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All drywall finishers undeniably have those projects that leave you scratching your head and muttering words not appropriate for this magazine. Bad framing jobs, twisted and warped wood, or designs that leave you wondering how an architect ever thought that would be a good idea. However, as true masters of your craft, you take whatever you are given and turn it a pristine smooth finished interior.

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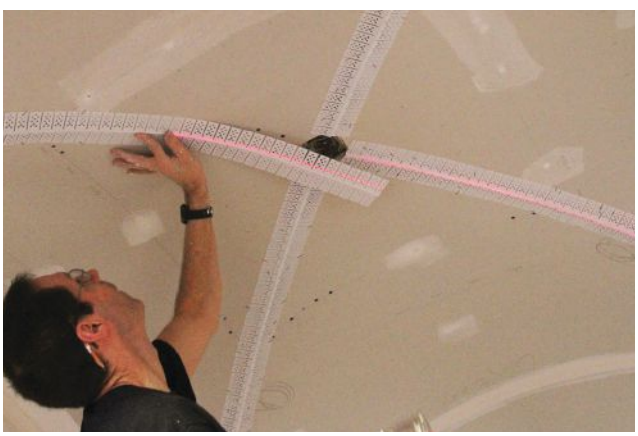

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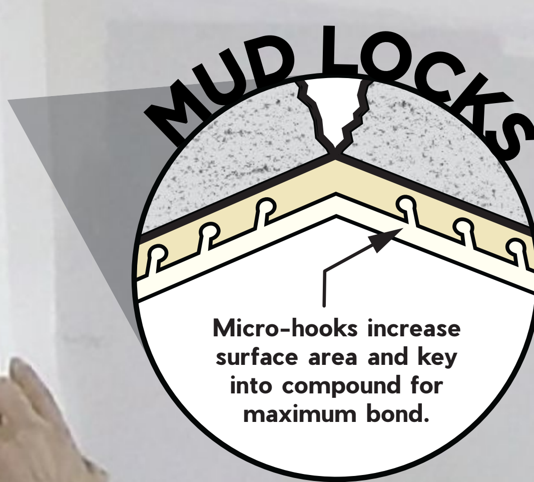

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On the cover: Dale Diamond, of New Dimension Construction, in Millbrook, N.Y., lines a built-in gutter with sections of copper fabricated with a metal brake and a cut-off wheel. Read about using a brake on page 53. Photo by Kyle Diamond.

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DEPARTMENTS

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BY GREG AND SUE BURNET

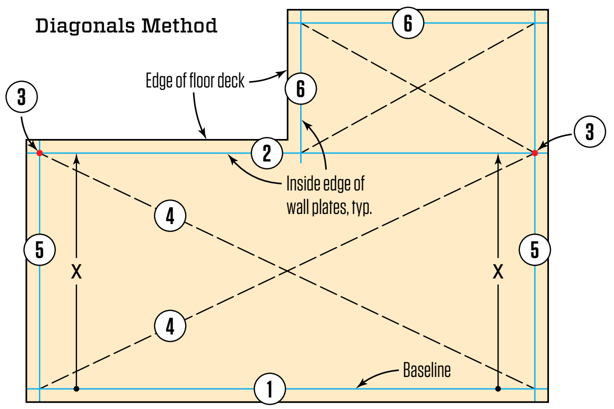
Snapping Layout Lines for Walls

The first step in framing walls is to lay out "plate lines" that will help you place the walls straight and square. Framers snap out these lines with a chalk line on the top of foundation walls or at the edges of a structural slab to guide the placement of the mudsills. Over some foundation walls (for full basements or crawlspaces), they build a floor frame, or "deck," on top of the mudsills and snap a second set of lines to keep the wall plates true.

In this article, we show the layout and squaring process on the deck, but it's the same if you're doing it on a slab or on the top of foundation walls (see "Mudsill Layout for a Complex Foundation," May/14). In each case, you need to be as accurate as possible; otherwise, you wind up with an out-of-true frame that will haunt you and every tradesperson on the project for the rest of the job.

Greg and Sue Burnet are co-owners of Toolbelt Productions (toolbeltproductions.com), an education and training firm for the building industry.

Two Ways for Snapping Square Lines for Wall Layout



Step 1 Mark corners using a gauge block (scrap piece of 2x plate material) and snap chalk line for the longest wall (baseline).

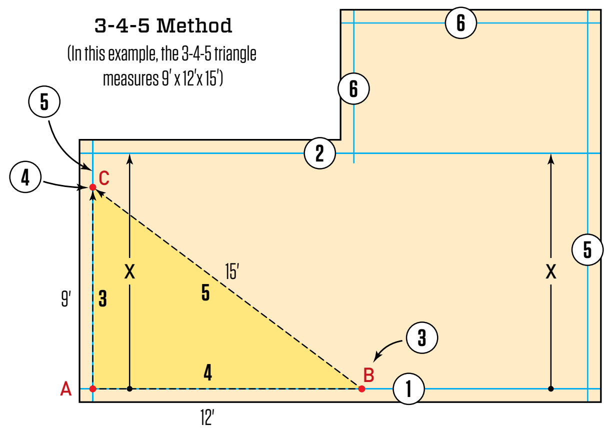
Step 2 Place the gauge block on the edge of the floor deck to find distance **X**, and use that distance to snap the parallel wall.

Step 3 Use the gauge block on the sides of the floor deck to mark the approximate corner points.

Step 4 Measure diagonals and adjust corners until measurements match exactly.

Step 5 Snap lines for perpendicular walls through the adjusted corner marks.

Step 6 Measure and snap lines for smaller rectangle; check with diagonals.



Step 1 and Step 2 Same as "Diagonals Method".

Step 3 Starting at corner point **A** on the baseline wall, measure 12' and mark point **B**.

Step 4 Stretch a tape from corner **A** toward the parallel wall, and a second tape from point **B** along the diagonal. Where the 9'- and 15'-measurements meet, mark point **C**.

Step 5 Snap a chalk line from corner **A** through point **C**, extending the line to the parallel wall. The baseline and the side A-C are now perfectly square. Measure from side A-C chalk line to define the opposite wall, similar to step 2.

Step 6 Measure and snap lines for smaller rectangle using diagonals or the 3-4-5 method.

Illustration by Tim Healey

Layout Lines for Wall Framing

Before building the walls of a house, the crew has to snap layout lines to keep the walls straight and the corners square.

The first line is for the longest wall, or baseline wall, of the house. Using a gauge block made from the plate stock, draw inside corners at both ends of the wall **(1)**. Check the measurement to confirm that the wall length is correct, then snap a line between the corners. From both ends of the baseline wall, measure out for the longest parallel wall (which establishes the largest rectangle on the floor deck), again marking the inside of the gauge block **(2)**.

Make an approximate corner mark on one end of the parallel wall and then measure over the length of the wall to mark the corner on the other end. Take diagonal measurements between the corners, first in one direction **(3)** and then in the other **(4)**.

Adjust the corner marks until the diagonal measurements are exactly the same **(5)**. Note that the lighter pencil mark in the photo is the original (approximate) corner mark made before the adjustment. Snap a line between the adjusted marks and the corners of the baseline wall **(6)**. Those walls should be perfectly square to the baseline wall. Lay out the other walls using the established lines as reference and double-checking for square with diagonal measurements.

Photos by Roe Osborn

Trex Transcend® Decking Shown in Island Mist.

Q One of my clients, a local restaurant, has a tiled floor in its commercial kitchen that has rotted out and needs to be replaced. How should the new floor be detailed so that it lasts longer, and what type of grout should I use?

A Tom Meehan, co-author of *Working With Tile* (Taunton Press, 2011) and a second-generation tile installer from Harwich, Mass., responds: While most of the tile work I do is in homes, every year I'm asked to do projects in commercial spaces. This work tends to fall into two general categories.

The first category includes commercial floors for areas like motel lobbies, where the floors are subject to high foot traffic and occasional mopping. Aside from using commercial-grade tile and grout, these installations follow the same basic guidelines that I use for most tile floors.

In the second category are the tile floors that I install in commercial kitchens in my area's many restaurants. In addition to holding up to a high volume of foot traffic, this type of commercial tile floor must be able to withstand spills of hot cooking oils and scalding water, as well as daily cleanings with harsh chemicals, degreasers, and pressurized water. Exposure to cleaning chemicals and the rigors of pressure washing can break down and erode the grout, allowing water to reach the substrate and ultimately result in the failure of the tile floor.

COMMERCIAL TILE INSTALLATION

Before you even start thinking about the grout, you need to know how to properly install the tile for a commercial kitchen, and that installation begins with the substrate. The subfloor in commercial tile jobs should be layered plywood at least 1 1/4 inches thick installed over solid, strong framing to minimize deflection. Because of the frequent cleanings that these floors receive, commercial-grade drains should be installed around the kitchen in strategic areas—such as near the dishwashing area, near the food-prep sink, near a slop sink, and in the vicinity of the cooking appliances—that are likely to handle the most water.

