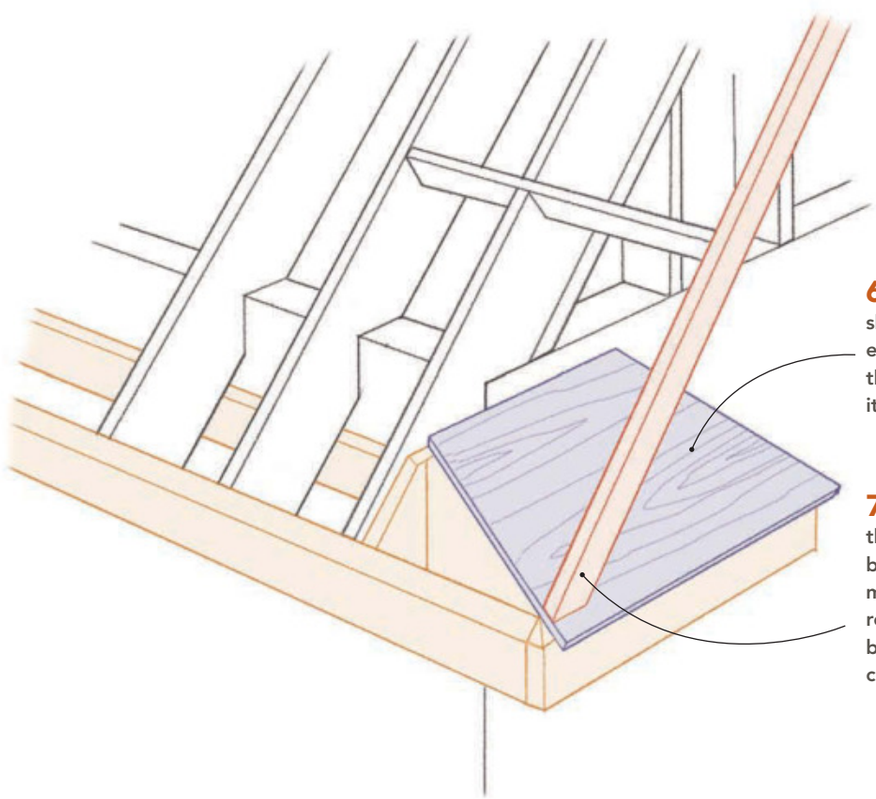
1 Notch the cornice-return ledger over the main eave ledger. Rip the top of the cornice-return ledger to match the desired pitch of the cornice-return roof. The ledger must extend from the outside end of the return over to the subfascia of the eave.

2 Extend the subfascia around to the gable-end wall. Rip the top of the cornice-return subfascia to match the pitch of the cornice-return roof, cut it to length, and nail it to the ends of the main-eave subfascia and ledger.

3 At the corner, pare the bevel of the subfascia of the cornice return to make it even with the bevel of the subfascia of the main eave.

4 Cut two or three return rafters at an angle that matches the desired pitch of the cornice-return roof.

5 The outside piece has to be 3 in. longer than the other pieces to allow it to overlap both the cornice-return ledger and the cornice-return subfascia.



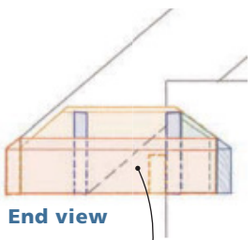
6 Cut and install the sheathing so that it doesn't extend past the plane of the main roof deck, and nail it to the rafters.

7 After making the top plumb cut on the barge rafter, mark a level cut for the bottom. Set your saw to a bevel that matches the pitch of the cornice-return roof, and cut along the line. Nail the barge rafter to the ridge, lookouts, and cornice-return roof.

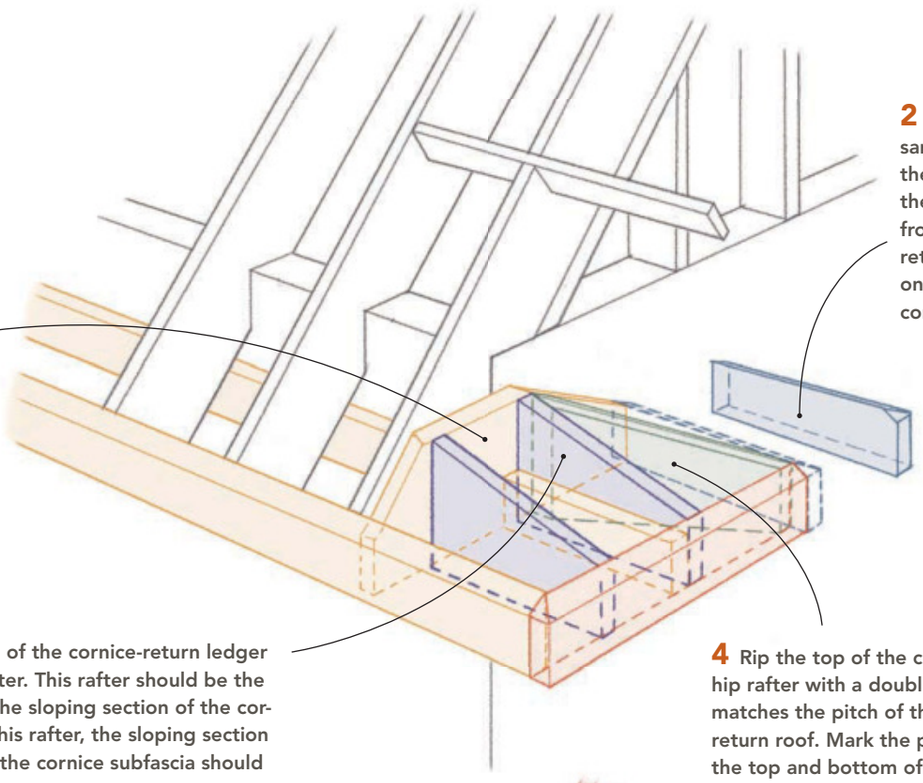
Photos: left, John Gruen; right, Justin Fink

Hip-capped cornice return

The sequence of building a hip-capped return is similar to the shed cap, but the hip on the outside end requires a change to the cornice-return ledger and subfascia, as well as a hip rafter.



End view

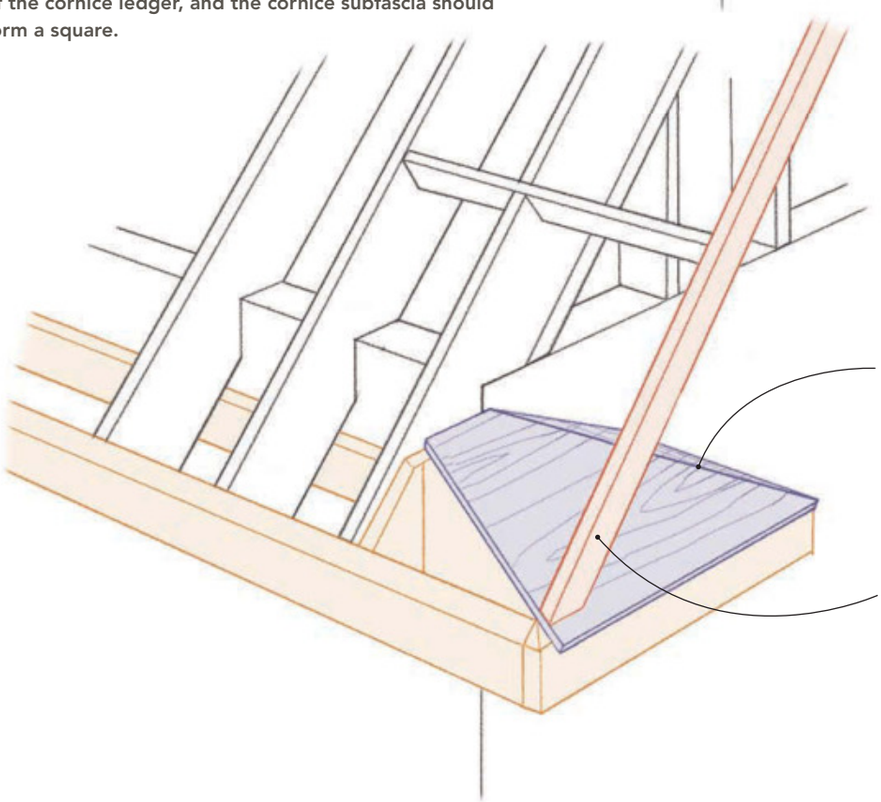


1 Lay out and cut the cornice-return ledger just like a shed-capped return, but with the outside end cut at the same slope as the common rafters in the cornice return.

2 Rip a piece the same size and with the same bevel as the subfascia on the front of the cornice return, and install on the end of the cornice return.

3 Where the level section of the cornice-return ledger ends, install a common rafter. This rafter should be the same length and pitch as the sloping section of the cornice ledger. In plan view, this rafter, the sloping section of the cornice ledger, and the cornice subfascia should form a square.

4 Rip the top of the cornice-return hip rafter with a double bevel that matches the pitch of the cornice-return roof. Mark the plumb cuts at the top and bottom of the hip, then set your saw to a 45° angle. Cut a double bevel at both ends of the hip.



5 Cut the hip sheathing to be in plane with the main roof deck and nail it to the rafters.

6 Install the barge rafter using the same method used for the shed cap.

Classic Character, Modern Comfort

Behind the brick lies an airtight envelope and an extravagant bath

BY JASON BLACK

The inspiration for the house we're building comes from time Gretchen and I have spent in historic southern towns, particularly Charleston, Savannah, and New Orleans. Like our New Urbanism community here in Norton Commons, the historic neighborhoods in these cities were developed with a mix of commercial and residential buildings. Walking the side streets and alleys of the Battery in Charleston, we were struck by the impact of a well-designed porch railing and the shadowlines created by wood window trim on an otherwise very simple and modest house. A mix of brick, wood, and stucco structures all from the same period can be found on the same street in these neighborhoods. We wanted to build something that added similar variety to our streetscape—within the parameters enforced by our architectural review board.

We have five style categories within the community pattern language book. For the *Fine Homebuilding* House, we designed within the Classical Vernacular category. We wanted the house to capture what we think is the best of historical southern design. On the exterior these hallmarks include our two-story front porch, the towering windows stretching 8 ft. up from the floor and flanked by operable shutters, and the built-up eave moldings to come later.

Historic southern houses in urban settings like Savannah and New Orleans are often brick—we liked

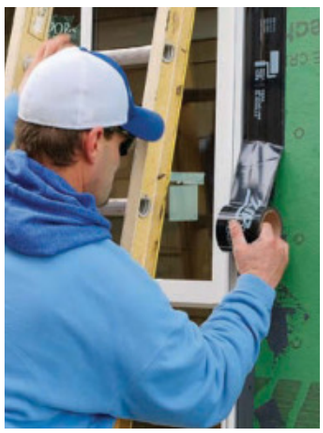
Brick and mortar. *On a street of houses wrapped with fiber-cement products, the brick cladding adds warm, rich color and is a nod to historical southern design.*

FOLLOW THE BUILD IN THREE PARTS

- **Planning & Framing**
- **Envelope & Mechanicals**
- **Design & Reveal**

In this three-part series, we explore the design and construction of a traditionally styled house in Kentucky. This installment covers the envelope and wet-room prep that provides comfort and durability.

Follow the build at FineHomebuilding.com/fhb-house and via our social channels.



PRODUCT KNOWLEDGE

Windsor Doors and Windows

- Patio doors in swinging and sliding configurations in heights up to 10 ft.
- Sliding doors available for up to 20-ft. opening and bifold doors up to eight panels wide
- Windows and doors in traditional and contemporary styles and several materials: clad wood, cellular pvc, and vinyl
- Energy Star–certified windows with Cardinal LoĒ³-366 glass
- Durable, extruded aluminum cladding and convenient tilt-in sashes

the idea of brick for our house to differentiate it from all of the nearby fiber-cement lap-sided houses. The brick we chose has a weathered, aged appearance, and the Flemish-bond pattern our mason laid both looks good and gives the appearance of a full, two-brick-thick wall. The Flemish bond is limited to the front of the house. Because the homes are so close together in Norton Commons, we focused our budget for special touches on the front; design flourishes on the other three sides would never be seen. By the same token, the front windows and door have a thick limestone sill, while elsewhere on the house we laid bricks on the flat to create a sill. The contrasting color and the texture of the limestone and the more pronounced shadowlines are worth the expense on the street side of the house.

Windows set the tone

We chose Windsor windows because they are on the town architect's approved list, they come in the sizes we needed for this project, and they are Energy Star qualified. We used Windsor's Pinnacle line of wood windows with white aluminum cladding and specified the mullion dividers on the outside. This creates a more realistic impression of a true divided-lite window, putting the shadowlines on the exterior. On the front elevation, the six-over-six windows are centered over each other, and we were also careful with the proportions of our lites—we wanted them to be vertically oriented rectangles somewhere between 3:2 and 4:3, roughly the proportions of the human face. The 8-ft.-tall double-hung windows on the front of the house flood the rooms with light; reinforce the connection between the house and public sidewalks, promoting the sense of community; and are accurate to the design language of the house. On the second floor, a six-lite door accesses the balcony off the master bedroom.

At the rear of the house, the indoor-outdoor connection relies on the 12-ft.-wide opening between the family room and the covered porch. The four-panel bifold door has one panel that operates as a

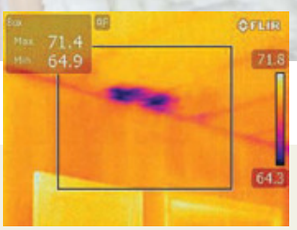
Photos facing page bottom right: courtesy of Flir.

Spray and seal. *We used single-application low-VOC open-cell foam to insulate the stud and rafter bays, helping to air-seal envelope penetrations and seams.*

single swinging door and the other three slide accordion-style against the jamb. This offers great flexibility: On pleasant days, the entire wall can open up and the family can flow freely between indoor and outdoor spaces; in the hottest part of the summer, the single door will provide access to the outdoors while conditioned air remains in the interior space.

Sheathing and insulating for a tight seal

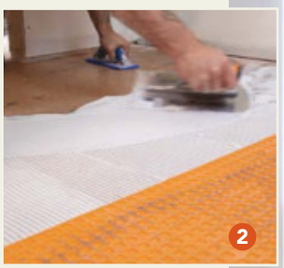
With the house dried in, we turned our attention to the energy performance. As I start thinking about energy efficiency, my reference point is homeowner comfort rather than a particular performance benchmark—the owner expects to be comfortable in the house and expects utility bills to be relatively low. How we meet these goals depends on the project budget, but we always start by air-sealing because the amount of insulation won't matter if there's uncontrolled air infiltration through the envelope. The Zip System R-sheathing is our air



PRODUCT KNOWLEDGE

Flir

- Advanced thermal imagery finds air leaks and insulation voids, and pinpoints temperature deviations
- Camera size and performance for a variety of trades: from smartphone plug-in to pocket-size full-feature to high-resolution handheld cameras for energy raters



PRODUCT KNOWLEDGE

Schluter

- Kerdi waterproofing membrane can be applied over bathroom wall and floor substrates or installed in board form with the membrane integrated to rigid-foam sheets
- Kerdi-Board can be used to form structural features like benches
- Prefabricated shower niches with adjustable-height shelves integrate seamlessly
- Ditra uncoupling membrane allows tile to move independently from wood subfloor
- Installing Ditra with Kerdi-Band at the seams fully waterproofs the floor

barrier on the walls. We air-sealed all of the panel-to-panel joints with Zip System liquid flash, which we also spread over the nail heads in the field of the panel. Unlike Zip System tape, the liquid flash can be applied when the sheathing is wet (although the temperature has to be above freezing). We found the liquid flash is particularly suited for flashing through-wall pipe penetrations as it's much easier and faster to get a good seal. On the windows and roof we used Zip System tape to flash and air-seal.

We used spray foam to insulate our assembly and as an additional air-sealing measure. In the basement, the walls are framed 1½ in. off the face of the concrete and insulated with 2 in. of closed-cell foam. This assembly controls water-vapor diffusion to the interior and leaves plenty of room to run wires and plumbing.

All of the above-grade insulation is open-cell Icynene Classic Ultra Select. Our installer recommends it because it's a low-VOC water-blown polyurethane spray foam. Before the insulators began spraying, they used sealant on joints between framing members on exterior walls—such as window headers and jack studs—for better air-sealing. This foam doesn't require an ignition barrier, so it works well in our unvented attic. (The attic is part of our conditioned space, so we can run our ductwork for the forced-air heat-pump system through it.) We sprayed R-40 to the underside of the roof sheathing and R-13 in the above-grade walls.

When the insulating was done, our energy rater conducted a blower-door test to direct the insulation team to air leaks and touch them up. This is an important step, as the expanding foam can visually hide small areas the installer missed on the initial spray. Sealing these small air leaks brought the final blower-door result to a tight 1.42 ACH50, which will keep the house comfortable. The rater's modeling shows our heating and cooling loads (22 kBtu per hr. and 13 kBtu per hr. respectively) will be met economically at around $250 annually with the ground-source heat pump.