The shower in your home depends entirely on gravity for drainage, so the shower pan below the tile must be detailed and

Tile Floor in a Typical Commercial Kitchen

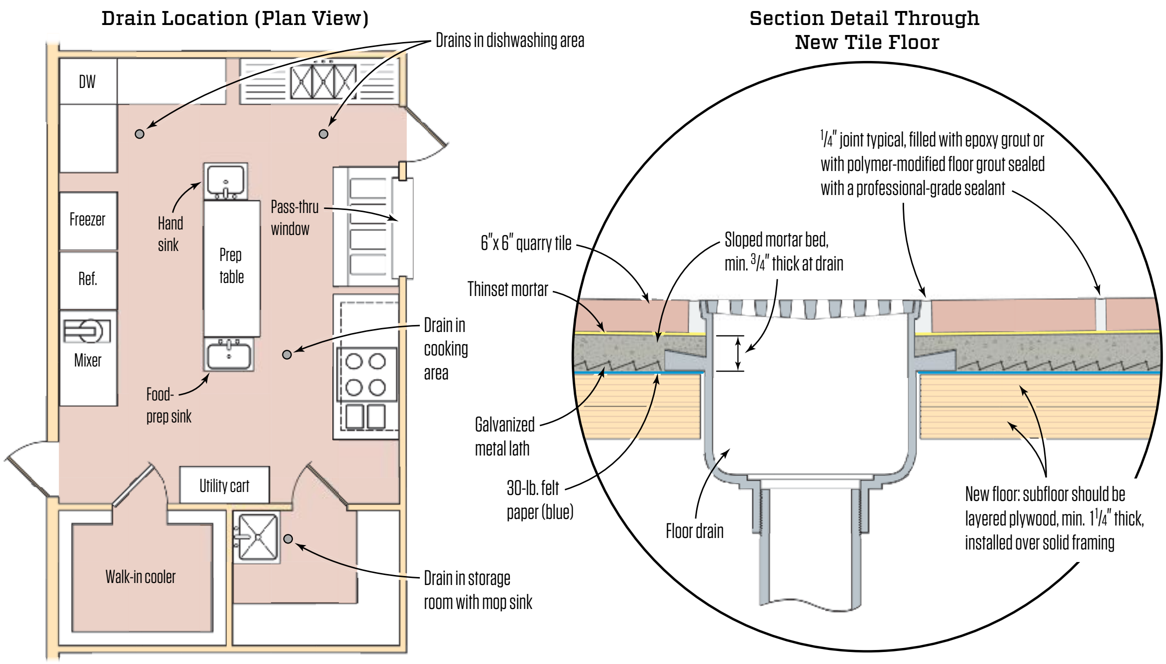


Illustration by Tim Healey

sloped properly ("Preventing Leaks in Tiled Showers," Oct/16). However, the floor in a commercial kitchen is different. The water on these floors is typically pushed to the drain with a mop or squeegee, so only a minimal slope is needed. The easiest and most effective way to create this type of sloped floor is with an old-fashioned mud job.

I begin by putting down a layer of 30-lb. felt paper on top of the subfloor. I nail a layer of 2.5-lb. expanded galvanized metal lath on top of the felt paper. To create the sloped surface under the tile, I put down a layer of mortar that embeds in the lath. The mix for the mortar is identical to the mix I use for a sloped shower pan: approximately 4 to 1, coarse mason's sand to Portland cement. I keep the mortar mix stiff and make the bed a minimum of 3/4 inch thick at each of the drains, with the slope screeded up from there.

The most common tile for commercial kitchen applications is commercial-grade, low-absorption 6x6-inch quarry tile. I install the tile with regular thinset mortar, leaving 1/4-inch-wide mortar joints.

GROUT

Now that I've gone over substrate and tile installation for commercial kitchens, I can finally address your question about grout. The folks at Laticrete recommend epoxy grout for commercial-kitchen tile. While I agree that epoxy might be the best grout option for these applications, I would consider it only for new installations that are clean and completely dry. Also, epoxy grout is expensive and labor-intensive to use. If you do use it, the restaurant owner or manager should carefully monitor the grout to make sure that it doesn't erode or degrade from exposure to spills or to harsh chemical cleaning agents.

I have had good results using high-quality polymer-modified floor grout in commercial kitchen floors, some of which are still going strong after more than a decade. If you opt for a polymer-modified floor grout, seal it with a professional-grade sealant, such as Miracle Sealants 511 Impregnator, to give the tile an extra level of protection. With the daily cleanings that these floors receive, the sealant should be reapplied regularly.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Yeah, It's Really
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BY MATT RISINGER

Tips for Building With Board-Form Concrete

Architects drool over it and clients love it, but frankly, board-form concrete can be a little daunting for a concrete sub or a builder. In this article, I am going to discuss some tips I've learned over the years from doing a number of architect-designed homes that have featured board-form concrete walls.

THINK "ART FORM"

Most poured-in-place concrete walls in residential construction are for basements, which have wall surfaces that are either underground or, if exposed on the interior, are considered part of an unfinished space. What we are talking about here is still a structural wall, but it is also a finished surface for aboveground walls.

It's really an art-form, or a sculptural process, that accentuates the surface and intentionally highlights the pattern and grain of the form boards. In many ways, board forming is an old technique; it's how all poured concrete walls used to be done before we had aluminum and plywood concrete forms. But it has been revived by architects looking for a dramatic, textured wall finish.

NOT YOUR AVERAGE CREW

A good concrete crew is essential. This is not blow-and-go work, and you need a crew that will listen and

Photos by Alterstudio Architecture and Risinger & co.

Board-form concrete walls mix well with glass and metal in modern house designs, such as this project Risinger built with Alterstudio Architecture of Austin, Texas **(1)**. The grain and texture of the individual form boards telegraph in reverse onto the surface of the concrete **(2)**. Since you get only one chance at the final pour, Risinger typically builds a mock-up on site **(3)**, allowing the architect to experiment and allowing Risinger to get complete buy-in from the architect and the client.

come up with solutions. Concrete guys know an amazing amount about how concrete behaves and how to get it to do what you want. I'm lucky that I'm able to work with Chris Walcher and the crew at Boothe Concrete here in Austin. It helps that the end product is an art form that features their work. If the job goes as planned, it makes them look good, and the project becomes their art form that we're showing off.

MOCK-UPS

When you eventually go to pour the walls, you get only one chance to get them right, so it is always a good idea to make sure the architect and the client are completely on board with what the finished surface will look like. Is the board pattern what they expect? Does the surface provide the detail and the overall look and feel they envision?

The best way to answer those questions and get complete buy-in from everyone involved is with a mock-up. On this mock-up, we used both sides, modeling a different board width and orientation on each one before settling on a horizontal scheme for this project.

When building a small, freestanding structure for the mock-up, you have to build a super stout structure, adding many more kickers to hold the bottom and a tighter spacing of wales than you might otherwise use. This also applied to the walls we were building for this project with intermittent, freestanding sections. For each one, the formwork had to be built like a small fortress. The last thing you want is a blow-out of a form to shift position while placing the concrete.

FORMWORK

When we're forming these walls, we need everyone to slow down. It takes two or sometimes three times longer to build these forms than it would using conventional concrete formwork.

We screw the formwork together to lock everything in place. Nails tend to loosen up a little and we don't want any creep in the formwork under the weight of the concrete. Using screws also makes it easier to surgically strip our forms afterwards.

We also miter inside corners, and double- and triple-check that everything is plumb and straight. When building the formwork, you need to always be thinking about what the inside of those boards will telegraph into the concrete. Sloppy work will be immortalized in the concrete for all to see for evermore.

Of all the lumber species we have tried, we have found that Doug fir leaves the most beautiful grain pattern and one that both architects and clients seem to respond to without our having to sandblast

On this project, freestanding board-form wall sections required lots of staked kickers and wales to hold the formwork secure **(4)**. The form builders had to think like finish carpenters, using blue tape to protect the finished slab **(5)** and mitering inside corners **(6)**.

or otherwise treat each board to accentuate the grain.

When we place the boards side by side, we join the edges with a bead of silicone. This helps keep the water in the mix and keeps the concrete from seeping out between individual boards.

When placing walls over a structural slab that will be used as a finished floor surface, as we did in the house shown in this article, we are careful to tape along the bottom of the wall. We want to prevent the wall concrete from bleeding out over the slab, and we also don't want silicone on the slab, as this can disrupt the slab finish. You almost have to think like finish carpenters, which is a real shift from the usual process of forming and placing concrete.

Form ties are critical. We typically use fiberglass wall ties, even though the more common choice is a steel rod. However, when these are cut flush, the steel stands out against the concrete surface and will rust over time. The fiberglass ties we use (Super Ties by RJD Industries) are grey and blend in, becoming almost invisible once they are snapped-off flush with the surface.

CONCRETE TIPS

We spec a 5-sack, 3,500-psi mix. This is a strong concrete with a high cement ratio. You want that rich cement paste in there to pattern the wood. With this mix, we can run a 5-inch slump instead of the usual 4-inch slump so it will flow well and reduce the chance of honeycombing.

We usually get to the higher slump using plasticizers as an additive to the mix. A plasticizer allows you to keep the water content low, so you get a strong mix, without sacrificing workability.

On pour day, we pump the concrete through a steel wall pipe. You want to be able to reach all the way to the bottom of the form and place the concrete in lifts before pulling the pipe up and pouring another lift. Our crew places the concrete in 2-foot lifts, working all the way across the wall before moving on to the next lift.

Vibrating the concrete is probably the most crucial step. We use two guys with long vibrators that reach all the way to the bottom of the formwork. The trick is to be consistent, but you do not want to over-vibrate, as that will bring aggregate to the surface. To get the detail of the wood, you actually want a high percentage of cement paste at the surface, not aggregate. There is never a guarantee that you will avoid honeycombing, but we give it our utmost and have had good luck for the most part.

Matt Risinger owns Risinger & Company, in Austin, Texas.