1 **ADHERE** Schluter-Kerdi membrane to the shower walls and mortar bed.
2 **APPLY** Schluter-Ditra uncoupling membrane and vapor barrier to the bathroom floors.
3 **WATERPROOF** the Kerdi and Ditra joints at the curb and floor-wall intersection with Kerdi-Band and preformed corners.
4 **PLUG** the drain and fill with water to test the shower.
5 **ESTABLISH** layout lines and install tiles.

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The *Fine Homebuilding* House is supported by a host of industry sponsors. As a brand, we're not comfortable telling you to put products in your homes that we wouldn't put in ours. So, we've worked closely with our design and build team to identify appropriate products to include in this build. Our sponsorship model is built upon an invitation-only basis. Visit FineHomebuilding.com /fhb-house for a complete list of project partners and for more information on the materials used in the build.

Wet room is the focal point

In our market, "homeowner comfort" includes a focus on luxury. One place where customers desire quality and comfort is the master bath. For this project, I wanted the space to create a spa-like experience: A 214-sq.-ft. retreat from the rest of the house where the owners will start and end the day. The focal point of the space is a large wet room containing his-and-hers showers and a bathtub. With two sets of showerheads and a rain head as well as a soaking tub, waterproofing the enclosure is critical.

First, we had to figure out the shower pan. Faced with sloping the oversize area to a central drain, we decided the best approach would be a traditional mortar bed that we'd waterproof with Schluter-Kerdi. Using the Kerdi membrane on the walls as well meant we could use drywall for the substrate. The Kerdi is a fleece-backed, modified polyethylene membrane. The 6-ft. 7-in.-tall roll is installed in one continuous piece on the three shower walls and in one single piece on the floor. This means fewer seams to waterproof with Kerdi-Band and fewer locations with overlapping membranes to tile over.

We used a Schluter-Ditra uncoupling membrane on the floors in the bathrooms so that any movement in the wood floor system over time doesn't cause the tile or grout to crack. The tile patterns that Gretchen designed for our bathrooms all have large-format tiles, so the Ditra is relatively cheap insurance for the investment in tile, labor, and our reputation.

At this stage, our focus turns to the final phase of the build. In the next issue, we'll look at the finishes Gretchen and I have chosen and why they work, especially in the kitchen and backyard entertainment area. □

Jason Black is a founder and owner of Artisan Signature Homes in Louisville, Ky. He has updates of the build on his YouTube channel, Building a Better South. Photos by Tim Furlong Jr, except where noted.

HOUSES

ARCHITECTURAL CHALLENGES AND SOLUTIONS

BY DESIGN

CURATED BY KILEY JACQUES

SITUATING ON A STEEP LOT

When architect Patrick Ahearn was asked to increase the square footage of this historic Greek-revival cottage, his first move was to address the topography. The design program included a new pool, a cabana, and a two-car garage/carriage house. The challenge was to site all of the structures so they would have a comfortable relationship to each other despite the steep grade transitions. The builders began by regrading the land so the main house could sit on one plateau—the highest—bordering the street (previously, the rear of the house had been on stilts). The street-facing facade maintains a modest scale because the team built outward on the new grade of the rear yard. The carriage house is set at the lowest elevation—in that location, they were able to use the second story to make the cabana level with the pool. Granite slabs cut into the landscape make the connection between the first level and the second-level pool area. The three-tiered solution enhances the functionality of each building.

Designer: Patrick Ahearn Architect, patrickahearn.com
Builder: Whitla Brothers Builders, whitlabrothers.com
Project location: Chatham, Mass.
Photos: Greg Premru

"The carpenter swore at me a fair bit regarding the canopies."

—Matthew Swett, Taproot Architects

ATYPICAL ROOF OVERHANGS

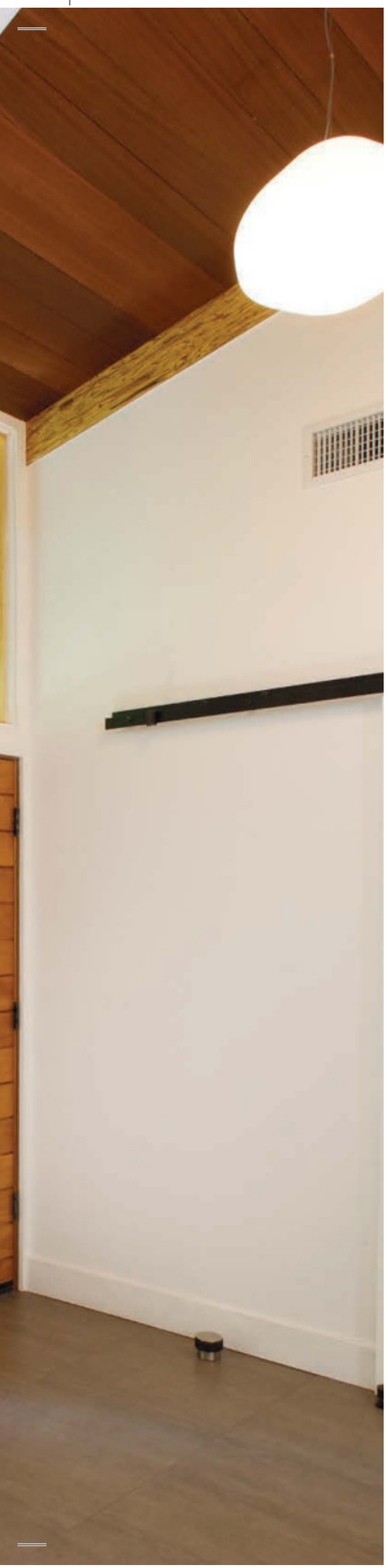
This project by Taproot Architects relies on floating roof canopies to provide covered areas around the building perimeter so the spaces can be used in Washington's rainy climate. To make them much deeper than conventional overhangs but still modest in scale, they were built with layered plywood that had to be field-assembled. Because there was no framework for attachment, it was a challenge to get the panels to lay flat until they were locked together by subsequent layers—there was a bit of head scratching and a lot of temporary shoring. In places where the overhangs are not part of the roof system, they were attached with a ledger and engineered fasteners. Adding gutters without a fascia board was also tricky; the solution was to use an aluminum channel at the roof perimeter. Not only does it provide structure for the gutter, it also protects the edge grain of the plywood.

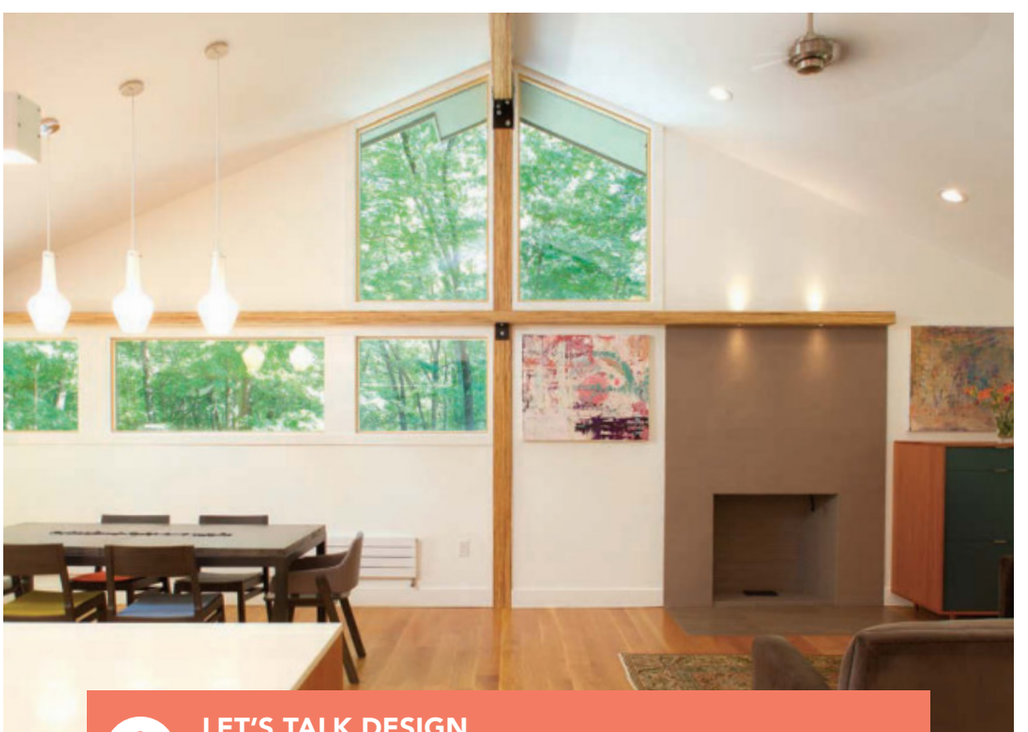
Designer: Taproot Architects, taproot.us
Builder: Spectrum Construction
Project location: Langley, Wash.
Photos: Michael Stadler, courtesy of Taproot Architects

A TARGETED APPROACH

Architect Duo Dickinson had a strict budget for remodeling this 1950s raised ranch. He pinpointed the overly deep eaves, the sunken living room, and the entry as priorities. The eaves were blocking light from reaching the interiors, and the south-facing gable end of the home was entirely devoid of windows. The build team shortened the eaves and removed all of the walls on the living-room side of the house, making way for a grid of beams and columns. An expanse of glass was then added at the gable-end wall. To raise the level of the living-room floor, they added solid 2x lumber blocking over the existing floor, followed by a plywood subfloor and clear white-oak flooring. This eliminates the issues associated with a dropped living/entry area, and it provides a completely open floor plan that improves circulation. At the entry, they used the existing opening and flipped the stair to more ideally connect the lower and upper floors. Dimensional lumber was used to infill between the two new engineered lumber beams, which serve as expressive brackets supporting the roof framing. The overhang with gutter and rain chains is an impactful new design element.