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On the mock-up for this project, Risinger experimented with different form ties **(7)**. Once snapped-off, a steel tie **(8)** is conspicuous compared with a fiberglass tie **(9)**. Cutting fiberglass ties flush to the surface can be done quickly with minimal damage to the surrounding surface **(10)**.

Attaching a Deck to a High-Performance House

BY TED CUSHMAN

Since last fall, *JLC* has been following a high-performance custom home project on Peaks Island, in the Portland, Maine, harbor. The designers, Portland architects Kaplan and Thompson, are aiming for compliance with the strict Passive House standard for energy performance. The project's ambitious energy goals, in combination with the building's unique architectural features, have posed a series of technical challenges for lead carpenter Mark Pollard and his crew from Thompson Johnson Woodworks.

The home's parallelogram footprint made foundation work a head-scratcher (see "Customizing an ICF Foundation," Nov/16), and an unusual window-wall bump-out with a reverse-slope shed dormer roof was an even more complex three-dimensional puzzle (see "Roof Framing Challenge," Mar/17).

The latest tricky situation is an outdoor wood deck, which will ultimately serve both as an outdoor gathering place and as a bridge from the main house to an accessory guest house a few feet away. Supporting the deck at the house isn't simple; the problem is how to provide a structurally sound connection, while still keeping the home's airtight insulated envelope intact.

The home's wall system starts with an inner 2x4 wood frame sheathed with Zip System OSB, taped at the seams with Zip Tape for airtightness. Fastened over this inner airtight framework is an outer insulated shell of wood I-joists run vertically, with the cavities insulated with dense-blown cellulose. There's no precedent for attaching a deck ledger to the flange of a vertical wood I-joist. But attaching a deck ledger directly to the floor framing would have created an excessive thermal bridge.

As a compromise, the builders chose to mount the deck to the house with Maine Deck Bracket hardware. The aluminum deck brackets are highly conductive, but they're spaced at 48 inches on center. And at most of the attachment points, they're bolted into a 5 1/2-inch LVL girder, with cellulose insulation in the floor joist

Attaching a Deck to a Superinsulated Fat Wall

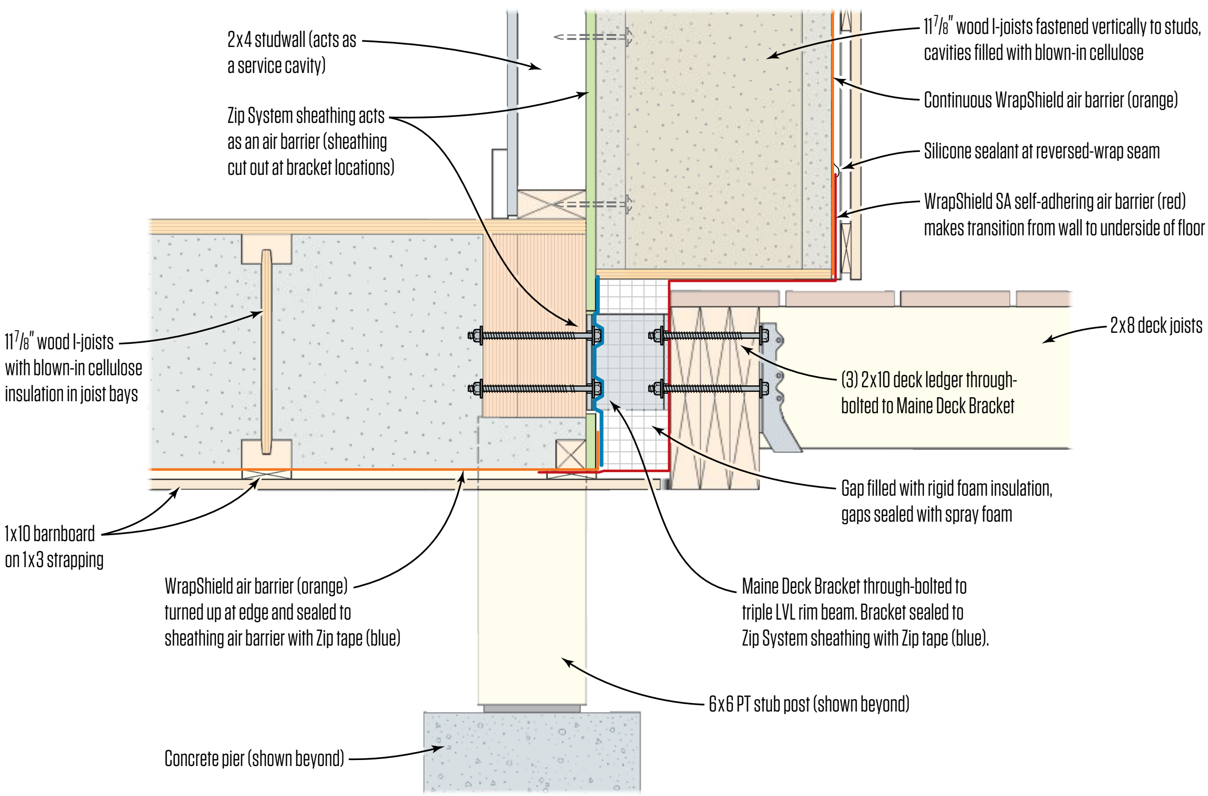


Illustration by Tim Healey

cavities behind that. Above the girder is the wall plate for the insulated 2x4 wall. So heat has to take an indirect path on its way out of the structure. And the crew insulated the space between the deck ledger and the house floor system with extruded polystyrene (EPS) foam, sealing any gaps with gun foam.

Aside from the thermal bridging problem, the team also had to address the other key problems in any high-performance envelope: air infiltration and vapor transmission. In that regard, the juncture where a wall meets a floor is always an important detail. Attaching a deck to the wall, particularly with a stand-off bracket, adds to the complexity of that problem.

Half of the one-story house sits on a superinsulated full basement, and the other half is a "raised floor" sitting on a pier foundation. The raised-floor part is framed with a triple-LVL carrying beam at the house perimeter; the part over a basement is framed with engineered rim board. The bracket attachment varies in those two locations. To secure the brackets to the rim board at the basement wall, the carpenters drilled through the rim board and attached the brackets using galvanized bolts, with washers and nuts on the inside. But where the brackets are attached to a built-up LVL beam spanning between piers, the nominal 6 inches of framing allows the use of lag bolts.

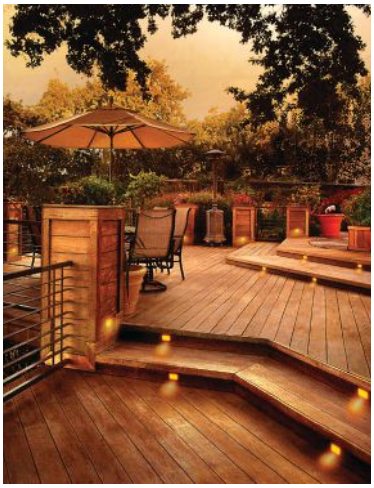
In either case, it turns out, the Maine Deck Bracket eliminates the need for a complicated connection through the rim joist to manage lateral loads, as required in recent versions of the International Residential Code. But while the hardware may simplify structural issues, it also forced Pollard and his crew to come up with a new set of details to achieve their building-science goals. And building the system on site to meet both the structural and the energy objectives was, Pollard says, "a drawn-out sequence of events."

The home's primary air control layer is the Zip System sheathing on the inner 2x4 wall. Joints between panels in that Zip sheathing are sealed with Zip Tape—including where the sheathing laps down over the floor system. But the Maine Deck Bracket's code approvals require the aluminum bracket to be bolted directly to structural framing, with no sheathing in between. So at every bracket attachment point, the crew had to cut out the sheathing to expose the main house framing.

Where the sheathing was cut out for the brackets, says Pollard, the crew had to seal up the penetration with Zip Tape. That's tricky, says Pollard, "because now you have to fold that tape in three dimensions, from the sheathing back to the framing, and then back up over the flange of the deck bracket. It's not fun." To be sure of an airtight result, the crew first applied Zip Tape lapped from the sheathing down over the beam. Next, they

Above, from top: A view of the Maine Deck Brackets attached at the floor above the perimeter foundation **(1)**. The brackets attached to the Zip-sheathed inner wall of the raised-floor portion of the house **(2)**. Wood I-joists in place above the deck brackets **(3)**. A view from below, showing the vapor-open WrapShield underfloor membrane **(4)**.

Photos: Mark Pollard/Thompson Johnson Woodworks



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bolted each deck bracket to the beam over the tape—and then they applied more tape over the deck bracket flange and the bolt heads.

The next step was to install the deck ledger beam. "Each ledger beam is a tripled-up piece of preservative-treated wood," explains Pollard. "So we put up one 2x10 piece, clamped it to the brackets, marked the holes, drilled them, then took it down and screwed two more 2x10s to it, and then drilled all the way through."