Designer: Duo Dickinson Architect, duodickinson.com
Builder: Keith Knickerbocker
Project location: Guilford, Conn.
Photos: Mick Hales





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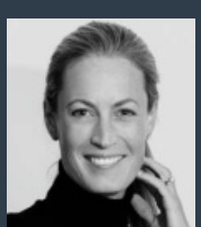
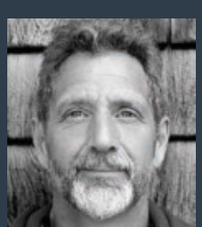
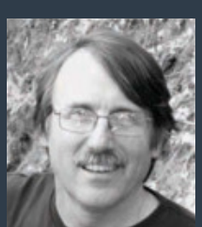


Christine Cronin
Preventing Stucco Failures

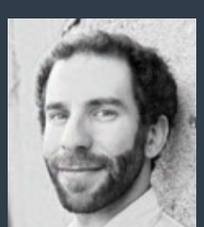


Mike Guertin
Thirty Years of Tips And Tricks



Martin Holladay
How to Build Well, Simply

Steve Baczek
Designing With Builders in Mind



Jordan Goldman
HVAC for High-Performance Houses

Michael Maines
The Pretty Good House

Peter Yost
Building-Science Puzzles

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SPEC

NEW AND NOTABLE PRODUCTS

HAUTE AND HARDWORKING

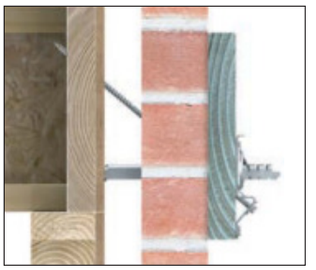
Aptly named, Perlick's new 24-in. Column Refrigerator features the company's trademark QuatroCool preservation system with four separate zones—deli, meat/fish, produce, and beverages—for precision cooling. Inspired by the refrigerated cases at delicatessens, the unit houses large glass windows and a two-tiered deli display to showcase enticing specialty items. Foodies will value the slide-in marinating pan, and all will appreciate the white theater lighting that makes colors vivid and labels easy to read. Humidity control has been integrated into the produce bin, which automatically adds moisture into the air stream to maintain the desired level. The compartment is also fitted with a filtration system that helps prevent premature wilting of fruits and veggies by removing the gasses they emit. Leafy greens can even be stored upright—another trick for keeping them fresher longer. *—Kiley Jacques, design editor*

- Temperatures maintained within 1°F of set point
- Smart touch-screen control
- 23¾ in. wide by 24 in. deep by 83 11⁄16 in. tall
- Interior is all stainless steel and glass
- $6850

perlick.com

Photos courtesy of the manufacturers, except where noted

DECK LEDGERS OVER BRICK, FOAM, AND MORE



Deck ledgers can't be mounted to brick- or stone-veneer cladding because masonry veneer is only designed to support its own weight. The conventional workaround is to build a self-supporting deck, but Simpson Strong-Tie's new BVLZ brick-veneer ledger-connector system offers a new alternative.

The BVLZ ($35 to $40 per kit) is a heavy-gauge steel plate suspended by two 14-in. structural screws driven diagonally upward into the house's rim joist and spaced off the cladding by an adjustable standoff that extends through the cladding to bear on the sheathing.

Unlike bracket-type systems for mounting a deck ledger to a veneer-clad house, which are designed to be installed before the brick or stone, the BVLZ system can be installed over existing cladding by drilling three holes through the veneer at each bracket location.

The BVLZ system will also work on homes clad with adhered-stone/brick systems, EIFS, and walls covered with exterior insulation beneath the cladding.

—Mike Guertin, editorial advisor

BETTER BLOCK WALL?

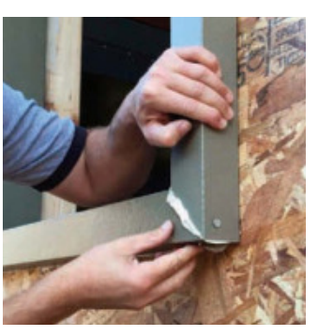
For years I've talked a good game about wanting to try my hand at laying a block wall, but if Comfort Block works as the company claims, I may be off the hook. Although similar in appearance to standard 8-in. CMUs, and still made from concrete, everything else about these blocks is different than what a mason is used to, and that's what makes them so installer-friendly.

A bed of mortar is still used to lay the first course, but because the blocks are more precisely cut than common CMUs and have interlocking ends, they can be set in a bead of gun-applied foam adhesive.

The core of each block is asymmetrical, with a wide outer void and a narrow inner void. The outer void accepts an optional EPS-foam insert (about R-5) and the inner void accommodates electrical boxes and wiring. Since electrical is in the wall rather than on the face, you don't need furring strips—the wall can be plastered. The 8-in. blocks are about $4 per sq. ft.; 16-in. blocks are also available. *—Justin Fink, editorial director*

BUCKS FOR OUTSULATION

One of the sticky details when installing exterior rigid-foam insulation is how to fasten flanged windows. Many window manufacturers frown on installing the window directly on top of the foam layer. A popular workaround is to install wood bucks between the framing and the window flange, but this creates a thermal bridge, which partially defeats the point of the foam. The best solution I've seen is the ThermalBuck. The high-density plastic-coated EPS-foam backer breaks the thermal bridge and won't compress like typical foam insulation. The 8-ft. lengths can be integrated into rough openings, mitered at corners, and joined with Dap Dynaflex 800 sealant. Available in widths from 1 in. thick to 4 in. thick in increments that match common insulation thicknesses, they are sold with and without a drainage gap. The sill is sloped for drainage, and the interior flange is ½ in. thick. Price depends on thickness, but runs between $3.80 and $6 per ft. *—Patrick McCombe, senior editor*



Product photo top left: Melinda Sonido. Drawing: courtesy of the manufacturer.

SYNTHETIC SIDEWALL SHINGLES

Made from injection-molded polymer, CertainTeed's Sawmill Shingles are a handsome addition to the growing number of man-made siding options on the market these days. The 12-in.-long shingles are produced in seven widths—sized from 4 in. to 8 in.—to mimic the randomized look of wood shingles, and are intended for a 5-in. exposure. The shingles are available in 24 colors, a mix of wood tones and solids. The solid colors are the most convincing when up close, but all of the options look more real than any vinyl siding I've seen. Some of this can surely be credited to the surface detailing on the shingles, from the replicated saw marks on the surface to the subtle parallel grain on the butt ends. The shingles cut with a knife or saw and install with nails or staples, just like real cedar, but because they are hollow-backed they must butt against corner boards. Woven corners are not an option, but CertainTeed does offer preformed corner shingles to create a mitered look. Cost is said to be slightly higher than Number 1 Grade, Blue Label cedar shingles. —*J.F.*

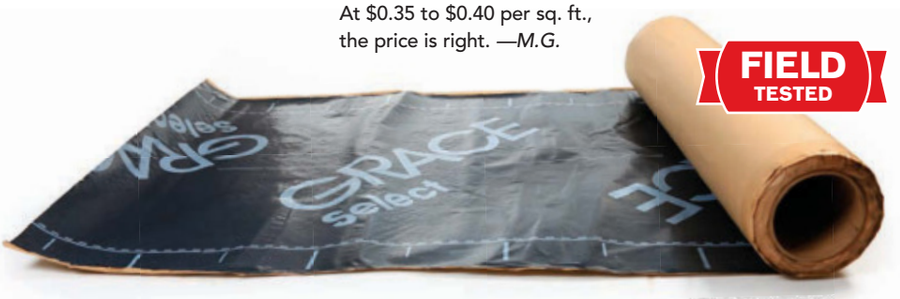
DOCK AND TUCK

Custom cabinet manufacturer Wood-Mode has partnered with Docking Drawer to develop a series of in-drawer power outlets. The slim design allows hardware to fit behind standard-size drawers (a minimum 2-in. space is required) in a variety of styles and capacities, so you can choose a setup to match your needs, for everything from charging your device to plugging in a hair dryer. Most popular in the new series is the $370 Blade Duo Charging Series, which includes both AC outlets and USB ports that can charge up to eight devices simultaneously. As a precaution, the system is equipped with a built-in breaker and a thermostat set to cut power when the surrounding area reaches 120°F. The outlets will fit into standard frameless, framed, and inset cabinets, and can be purchased separately or installed by the manufacturer before shipping. All told, the outlets provide a clever, safe way to keep counters clear of charging cords and devices. —*K.J.*

THINNER PEEL-AND-STICK MEMBRANE

In 2012, GCP introduced Grace Select, a 25-mil-thick version of their popular 40-mil Grace Ice & Water Shield membrane. Grace Select is lighter and the smaller rolls are easier to handle up on a roof, especially when working alone. Compared to the original, I also found the thinner material easier to bend and fold, and it has a lower profile when folding it together with regular underlayment, so the fold won't telegraph through the roof shingles.