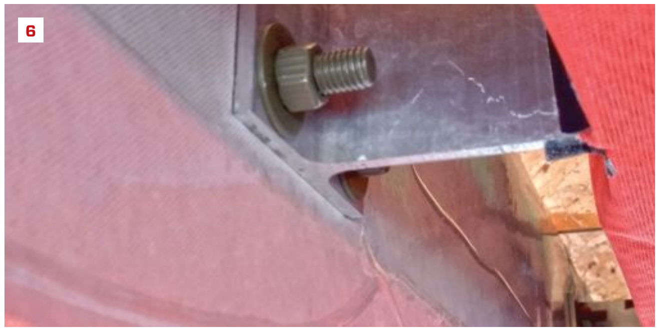
Both the walls and the raised floor of the building have an outer layer of WrapShield airtight, vapor-open membrane applied outboard of the insulated cavity. To maintain continuity of this membrane at the wall-to-floor transition, the crew had to connect the air barrier membrane under the floor to the air barrier membrane on the wall exterior, bringing the membrane behind the deck ledger beam. So before attaching the beam, says Pollard, "we took some of the WrapShield self-adhered membrane and stapled it to the back of the deck ledger beam, leaving 8 inches poking up over the top and poking down past the bottom. Later, that piece would get wrapped up and adhered to the WrapShield on the I-joists at the top, and get wrapped down underneath and adhered to the WrapShield under the floor system, to complete the air barrier."

This exterior WrapShield membrane forms a redundant air barrier, Pollard says: "The Zip System is our primary air barrier. The WrapShield is a backup." But without the well-sealed WrapShield to the exterior, the insulation in the I-joist wall cavities and in the underfloor joist cavities would be exposed to wind-washing, which could degrade its performance. So while the well-sealed membrane is not essential to keep outdoor air out of the conditioned indoor living space, it is important for the performance of the insulated wall and floor.

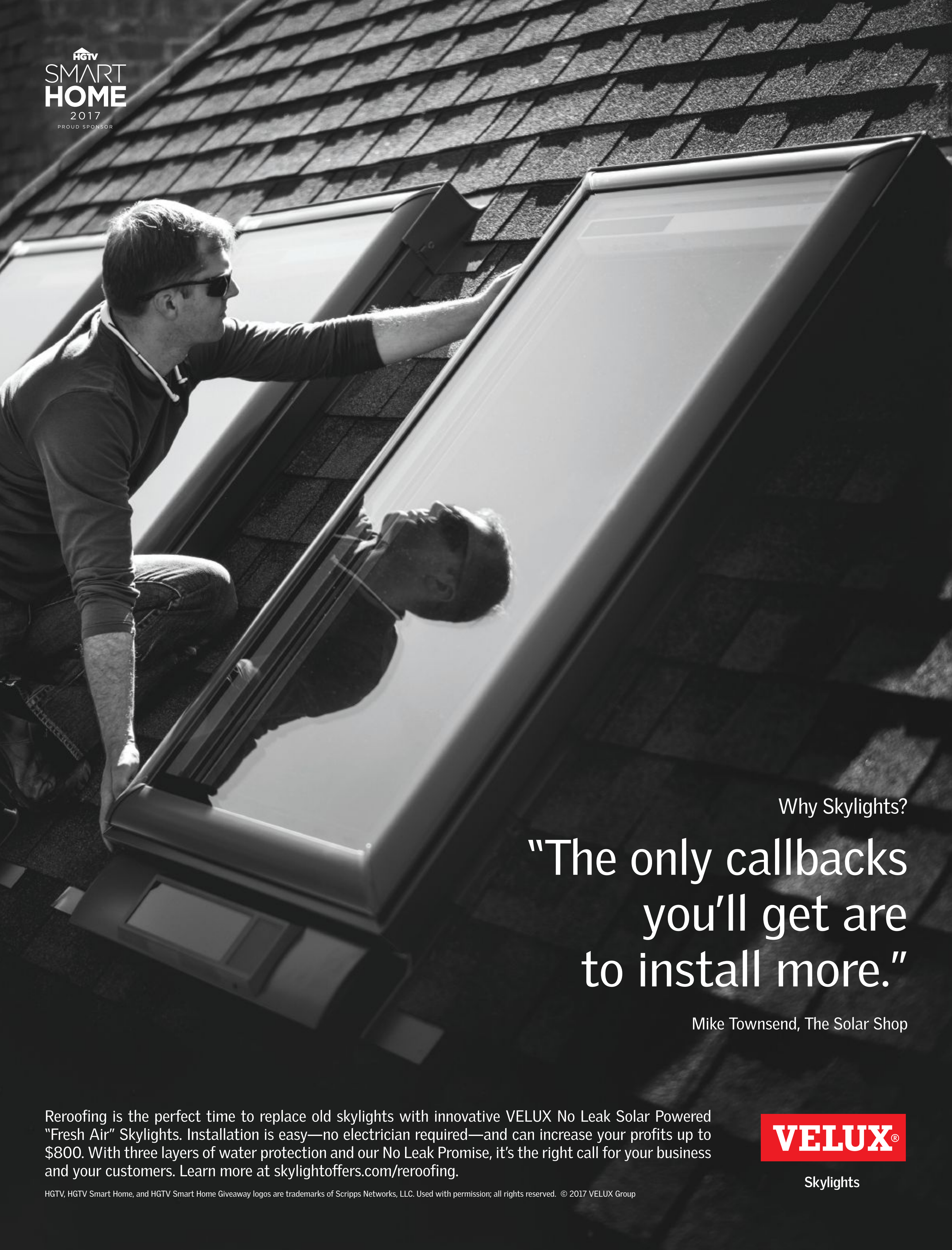
But before sealing the splice between the underfloor membrane and the wall exterior membrane, the crew had to insulate the spaces behind the deck ledger, between the metal brackets. They did this with pieces of extruded polystyrene, cut to fit. "We notched out for the deck bracket mounting bolts," says Pollard, "and then squirted low-expansion foam in to fill any voids."

"So that on the back deck," says Pollard, "there are 12 inches of cellulose in the floor system, there are 12 inches of cellulose in the walls, and there are about 3 inches of EPS between the ledger and the sheathing. That gives us around R-12 or R-13 at that floor perimeter location. So it was a compromise. But it saved us from either having to build a freestanding deck with more footings and piers, or ending up with a more significant thermal bridge at the edge of the floor."

Ted Cushman is a senior editor at JLC.



Above, from top: The tripled-up ledger beam bolted onto the deck brackets **(5)**. The space behind the ledger, which the crew would insulate with rigid foam and gun foam **(6)**. Plywood attached to the bottom of the wood I-joist buildout, with WrapShield membrane adhered **(7)**. The fully framed deck, with the continuous wall and floor membrane installed **(8)**.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Custom Tapered LVL Roof Rafters

BY TED CUSHMAN

When Andrew James Gregor designed this custom renovation in the dry hills east of San Francisco, he wanted to keep the building's profile low, while making the most of the site's expansive views. He also needed to capture and store rainfall on the roof to help with irrigating the landscape.

Gregor's solution was a series of nearly flat roofs stepping down the hillside, with wide eaves to shade the house. The eaves also had to direct rain back toward the house, with gutters at the wall-to-roof intersection directing the rain into a collection system.

Gregor chose LVLs for the rafter system. Wood I-joists would have been cheaper, he says, but LVLs offered the opportunity to build a roof that sloped in toward the house from the wide, overhanging eaves at every side. Unlike wood I-joists, whose strength depends on keeping each member's top and bottom flange intact, LVLs can safely be ripped at the edge, as long as the reduced depth of each piece still satisfies the structure's load requirements.

An architect by training, Gregor used the LVLs to accomplish a visual purpose. "One of the things that annoys me about flat roofs is that they pitch at different angles around the building, and the angle is really weak—like three degrees," he says. "It ends up looking like a twist. So I designed this roof with a fascia that is absolutely level all the way around, and the pitch is all inside the roof." By ripping the LVLs individually on a custom taper from 12 inches in the center to 8 inches at the wall plate, Gregor created a slope of 1/4 inch per foot in both directions. But at the fascia, the LVLs widen to full width to create a level visual line.

The most complex framing came at the corners, where sloping the overhang inward from both roof edges required tapered blocking and outriggers, assembled into a cross-hatched grid. "My crew called it 'the diamond,'" Gregor says. *—T.C.*

Custom-ripped LVL rafters create a slope toward the gutter from both the center and the edge of the roof **(1)**. At corners, tapered blocking forms a grid the framing crew called "the diamond" **(2)**. At the fascia, a steeper slope back toward the wall maintains a straight, level sight line **(3)**. Each LVL rafter was individually scribed and cut **(4)**.

Photos: Andrew James Gregor/Blue Dog Construction

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BY KYLE DIAMOND

Getting Out of the Field

My father, Dale Diamond, and I are partners in a residential remodeling business in Millbrook, N.Y. Together, we run an 11-person company; we have six employees working on site and five in the back office (including Dale and myself, and three part-time employees who help with marketing, bookkeeping, and administration).

I've been working in construction for about 25 years. For most of that time, I wore a toolbelt and worked on site, and for the last 20 years, I also managed projects.

In the past five years, however, I've pulled myself off the construction site and moved into the office, taking on a new role with our company. During that same period, our company's business volume has grown from about $800,000 a year to about $2 million a year—growth that would not have been possible without my making the transition from being a tradesman and job supervisor to being a business owner and business manager.

That transformation for our company has been interesting and rewarding, but not always easy. And I have had to learn a lot along the way.

CHANGING YOUR MINDSET

Six years ago, my thinking was: "I love my work. Why would I ever leave the field?" I was proud of being one of the best craftsmen on the job. If I left, who would run the jobs and get the projects built?

But as I thought about it, I realized that as a business owner working mostly on site, all I owned was my own job. I didn't have something that would function and have value without my personal labor. As long as that remained true, my company's growth and value would be limited by me.