The plastic cap film separates the rubberized adhesive from the overlying roof shingles, making future reroof preparation easier. Grace Select has a different edge treatment than Ice & Water Shield. The plastic cap sheet on Grace Select extends all the way to the edges, completely covering the asphalt backing, unlike Ice & Water Shield, which has a narrow band of exposed asphalt. I find it easier to position and place the Select without the exposed asphalt, which can sometimes stick to unintended surfaces when laying it down and gets stuck to your fingers on hot days. At $0.35 to $0.40 per sq. ft., the price is right. —*M.G.*



Product photos top right and bottom right: Melinda Sonido

ask the experts

YOUR QUESTIONS—PRO ANSWERS

To vent or not to vent?

I recently purchased a 1930s-era home that has a low-pitch hip roof over an enclosed porch that has been opened up to the living space. The roof is unvented and, like the rest of the porch, uninsulated. It gets very hot in the summer, and enormous icicles hang from the porch roof in the winter. I'm going to insulate the space, but I don't know what the best strategy is for the roof. Can I drill holes in between each rafter and install a soffit to vent it, or should I go for a hot roof and spray foam underneath it?

—BEN RUMERY
via email

Editorial advisor Mike Guertin responds: Venting a roof on a single-story section of the house that dies into the wall of a second floor is challenging, and your porch roof makes it even more so. Roofs need a driving force to move air in and out, and intake- and exhaust-vent openings large enough to facilitate this movement. In an attic, the primary driving force is the buoyancy of warm air rising in the vault of the roof. As the warm air escapes through vents high on the roof, cooler air enters the lower vents.

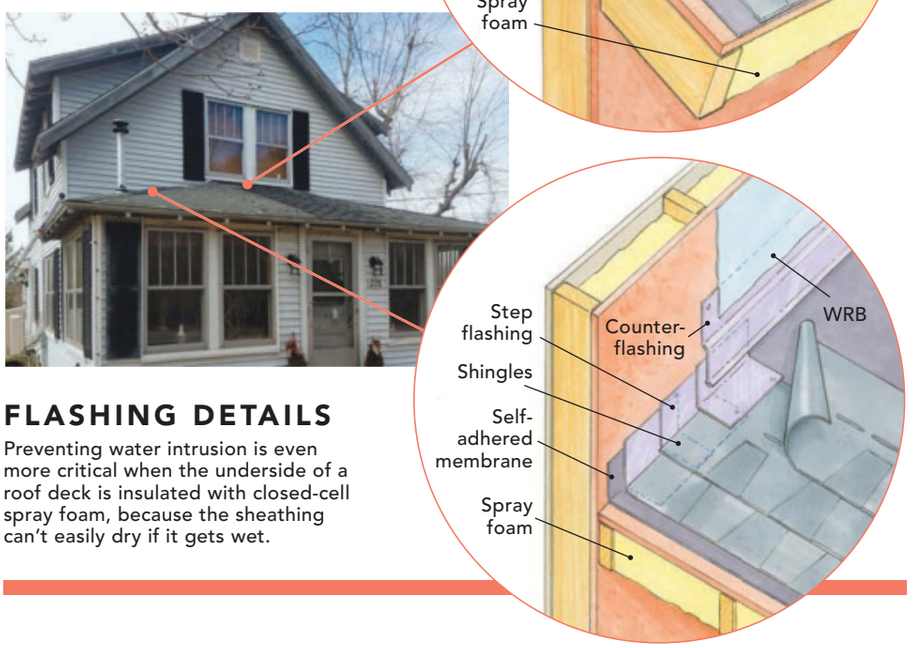
Your roof has a couple strikes against it—first, its low slope. The buoyancy of the air won't drive much flow with such a minor height difference between intake and exhaust vents. The intake vents also need to be generously sized. A few holes in the blocking between the rafter tails won't let enough air in. Ideally you'd need 1-in. or wider slots cut from rafter to rafter, which you could cover with screen or a 2-in.-wide louvered vent strip between rafters.

Then there's the exhaust vents. Surface-mounted vents will look ugly on the front of the house—and you'll need several. There are special roof-to-wall combination vent/flashing products that would be less obtrusive, but they won't work on your porch roof. The hip-style porch roof leaves just a short section of horizontal roof meeting the wall, and there's no room between the windowsills and that section of roof for the vent to fit.

Since conventional venting is probably not a good option for your roof, the needle points toward the spray-foam option you noted. I don't recommend spray foam frequently, but it seems that it's going to be your best bet. To do the work, the ceiling on the inside will have to be opened up for the installer to access the underside of the roof/ Ideally you should have the installer use closed-cell, high-density spray foam. It will act as a vapor barrier, reducing the chance of condensation on the underside of the roof sheathing.

You want to make sure the roof on the porch is in good condition when adding insulation. Since it will be unvented, even small leaks will dry very slowly. I recommend that you evaluate the condition of the roof and replace it and any flashing that doesn't meet today's minimum standards (4 in. to 5 in. up the wall and on the roof for both step flashing and vertical wall flashing). Installing a self-adhering self-sealing membrane over the entire roof before new shingles are installed can also help, especially since you noted that ice dams and icicles regularly form. The tricky spot is going to be those windows. The sills are so close to the roof that any leak around the windows becomes a risk. Though it's a lot of work, I suggest that you pop out the windows completely and install a sill-pan flashing that laps positively over the roof-to-wall flashing below—unless that already exists.

Whether you replace the roof or leave the existing roof in place, you can check the roof periodically for signs of leaks using an infra-



FLASHING DETAILS
Preventing water intrusion is even more critical when the underside of a roof deck is insulated with closed-cell spray foam, because the sheathing can't easily dry if it gets wet.

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

Photo: courtesy of Ben Rumery. Drawings: Dan Thornton.

red thermal-imaging camera. By checking the roof and nearby wall areas every year or two, you can catch leaks and make repairs before any damage occurs.

Vapor barrier over mineral wool

When installing skylights in our living room in Atlanta, Ga., we discovered some rot that led to us having to demo and reframe around our fireplace. I'm happy to say we passed our framing inspection. For the future insulation inspection, the inspector told us that he wants to see a vapor barrier on the mineral wool we used in the chimney chase. There was no insulation in the chase before, and we decided to go with mineral wool over fiberglass-batt insulation (which can come with its own integrated vapor barrier). My question is, what should we use for the vapor barrier inside the chimney chase?

—ANNA
via email

Green Building Advisor editor Martin Holladay responds: Your inspector is wrong. There is no code requirement in your climate zone (zone 3) for walls to have an interior vapor retarder, much less an interior vapor barrier. Building codes sometimes require an interior vapor retarder, but only in zones 5 and colder.

While there is no need for a vapor barrier, you certainly need an air barrier in this location. The best air-barrier material in this case would be ½-in. drywall with taped seams. For more information on the need for air barriers behind metal fireplaces, visit this useful web page from the U.S. Department of Energy: basc.pnnl.gov/resource-guides/walls-behind-fireplaces.

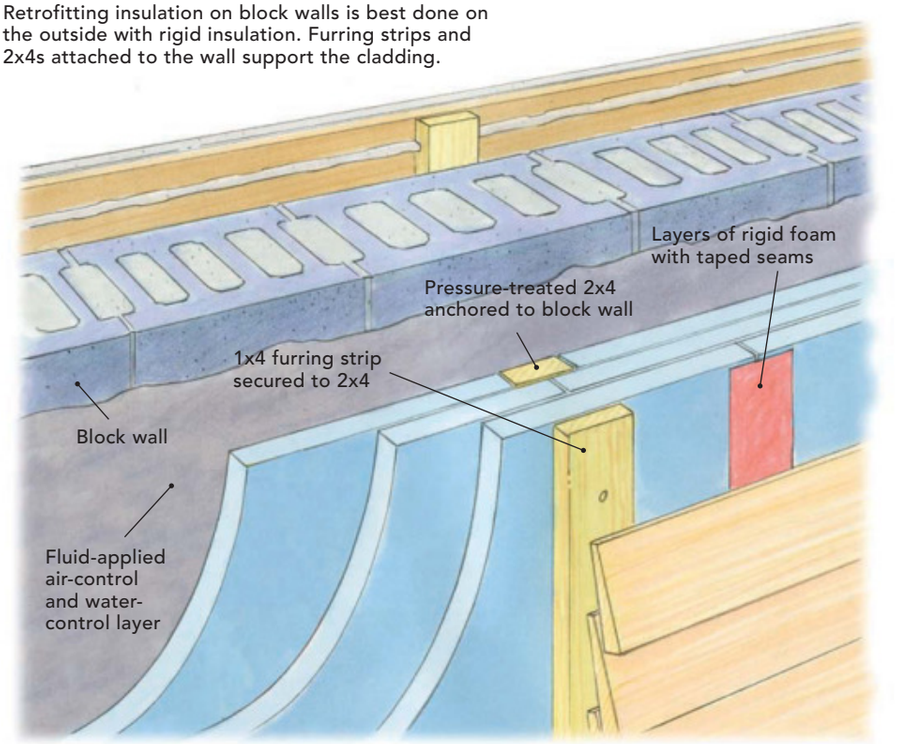
Insulating an uninsulated block-wall home

Two years ago I purchased a small home near Toledo, Ohio. It was constructed by the owner in the mid 1950s using cinder blocks, and the interior walls are lath and plaster. There is no insulation on the exterior walls, and I want to add some without losing already limited floor space. There's a less than 1-in. gap between the plaster and cinder blocks, so spraying insulation in there won't work. The house has a vented crawlspace that's also uninsulated. I've insulated the attic to R-60, but I want to make the home more energy efficient and comfortable, and enhance its future salability. What insulation approach would you recommend for the walls and crawlspace?

—RICHARD THERIAULT
via email

OUTBOARD INSULATION

Retrofitting insulation on block walls is best done on the outside with rigid insulation. Furring strips and 2x4s attached to the wall support the cladding.



Joseph Lstiburek, founding principal of Building Science Corporation, responds: I would recommend insulating on the exterior. This can be done with pretty much any rigid insulation. In your climate zone (zone 5), code requires you to insulate concrete block and other mass walls to at least R-13 if all of the insulation is on the exterior. Before insulating, coat the exterior of the walls with fluid-applied water-control and air-control layers. Then attach 2x4s on the flat directly to the masonry, insulate between and on top of them—staggering the joints in the insulation—and install additional furring on top of the insulation to attach your cladding.

The key decision relates to windows. I would recommend replacing them as well and pushing them to the exterior, turning them into "outies."

As for the crawlspace, it should either be completely connected to the house and conditioned or completely disconnected from the house. Most crawlspaces are partially connected to both the exterior and to the interior, which is a bad idea. You do not want stuff from the ground or the outside to get into your house. Ideally, treat it like a mini basement. Leave the floor above it uninsulated, vapor-seal the ground below with polyethylene and a thin concrete slab, insulate the walls with a foam-based insulation (such as 4 in. of unfaced expanded polystyrene [R-15]) that allows the foundation to dry inward, and condition the space with air from inside the house.

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BY MICHAEL MAINES

Windows in thick walls

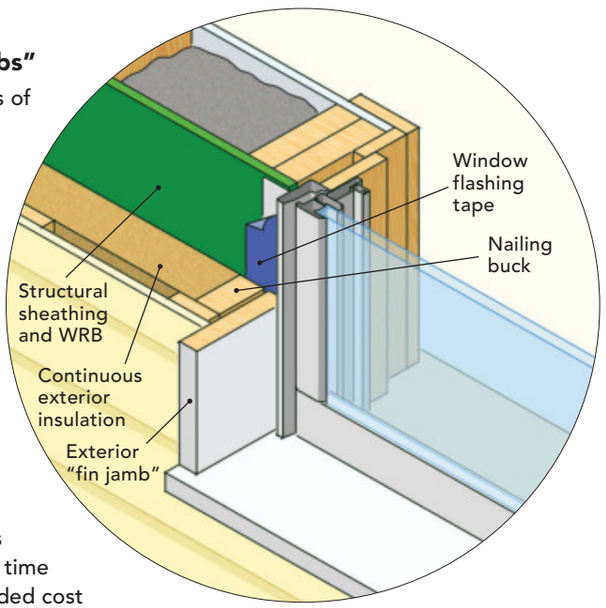
Thick, highly-insulated walls are great for lowering energy bills and creating a more comfortable interior environment for occupants, but they present some unique challenges for builders when it comes to installing windows and doors.

I've designed and/or built homes with many different types of thick walls, including 2x4 walls wrapped with continuous exterior insulation, cross-strapped 2x6 walls (aka "Mooney walls"), 12-in. double-stud walls, and 18-in.-plus panelized walls—and that's not all of the different types of thick walls out there. In this first part of a two-part series, I describe some of the snags I've hit when installing windows in these thick-wall assemblies, and the solutions I designed or used in response. The details shown here are for moderately high-performance envelopes in climate zones 3 and higher, but they can be used for warmer zones or adapted for Passive House performance levels. In the next issue, I'll address the issue of installing doors in thick walls.

Contributing editor Michael Maines is a design/build contractor in Palermo, Maine.

Recessed windows with "fin jambs"

Windows have to perform the functions of both the water-resistive barrier (WRB) and the air barrier. With the WRB and airtight layer at the sheathing, in some ways it's easiest to keep the window flanges at the sheathing as well. This leaves the window recessed from the wall's exterior plane and provides some welcome shadowlines, which are often absent from modern facades where everything is in plane. Before the continuous exterior insulation is installed, it's business as usual. Once you add the exterior insulation, though, you have to create extension jambs toward the exterior, as well as a sill extension. This takes extra time and materials. One way to keep the added cost to a minimum is to eliminate the conventional exterior casing and allow the extension jambs to be the only exterior trim. It's a modern look that not everyone likes, but the clean lines work well with some architectural styles.



The jamb must project far enough to terminate the siding cleanly. I have been looking for a name for this detail for years and have not found one that fits, so I'm coining it a "fin jamb." (Walls that project into space are called fin walls, as in radiator fins, so I'm drawing from that term.) I recommend using 5/4-in. or thicker material for the fin jambs so they have a substantial-enough look and remain straight. I like using real wood, but a composite such as fly-ash trim or a cellular PVC material would also work. Preassemble the jambs and sill and install as a unit.

Recessed windows with traditional casing

If exterior casing is required, you can do that—the other details remain the same. In all cases, slope the sill extension (the ones on old homes were usually 10° to 15° to shed water, but steeper ones can provide visual appeal). The sill material does not have to match the jamb and casing material; it can be wood, fly-ash trim, stone, or metal. (Stone or metal have to be installed before the jambs.)