If you're in that situation, I recommend reading widely to expand your thinking. I started with "Who Moved My Cheese?," by Spencer Johnson, which got me thinking about change. I also enjoyed "The E Myth," by Michael Gerber, which is aimed directly at people who, like so many small contractors, have great technical skills but few business skills. A third book, "The One-Minute Manager," by Ken Blanchard and Spencer Johnson, has helped me overcome a tendency to micromanage and be a perfectionist—great qualities in a craftsperson but not such positive traits for a business manager. The final book on my favorites list is "Raving Fans," by Ken Blanchard and Sheldon Bowles, which focuses on how to turn great customer service into a strong marketing asset and a good source of referrals.

I have also benefited from attending trade shows such as JLC Live and from taking classes sponsored by local lumberyards and product vendors. Those are good ways to learn about the perspective of a business owner, as opposed to the mindset of a craftsman whose contribution is strictly the product of his construction skills.

In addition to reading and taking classes, we hired a business coach, who has been helping us define our goals and implement formal systems for improving our business performance.

Finally, I continually look for mentors: people who are successful in business and who might be willing to help me grow and develop in my role as a business owner. Two business associates, brothers who run a gutter company in my market, have been particularly helpful to me. Beyond learning from them directly, watching them develop and expand their own business has been beneficial. I hire them for my projects, and they refer work to me; because we're not competitors, they've been willing to talk frankly to me about business choices. In fact, they are the ones who first said to me six or seven years ago, "Kyle, you have to get out of the field and start being a businessman."

REPLACING YOURSELF ON SITE

There are many obstacles to making the switch from field production. For most of us, the biggest one is probably this: If I don't build our jobs, who will? Obviously,

For most of us, the biggest obstacle is probably this: "If I don't build our jobs, who will?"

the answer is that you have to hire somebody else to do the job you've been doing. And that means looking at hiring differently.

When you're running your jobs yourself, the tendency is to hire young, inexperienced people who don't know very much. They need a lot of management. You can't leave them alone on the site, or they'll make mistakes, but if you micromanage their work—as I tended to do—they never develop the skill to work independently.

After operating that way for years, we realized that our labor cost wouldn't increase by that much if we brought in a more-qualified employee. For that small investment, we would gain not only an employee who would be able to take on increasing responsibility and contribute more and more to the success of the company, but also the time I would need to focus on growing our business.

We got lucky in our first hire after reaching this conclusion: A qualified person who we already knew agreed to join our company. At that point, I was not quite ready to pull out of the jobsite, and we were able to make sure that the fit was right before we committed to having our new employee take over my on-site role. As the company grew, we continued using our new hiring approach so we had more lead carpenters to run more jobs.

REDEFINING YOUR ROLE

With lead carpenters handling the work on site, I now have time for a new set of responsibilities. For one, I run our marketing. This included overseeing the redesign of our website. I develop our strategy for blogs and social media, and I network extensively in our local area, cultivating contacts among real-estate brokers and architects and participating in business groups such as the Chamber of Commerce—all with a view to generating sales leads and driving calls in our direction.

I also handle sales, so when calls come in, I follow up. I pre-qualify leads on the telephone; if they seem like good prospects, I meet with the customers. I develop a scope of work and an estimate (which we charge for).

I still have some responsibility for production management, as well, making occasional site visits as needed to keep our projects on track. On site, I meet with our clients to keep them updated about progress on the job and about where they stand in terms of percent completion and progress payments (and sometimes I meet with them just to keep them from distracting the site supervisor and his crew).

LEAD CARPENTER/JOB SUPERVISOR DESCRIPTION

A formal, written description of the lead carpenter's duties, and the abilities required, has helped us stay focused on our goals as we hire, train, and supervise individuals for that position. Here's what our lead carpenter job description says.

OBJECTIVES:

- To ensure company and customer satisfaction through professional appearance, expert workmanship, and polite communication
- To ensure jobsite safety and enforce jobsite rules for the clients, their property, and all workers
- To be responsible for the efficient and profitable use of the company's time, manpower, materials, tools, and equipment for each project as assigned by the production manager

QUALIFICATIONS:

- Good communication and organization skills
- Strong teaching and leadership skills (must command respect of the work crew and be able to motivate them)
- Extensive rough and finish carpentry skills with superior craftsmanship
- A good working knowledge of related building trades

RESPONSIBILITIES:

- Read and interpret paperwork (plans, specifications, change orders, and so on); bring questions, discrepancies, and unusual conditions to the attention of the production manager
- Coordinate scheduling and details (including materials and subcontractors) with the production manager
- Participate in production meetings and jobsite inspections with the production manager
- Make work assignments, supervise carpenters, and monitor quality
- Train apprentices as time allows
- Maintain regular client contact for duration of project


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The lead carpenter job description (see page 34) specifies the duties of the skilled craftsman hired to replace the author on site. At right are the responsibilities that remain for the author as company owner and production manager—easily a full-time job.

Initial Call	First Meeting	Present Bid	Contract/ Staging	Job Completion	Proactive Warranty
Fill out lead sheet	Get scope	Get desired start date	Establish start date	Exit interview	3 month check in and review email
Set appointment	What's important to homeowner?	When do we expect close?	Site rules development	Request referrals	6 month check in and review email
Send follow-up info email			Pre-construction meeting	Review request email	1 year check in and review email

The goal is to have a business that supports you, instead of a business that you support.

Then, once the job has been completed, I keep in touch with our clients to check on their long-term satisfaction with the work, and to prospect for referrals.

There's also the big picture. It's my job to keep an eye on our future: to develop the company's long-run strategy, to define our goals, and to continue refining and implementing the systems that we hope will get us there.

DEVELOPING SYSTEMS

By "systems," I mean that we're working on writing down every important process in our company. That includes written job descriptions for our lead carpenters. It includes a standard contract and scope of work. It includes a written process for the entire sequence of a job—from generating leads and making sales calls through holding scope-of-work meetings, estimating, bidding, signing the contract, staging the job, handing off to the production team, managing production, creating the punch list, conducting the exit interview, and providing proactive warranty service. And it includes things like our simple, easy-to-read form for routine meetings with clients, which updates them on the progress of the job and where they stand on payment.

The goal is to have a business that supports you, instead of a business that you have to support. If you create systems for your business that can work when you're not there, you create time for yourself: time to work on growing your business and time to enjoy your life and your family. And you create value in your business that may be there for you if circumstances don't allow you to keep working the way you're working today.

Working in the office instead of on the jobsite may not be what every person wants. You may love working on site every day, and you may want to keep doing it. But even if that's the case, you will still benefit from having systems that organize the way your company works. It's worth it to carve out a little time every day, or every week, to work on the systems that help you run your company, instead of having your company run you. That way, if you do change your mind about having that toolbelt on every day, you'll have the option of doing things differently.

Kyle Diamond co-owns New Dimension Construction in Millbrook, N.Y., with his father, Dale Diamond.

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A Texas Tornado: Lessons Learned

Stronger Connections Could Have Saved Homes

BY TED CUSHMAN

Photos courtesy of APA - The Engineered Wood Association

At nightfall on the day after Christmas in 2015, a killer tornado ripped a 13-mile track through the Texas towns of Sunnyvale, Garland, and Rowlett, killing 10 people. Based on the wind damage to structures and vegetation, authorities rated the twister an EF-4 on the Enhanced Fujita scale—the strongest tornado in history for December in Texas. That EF-4 rating corresponds to wind speeds between 166 and 200 mph; according to a National Weather Service estimate, the Garland-Rowlett tornado winds topped out at 170 to 180 mph.

But experts determined that only a few locations along the storm's track saw that kind of wind power. For most of the tornado's path, destruction reflected much lower wind speeds—primarily EF-0 or EF-1 levels of damage (corresponding to winds of 65 to 100 mph), with some zones of EF-2 and EF-3 destruction (corresponding to winds of 111 to 165 mph).

In the days after the storm, engineers from APA - The Engineered Wood Association toured the affected area to draw lessons for the construction industry. The team's report on the aftermath, "Texas Tornado Damage Assessment Report," is posted on the APA's website (apawood.org). Photos in this story are drawn from that report.

APA engineer Mary Uher was on site with the damage assessment team. For Uher, the work is personal; she was born and raised in the heart of Tornado Alley, and family members still live there. As she said to *JLC*, "Tornadoes are a real-life thing to me."

Educating builders and remodelers is part of Uher's mission with APA. "I hear a lot of people say, 'You just can't design for a tornado,'" she says. "But it's not true. On the shoulders of this tornado, where we saw a significant portion of the damage shown in these pictures, the wind speeds during the storm were right at code wind speeds, or just a little bit above. And you can design to save those homes, or to experience less damage."

To survive high winds, a house needs a continuous load path;

Above are three examples where the wind ripped lower-story walls away from their slab foundations. This kitchen wall **(1)** was not fastened down with anchor bolts, but only with powder-actuated nails. Nails used to fasten another detached wall plate **(2)** do not appear to have penetrated the concrete when the plate was installed. In photo **(3)**, the wall plate stayed in place, but the wall above it came loose; the fastening of laminated fiber or foam sheathing was insufficient to hold the wall studs in place.

wind forces on the roof and walls have to be transmitted through those structures into the foundation below (see Improving Tornado and Hurricane Resistance of Wood-Frame Buildings, page 41). "A chain is only as strong as its weakest link," Uher says. "So you have to have your sheathing attached to your roof supports properly, your roof supports attached to your wall properly, your wall properly framed and sheathed and nailed to transfer the loads between the walls and the floor. You have to have your floors connected together properly, your floors connected to your foundation properly, and then your foundation has to be properly sized. And wherever the weakest link is, that's where the failure will occur. That doesn't mean everything else is strong enough; it simply means that the load has found the weakest link in the chain."