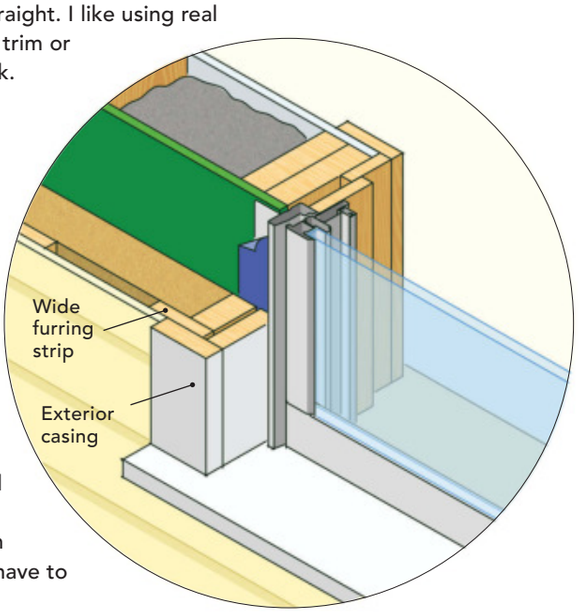
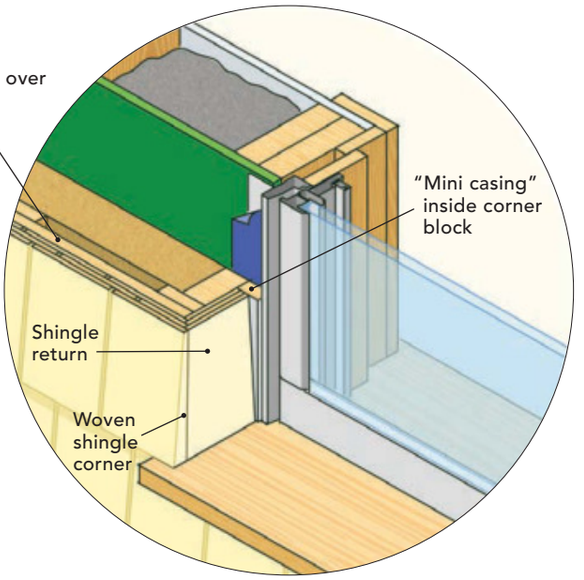
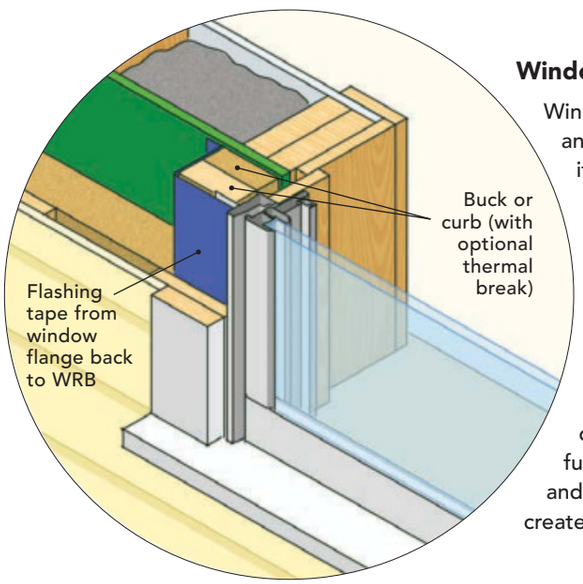


Photo: John Deans, Emerald Builders. Drawings: Arthur Mount.



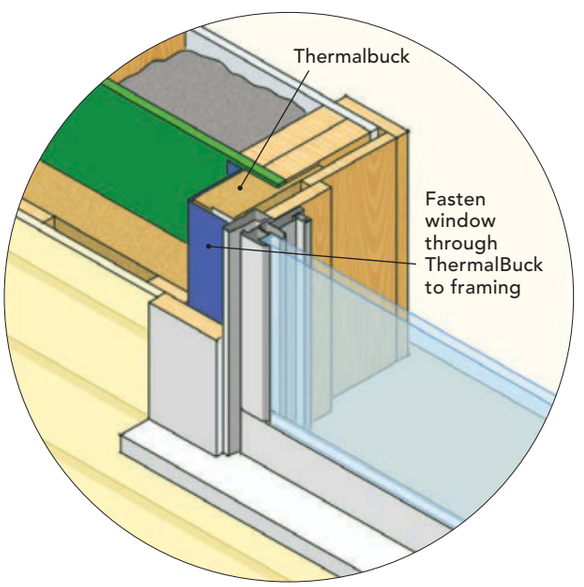
Recessed windows with shingled returns

Another detail I'd been waiting to try, after seeing it first in a *Fine Homebuilding* article many years ago, is shingled returns, which I did recently. Instead of using extension jambs at all, just install the sill extension and wrap sidewall shingles around the corner. With flangeless windows, you can run the shingles right up to the window frame, but with flanged windows you would end up with an awkward void, so I would first install a small casing, similar to using an inside-corner block when siding walls.



Windows curbed to the exterior

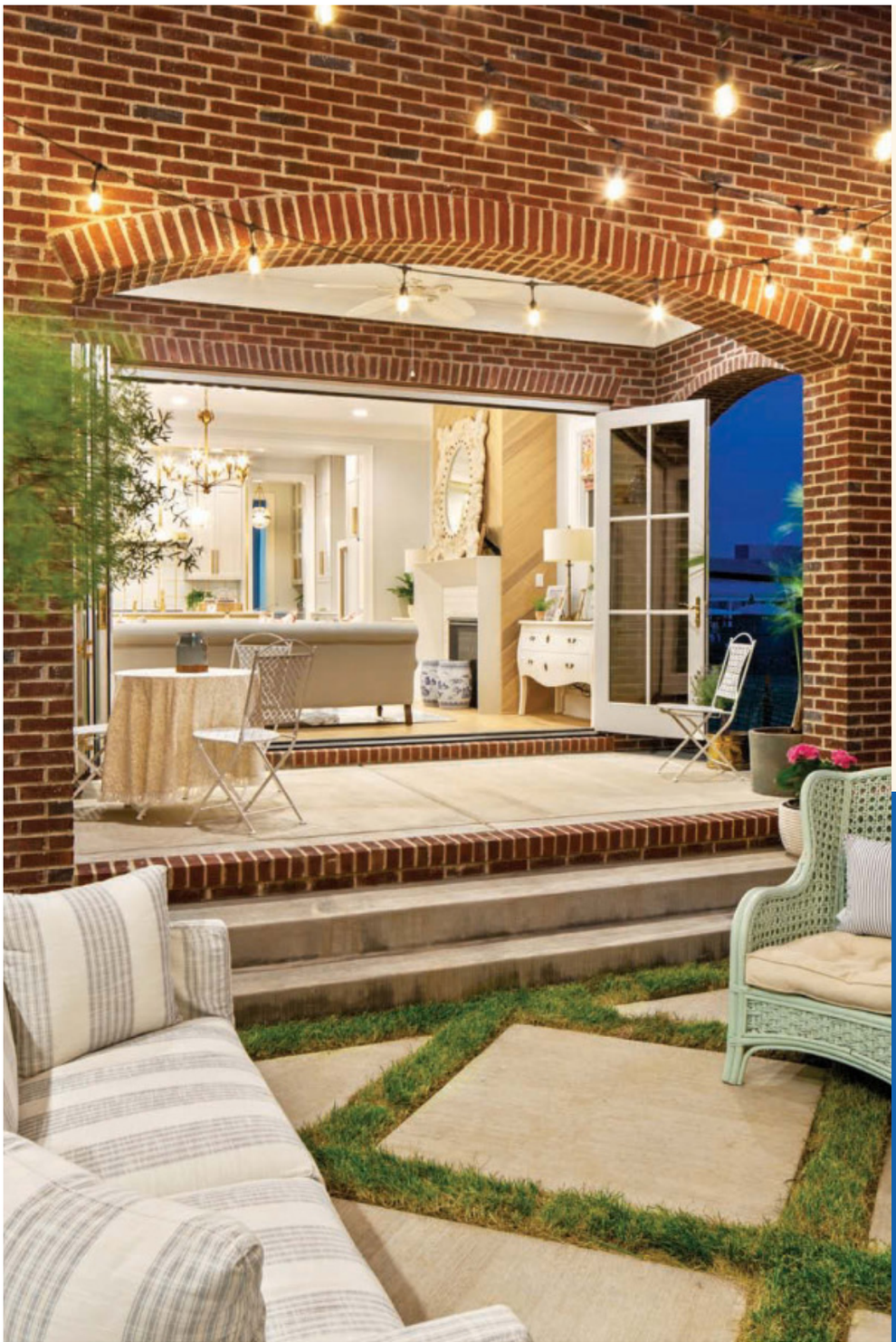
Windows located at the center of the wall depth usually perform the best thermally and they allow for easy integration of the WRB and airtight layer, but sometimes it's necessary to place the windows closer to the outer plane of the wall. When using continuous exterior insulation, one approach is to create a buck or curb around the rough opening. It's important to seal the windows back to the WRB, so this curb should be built and wrapped with a self-adhering or fluid-applied membrane before the exterior insulation is installed. The curb can be made of solid wood. With an insulating value of about R-1.2 per in., wood is not bad as a thermal bridge, and it will likely perform better than the window frames. But to reduce thermal bridging, first run a layer of foam, cork, or wood-fiber insulation behind an outer layer of framing lumber to create the curb. The detail locates the window flange behind the 1x rainscreen furring. The furring behind the window casing would not be visible in most cases, and you can seal the casing to the furring to prevent water infiltration. This detail creates a slight shadowline at the windows.



Curbed windows with ThermalBuck

The above approach requires several steps, but you can eliminate one by using a buck premade for the situation: ThermalBuck. ThermalBuck comes in different depths that work with different thicknesses of exterior insulation (for more, see p. 82). It has various installation details, but whichever one you choose, be sure to make the WRB continuous to the window flanges using tape, membrane, or sealant, and plan ahead for the long fasteners that are required to fasten the flanges through the buck and into the wall framing.