Photos in the APA report show examples of failure at all these connection points—even in homes at the storm's edge, where damage to surrounding structures and vegetation was not extreme. In many cases, better construction could have saved homes.

WALL ANCHORING FAILURE

APA's 2015 design guide, "Building for High Wind Resistance in Light Frame Wood Construction," recommends that wall sills be attached to foundations using anchor bolts spaced at 32 inches to 48 inches o.c., connected with nuts over 3-inch washers. The guide calls for walls to be fully sheathed with wood structural panels (OSB or plywood), attached with 8d nails at 6 inches o.c. in the field and at 4 inches o.c. on the edges (including at the sill plate).

The 3-inch washers, Uher explains, help to prevent cross-grain bending of the sill plate, as well as preventing the sill plate from lifting off the foundation. In Texas, however, the APA team found many examples where anchor bolts weren't even used—just powder-actuated nails (which didn't always penetrate the concrete).

But even where sill plates were firmly attached to the foundation, says Uher, carpenters often neglected to nail the wall sheathing to the plate. That step is important, Uher says: "It really finalizes that connection."

Improving Tornado and Hurricane Resistance of Wood-Frame Buildings

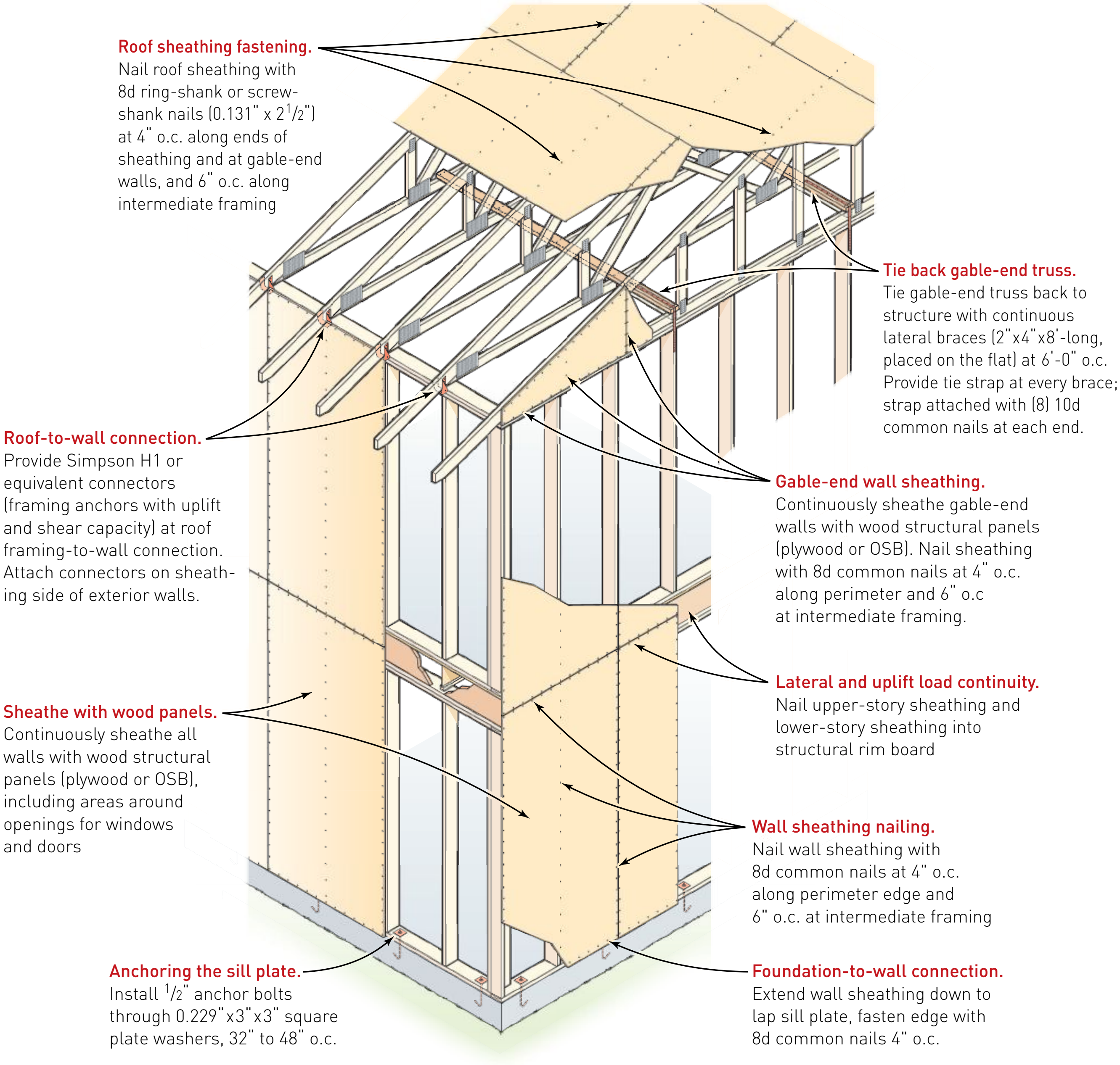

Illustration adapted by *JLC* from APA "Building for High Wind Resistance in Light-Frame Wood Construction Manual" (M310, 2015).

After inspecting hundreds of damaged or destroyed homes in multiple storm events in many different locations in the United States, APA engineers have concluded that a systematic upgrade of the component and assembly connections, designed to create a functioning load path for wind resistance throughout the structure, could save many homes at a reasonable cost.

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Failure of brick veneer exposed to relatively moderate wind speeds was common on the fringes of the tornado's track. Vertical cracking in the brick at the corners of buildings **(4, 5)** was a typical failure—the result of lateral displacement, or "drift," of stud walls built without sufficient bracing. In one case **(6)**, brick veneer and foil-faced foam sheathing were both blown off the gable wall—possibly after the wind breached the garage door. In another example **(7)**, portions of a brick wall collapsed. "Lateral flexibility within these structures is incompatible with rigid and brittle brick-veneer wall coverings," notes the APA report.

SHEATHING AND CLADDING FAILURE

In any kind of high-wind event—a hurricane, a tornado, or even a strong thunderstorm—wind applies pressure on the upwind side of the building, and suction on the downwind side. And while the public perceives brick walls as strong and durable, brick veneer cladding on houses typically is not designed or intended to resist these lateral forces of wind. Instead, that job is done by the wood framing of the house walls and by the bracing on those walls. The brick has to be attached to the wood-framed walls, and those sheathed stud walls have to pick up the wind forces on the house and transmit them into the foundation—without excessive flexing or racking.

"It's another homeowner misconception," says Uher. "People think, 'My house is brick, it's strong.' That's what the three little pigs taught us. But the brick isn't really what's holding your house up."

Images 4 and 5 (above) show big cracks at wall corners. "We saw this repeated over and over again in Texas," says Uher. "We think that it is due to lateral displacement. Brick is really brittle, and the lack of flexibility of brick can be a problem in these high wind speeds." Structural wall bracing is important to maintain stiffness so that inflexible components such as brick cladding, doors, and windows will not be damaged by "drift" of the wall structure.

Attachment of the brick cladding to the framed wall can also be a factor. In image 7 (above), the destructive wind action "was likely suction," says Uher. "There were brick ties installed on the sheathing, but they were never installed into the brick. So somebody knew the code, and knew to put the brick ties on, but then they didn't embed them into the mortar."

APA recommends fully sheathing walls with wood structural panels (plywood or OSB), as backup protection for the building and contents in case cladding is lost. APA's "Building for High Wind Resistance" guide notes, "The minute the siding is blown off the wall, the remainder of the wall left behind must be able to protect the contents of the structure from the wind and rain by itself."

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Perfecting the wind uplift load path requires tying roofs to the tops of walls and tying upper-story wall systems to lower-story walls. In the Garland-Rowlett tornado, homes suffered complete loss of the roof structure because wall plates weren't tied to walls with well-nailed structural sheathing, or roof members weren't securely fastened to wall plates **(8)**. In other cases, inadequate connections between upper and lower stories resulted in the destruction of upper stories **(9)**. Inadequate bracing of tall walls **(10)** and lower-story walls with multiple openings **(11)** also resulted in structural failures.

TALL WALL FAILURE

Unusual architectural features can create special weaknesses in a wood-framed wall. In the Garland-Rowlett tornado, the APA team noticed a few cases where failure occurred because two-story walls weren't adequately braced or supported against lateral loads.

In one case (image 10, above), the wall for a two-story open space with a cathedral ceiling was framed as two walls, with a mid-height wall plate creating a "hinge" halfway up the wall. "Walls such as this should be designed using balloon framing or some other means of laterally bracing the wall," says APA.

In another example (image 11), first-story walls with extensive window and door openings had intermittent wood structural panel sheathing, infilled with laminated fiber sheathing. The first-story walls collapsed completely. The many openings "should signal the designer to pay special attention to the wall bracing specified in the building code for lateral resistance," says APA. "Collapses such as this obviously represent a serious life-safety issue."

WALL-TO-ROOF CONNECTION FAILURE

When carpenters frame a house, we start at the bottom—and we think mostly about the problem of holding the house up. But when wind tries to tear a house apart, it generally works from the top down. As the winds pass over a peaked roof, wind suction tends to pull roof sheathing upward. This uplift force is transmitted into the rafters or trusses, which then pull up on the top plate of the wall.

In the Garland-Rowlett tornado, that wind force pulled some roofs off their walls. Touring the damage zone, APA engineers noticed that the connection of walls to roof was often insufficient. Roof framing wasn't typically tied down to wall plates with metal connectors, and wall sheathing often didn't overlap wall top plates.

In high-wind events, the roof-to-wall connection is subject to shear as well as uplift loads, notes the "Building for High Wind Resistance" manual. APA recommends framing connectors that can handle both kinds of loading, attached on the outside of the wall. Sheathing should overlap the plate, with nails at 4 inches o.c.

This garage door opening **(12)** shows a classic racking failure that is also commonly seen in earthquakes. Image **(13)** shows similar racking of another garage door frame, plus catastrophic failure of the adjacent walls and roof—likely a result of the sudden pressurization of the building when the garage door was lost. In images **(14)** and **(15)**, pressurization of the garage apparently contributed sufficient force to cause the loss of roof sheathing in nearby areas of the main house roof.

ATTACHED GARAGE FAILURE

Attached garages can be risky in more than one way. Garage door openings typically leave only a small length of wall flanking the door, which makes it hard to brace the wall adequately.

One code-allowed solution is to use a "portal frame" as prescribed in the International Residential Code (IRC), with a continuous header across the large opening, and heavily nailed wood structural panels tying the wall framing to the header—plus metal anchors tying the wall base to the foundation.

But the garage door itself can also be a weak point. "Failure of a garage door pressurizes the inside of the house," explains Uher. "Once the garage doors go, the wind is now not only on the outside of your house, but inside. You have suction on the roof, plus pressure from underneath. The pressures double, essentially—and then it's typically a sudden failure of the roof." One weak link can be the connection of the wall to the roof. "If that fails," Uher says, "it allows both your walls to fall out and your roof to blow off."

THE BUILDING CODE—AND BEYOND

The lessons of the Garland-Rowlett tornado are twofold, says Uher. Some homes were damaged or destroyed because they fell short of code requirements. But some homes that failed did meet code. Of those homes, APA says, many could have been strengthened enough to withstand the winds, and for a modest cost. APA's above-code "Building for High Wind Resistance" manual requires only a few modifications (called out in the illustration on page 41)—but these could make the difference between destruction and survival.

"Designing to code is important," says Uher. "However, for my family, who live in Tornado Alley, if, as a rough estimate, they can spend an extra $1,000 to make their house safer (depending on the size and location), just to be a little more sure that it's going to stand up when the tornado comes through—that's worth it, in my eyes. It's a lot easier than dealing with your house blowing down."

Ted Cushman is a senior editor at JLC.

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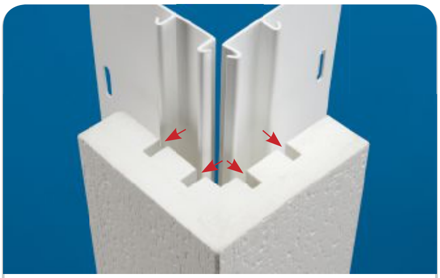

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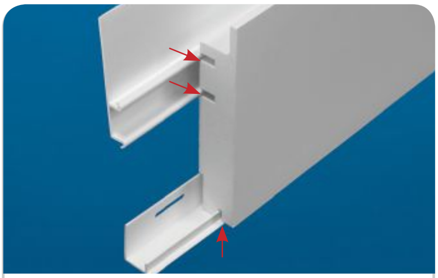

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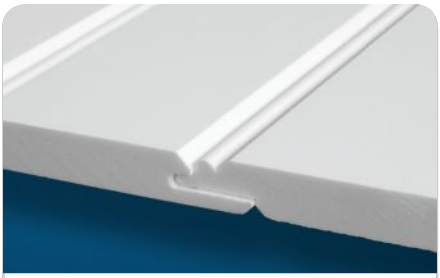

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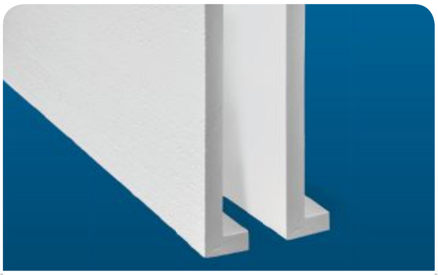

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Photo: Ted Cushman

Avoiding Wet Walls

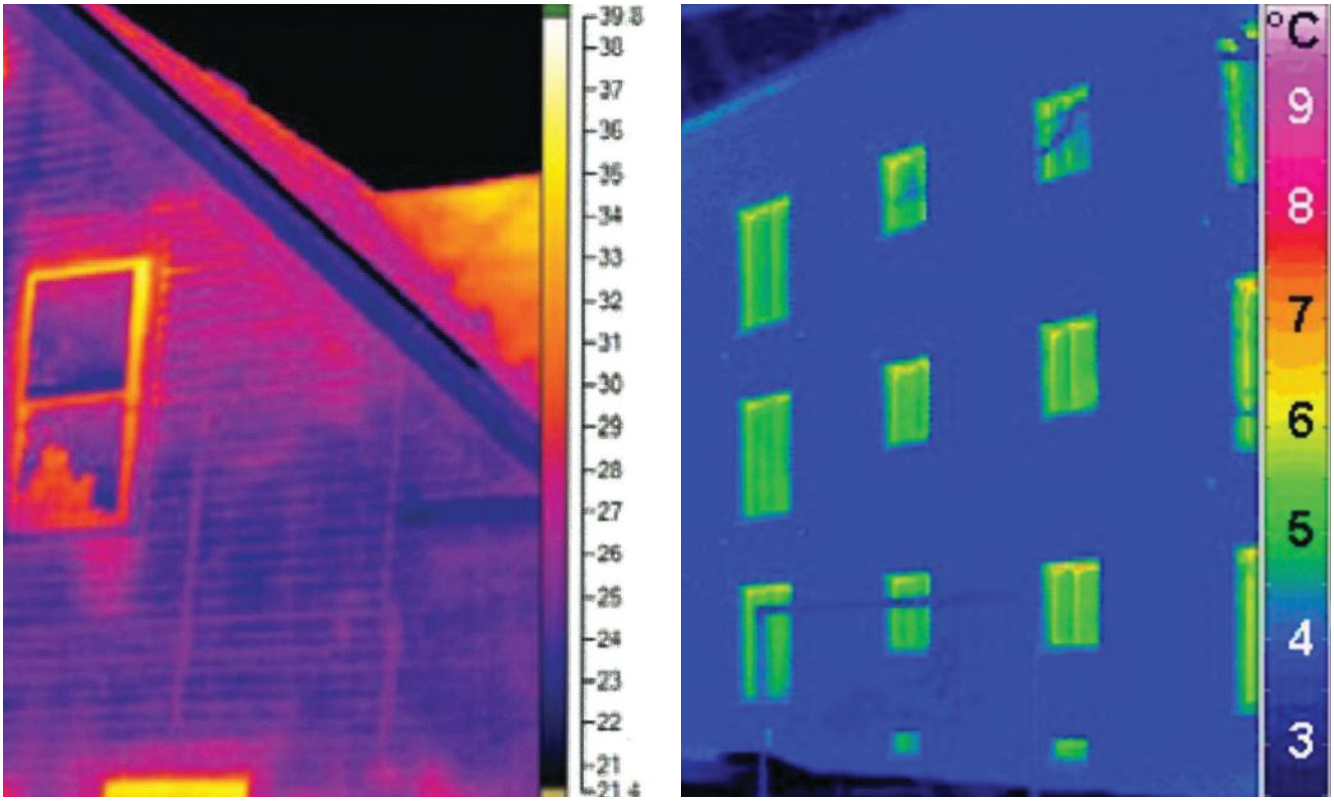
The energy code provides guidance on limiting the risk of condensation, if you know where to look

BY CLAYTON DEKORNE

Continuous exterior insulation—commonly provided by wrapping a building with rigid foam—is nothing new to residential construction. But as it has found its way into energy codes in northern communities, it has advanced to become a mainstream wall system, even though a lot of builders are still unfamiliar with it and don't always understand the role it plays in the thermal and moisture performance of walls.

Continuous insulation (CI) was first introduced to the 2006 International Energy Conservation Code (IECC) as an option in climate zones 5 and 6. (In the code, it is indicated with an equation, such as "13+5," which stands for R-13 in the wall cavity and R-5 continuous exterior insulation.) With the introduction of the 2012 IECC (and continued under the 2015 edition), continuous insulation became a requirement for climate zones 6, 7, and 8. In these zones, you have two choices and both require continuous insulation: 20+5 (for example, a high-density, R-20 batt in a 2x6 cavity with 1 inch of XPS foam on the exterior) or 13+10 (for example, a $3\frac{5}{8}$-inch fiberglass batt in a 2x4 wall with 2 inches of XPS on the exterior).

Perhaps leery of taking the CI plunge exclusively, some states have amended this requirement. New York is a notable example. By the time the state adopted the 2015 IECC (skipping over 2012), the NYS 2016 energy supplement allowed two options for climate zone 6. "Option 1" is equivalent to the chapter and verse of the current IECC wall insulation requirement. "Option 2" allows R-25 cavity insulation only, without continuous exterior insulation. (Note: if builders follow Option 2, they have to opt in for the full gamut of fenestration and insulation requirements, including slightly more energy-efficient windows and slightly better interior basement insulation). Option 2 is largely seen as a hat-tip to spray-foam insulation, which has gained a strong foothold in the New York market, though you



Thermal bridging at a glance. The effect of thermal bridging can be seen immediately in the infrared image of the house on the left. Without continuous exterior insulation, heat conducting through the framing is visible (also visible are air leaks and conductive losses at windows and through spotty patches of insulation). The thermal envelope on the house on the right has been built specifically to reduce thermal bridging and shows no heat loss through the framing.