For more editions of "Building Matters," visit FineHomebuilding.com/buildingmatters.



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BY SCOTT McBRIDE

Confessions of an energy dinosaur

THEY JUST DON'T BUILD 'EM LIKE THEY USED TO

The way we used to build houses feels less and less relevant with each passing day—and I've reluctantly come to realize that's probably a good thing.

In recent years, I've been struggling to make sense of the disconnect between the hi-tech "builds" that I read about in today's trade journals and the world of residential construction as I experienced it some forty years ago. In those days, houses were framed and sided on a per-square-foot basis by restless young men with strong backs and not much education. Energy efficiency, if it was considered at all, rated way behind important things like fast cars, controlled substances, and girlfriends.

The builders for whom these roughnecks toiled were perhaps even less focused on building an efficient house. Many of them practiced a sort of slash-and-burn house-building that was just good enough to close the sale, pay off the bank, and move on to the next project.

When OPEC choked down on the oil supply in '75, shock waves reverberated throughout the economy, including the building trades. To save petroleum, a few low-hanging-fruit measures were permanently adopted, such as 2x6 exterior walls and insulating glass—but when oil prices retreated, most things went on as before. This wasn't just negligence; the know-how to build efficient houses—"building science"—was in its infancy, and the knowledge was slow to disseminate because there were few institutions for training the people building the houses. Unlike the manufacturing sector, which invests heavily in worker training both in-house and through trade unions, home building in the U.S. remains, even today, a highly decentralized industry with little long-term commitment on the part of builders toward their carpenters, or vice versa. It takes a village to establish and maintain a training program, but across much of America builders and remodelers are still harried loners struggling to run a business and make a buck. Sorting through the differences between Swedish flashing tapes would be nice, but who has the time?

And yet change we must. It's increasingly obvious that wasting fossil fuel isn't just extravagant—it's self-destructive. Even the possibility of man-made climate change demands action of any thinking person. Yes, it's confusing and stressful to do things differently than "the way we've always done it." But here's the good news: The impact generated by a conscientious builder will be multiplied every hour of every day for the life of the building. Think about it: recycling an aluminum can is a one-time good deed. But if you pause for a minute to shoot a bead of caulk under a wall before you raise it, there will be energy saved and CO_2 reduced for the next seventy years or more. You can think of that as an awesome responsibility, but perhaps a better motivator would be to think of it as a pretty cool opportunity.

So here are a few lessons offered not by an on-fire energy nerd, but from a grouchy old dog who has reluctantly got with the program.

The envelope redefined

The boundaries of the thermal envelope have shifted markedly since I started building. At that time, much of the space within a house was unconditioned. We stuffed fiberglass batts under the first floor, leaving a cold, damp basement or crawlspace underneath. In unfinished attics we insulated the floor, and in

Photos: Justin Fink

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finished attics we insulated the kneewalls. It made intuitive sense: When you're in bed on a cold night, you wrap the blanket around yourself as tightly as possible. As for the unfinished spaces outside the thermal envelope, we believed that air movement was good—the more ventilation the better.

But there were problems with these unconditioned spaces. First, we didn't understand that air moving through fiberglass insulation slashes its effectiveness. Second, we didn't appreciate the amount of energy lost by ductwork passing through those unfinished spaces, even if the ductwork was insulated. Most importantly, we didn't realize that a zigzagging thermal envelope composed of many separate parts (floorboards, baseboard, drywall) loses tremendous amounts of energy as air filters silently through the cracks.

One part of the solution to these problems has been to push the envelope outward as far as possible. That makes it simpler and thus easier to seal, especially with foam. It also reduces losses from ductwork by keeping it inside conditioned space. The other part of the solution is learning to aggressively hunt down and seal the air leakage that you can't see or feel—unless of course you're the one paying the energy bills.

Managing moisture

Condensation was not well understood in the old days because it was a rare problem. Houses were so leaky that when condensation did occur inside wall cavities and crawlspaces, it usually dried out on its own. The first time builders realized they had a problem was when cathedral ceilings came into vogue in the 1960s. Warm, moist air rising between the rafters caused paint to fail, and removing the damp drywall exposed wads of soggy fiberglass. The situation was even worse with a tongue-and-groove ceiling.

Moisture wafted its way through the fiberglass until it chilled on the vapor barrier like droplets on a glass of lemonade.

Since spray-foam insulation was unheard of in those days (unless you operated a cold-storage facility), builders addressed the problem with polyethylene vapor barriers. The results were mixed. These barriers worked where summers were cool and reasonably dry, but caused problems in swing climates such as those in the mid-Atlantic. Imagine August in Virginia with a muggy 95°F on the outside and an air-conditioned interior at 65°F. The temperature differential caused exterior moisture to drive through siding and gaps in the sheathing. It then wafted its way through the fiberglass until it chilled on the back side of the vapor barrier like droplets on a glass of lemonade. Since drying to the inside was blocked by the vapor barrier, condensation was trapped in the wall cavity, causing mold and decay.

Wood in the wall

It's pretty obvious that wood is a poor insulator. All you have to do is look at a snowy roof as it melts. Vertical stripes show plainly where heat passes quickly through the rafters compared to the rest of the roof. But in a time when both wood and energy were cheap, we thought nothing of packing the wall with wooden members of questionable necessity. Headers? Make 'em all 2x10 "to be on the safe side," and slap a flat 2x on the bottom just to make it the same thickness as the wall. Plates? Double them automatically, and run a plate through the gable wall to make it easier to frame. Plywood missing a stud? Throw in a nailer. Altogether this extra wood might have saved us carpenters a few hours. But for the next century, it would bleed Btus and drain the finances of succeeding generations of homeowners.

Insulation gaps

It's tempting to think of insulation as the last thing that happens before close-in, but at that point there may be places you can't reach because you didn't pay attention to what the subs were doing. Did the framers detail their corners and wall intersections such that they can be filled with insulation? Did the HVAC crew run ducts in the basement that block access to the band joist? Did they remember to put foam board behind that vertical duct that had to go in an exterior wall? Can we insulate effectively behind the whirlpool bath? Is there insulation behind the breaker panel?

In other cases, special conditions create spaces that are too small for even the smallest insulator to wriggle into. If you can't eliminate these insulation dead zones in the design phase, then you'll need a strategy to insulate them outside of the normal construction sequence.

Rise to the challenge

Frankly, the subject of energy detailing isn't what puts fizz in my cup. My primary satisfaction as a carpenter is to stand back and look at what my hands have made. And the beauty of an energy-efficient home goes unseen. With so many other demands pressing on builders—impatient clients, government regulations, and, of course, the bottom line—it's tempting to punt on energy. But my faith teaches me to take the long view. A Proverb reads: "Where there is no vision, the people perish." I take my hat off to the young builders—and architects, academics and publishers—who have responded to this moment in history by raising the bar on efficient building practices. Who knows whether or not they have been placed on our fevered planet for such a time as this?

For more editions of "As-Built," visit FineHomebuilding.com/asbuilt.

Scott McBride is a builder and writer in Virginia.

PRODUCT SHOWCASE

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keepcraftalive

CELEBRATING PASSION FOR BUILDING

Bruno Sutter, a professor and chair of the woodworking department at the esteemed American College of the Building Arts, grew up in France, where he was first introduced to carpentry by an uncle. His background is common to those who build for a living: A family member afforded him an opportunity to construct something by hand, the seed was planted, and a career in building was born. But where Bruno's story differs is in his course of training, which seems to be of another world, and certainly of another time. At 19, instead of going to college, Bruno entered a two-year apprenticeship before joining a guild called Les Compagnons du Devoir.

This particular guild can be traced back to the middle ages and serves to pass on the trades through the generations. Bruno's initial training in the guild lasted eight years. Every day was spent working for a timber-framing or carpentry company. He would then attend class from 8 p.m. to 10 p.m. every night and on every Saturday. He lived in the guild's house with a community of others studying the trades. It was an immersive, decade-long journey.

Now, in addition to running Timber Artisans, a timber-framing company he started with a graduate of ACBA, Bruno spends his days delivering a condensed, four-year training curriculum to students that is heavily influenced by the traditional guilds of France.

ACBA was founded after hurricane Hugo destroyed Charleston, and the community quickly discovered the lack of true craftsmen to rebuild the city. For the past 14 years, Bruno and his colleagues have been turning out graduates skilled enough to handle work few others can.

—Rob Yagid, executive director, Keep Craft Alive

"As a professor, I enjoy passing on the knowledge that was passed on to me by others. As a timber framer and business owner, I enjoy building structures for people to enjoy for hundreds of years to come."

BRUNO SUTTER,
PROFESSOR OF CARPENTRY AND TIMBER FRAMING
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