Images: John Snell (left); Passivhaus Institut (right)

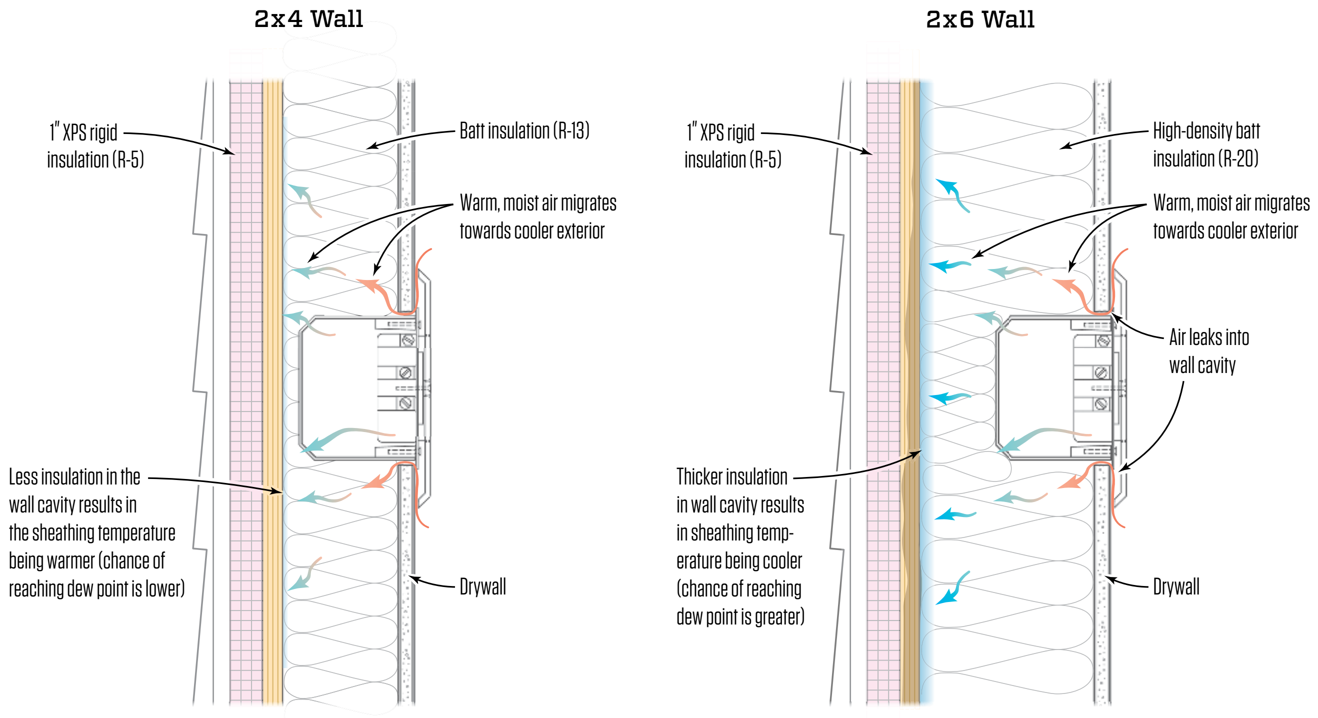
can comply with Option 2 using any wall system that provides R-25; an 8-inch fiberglass batt in a 2x8 wall, for example, would comply. What Option 2 doesn't provide is relief from thermal bridging or condensation control.

WHY CONTINUOUS INSULATION?

In a wall, cavity insulation only slows down the flow of heat through the stud bays, while every stud, trimmer, header, cripple, and wall plate acts as a thermal bridge, bypassing the cavities and siphoning heat from the building **(1)**. Peter Baker and Joe Lstiburek, in the must-have Building America resource "Measure Guideline: Incorporating Thick Layers of Exterior Rigid Insulation on Walls," estimate that thermal bridging reduces a conventionally framed wall's nominal insulation value by at least 20%. In a typical framed wall without continuous insulation, R-20 batts really perform at about R-16, and R-13 insulation at about R-10.5—well below nominal insulation values. Adding foam to the exterior brings the total wall value near the nominal values for the cavity fill: A "20+5" wall (for example, R-20 batts and 1 inch of XPS rigid foam) has a total wall value of R-19.4; a "13+5" wall (for example, R-13 batts and 1-inch XPS) has a total wall value of about 14.3.

Thermal performance is only part of the equation. The energy code is about much more than saving energy. As the code evolves, it is aligning more with building science and getting better at addressing the impacts on buildings that follow energy performance, namely building durability and indoor air quality. Of course, client comfort is another clear impact, but no code official is likely to say his job is to make occupants more comfortable. Nor is he likely to say it's about saving occupants money on their utility bills. For code officials, it's all about safety, and that's exactly

Condensation Potential in Wood-Framed Walls



More cavity fill requires more continuous insulation. In a wall with continuous exterior insulation, the risk of condensation depends on the proportion of cavity fill to continuous insulation. As you add insulation to the cavity, you need to increase the thickness of continuous exterior insulation. If you don't, the increased cavity insulation will result in the sheathing being cooler. This increases the chance that the sheathing temperature will reach dew point and wet the sheathing with condensation.

Illustration: Tim Healey

where the energy code is beginning to make sense.

Continuous insulation reduces the condensation potential of walls by keeping the exterior sheathing warmer. In theory, when the sheathing is warm enough to stay above the dew point, it doesn't matter from a vapor-control perspective if warm, moist air leaks into building cavities. The moisture stays in the air, doesn't condense, and doesn't risk mold growth or rot.

But here's the subtlety that this article is really about: While the insulation requirements in the latest versions of the energy code embrace the concept of condensation control more than they ever have, they don't go far enough to stave off the condensation risk completely. The current insulation requirements may even increase the risk in climate zones 6, 7, and 8.

To understand this risk, we need to examine exactly how the building code addresses the condensation risk.

CODE'S ELUSIVE CONDENSATION STRATEGY

Condensation happens all the time in most buildings. In winter when moist, indoor air leaks into building cavities, water is likely to condense on the inside of the sheathing in many homes. In the summer, it is likely to condense on the back of the drywall. If this happens occasionally on the coldest or hottest days of the year, the water usually dries eventually without mishap. Condensation only creates problems (peels paint, grows mold, rots the structure) when it occurs frequently enough that walls stay wet for longer periods than they stay dry.

Building codes have traditionally addressed condensation by trying to limit the amount of water vapor that gets inside building assemblies. Chapter 7 on Wall Coverings in the IRC is where you need to look to find guidance on reducing the condensation risk with continuous insulation. It's couched in the vapor-retarder requirement,

TABLE R402.1.2 WALL INSULATION REQUIREMENTS	
Climate zone	Wood frame wall R-value
1	13
2	13
3	20 or 13+5
4 except Marine	20 or 13+5
5 and Marine 4	20 or 13+5
6	20+ 5 or 13+10
7 and 8	20+ 5 or 13+10

The excerpt of Table R402.1.2 (left) shows IECC Chapter 4 wall insulation requirements. Continuous insulation is an option in climate zones 3 to 5 and is required in zones 6 to 8 under the IECC. For controlling condensation, the guidance in Table R702.7.1 (below) provides a safer wall system, regardless of which class vapor retarder you install.

TABLE R702.7.1 CLASS III VAPOR RETARDERS		
Climate zone	Class III vapor retarders permitted for:	Compliant wall example
Marine 4	Continuous insulation with R-value ≥ 2.5 over 2 × 4 wall.	½-inch XPS over 2x4 with R-13 batt
	Continuous insulation with R-value ≥ 3.75 over 2 × 6 wall.	¾-inch XPS over 2x6 with R-19 batt
5	Continuous insulation with R-value ≥ 5 over 2 × 4 wall.	1-inch XPS over 2x6 with R-13 batt
	Continuous insulation with R-value ≥ 7.5 over 2 × 6 wall.	1 ½-inch XPS over 2x6 with R-19 batt
6	Continuous insulation with R-value ≥ 7.5 over 2 × 4 wall.	1 ½-inch XPS over 2x4 with R-19 batt
	Continuous insulation with R-value ≥ 11.25 over 2 × 6 wall.	layered 1 ½-inch and ¾-inch XPS over 2x6 with R-19 batt
7 and 8	Continuous insulation with R-value ≥ 10 over 2 × 4 wall.	2-inch XPS over 2x4 with R-13 batt
	Continuous insulation with R-value ≥ 15 over 2 × 6 wall.	3-inch XPS over 2x6 with R-19 batt

Note: As a "base case," the IRC requires a Class I (e.g. poly) or a Class II (e.g. Kraft paper) vapor retarder on the interior side of walls in these five climate zones. You can use a Class III vapor retarder (e.g. latex paint), but only when the wall includes vented cladding (not included here) or continuous insulation. The example walls are for reference only and not mandated by code.

and is a little veiled. Section R702.7 states that you need a Class I (poly) or a Class II (Kraft-paper) vapor retarder on the interior face of walls in climate zones 5, 6, 7, 8, and Marine 4. You can use a Class III retarder (latex paint on the drywall), but only when you either install a vented cladding on the outside of those walls or install enough continuous exterior insulation to cool the sheathing.

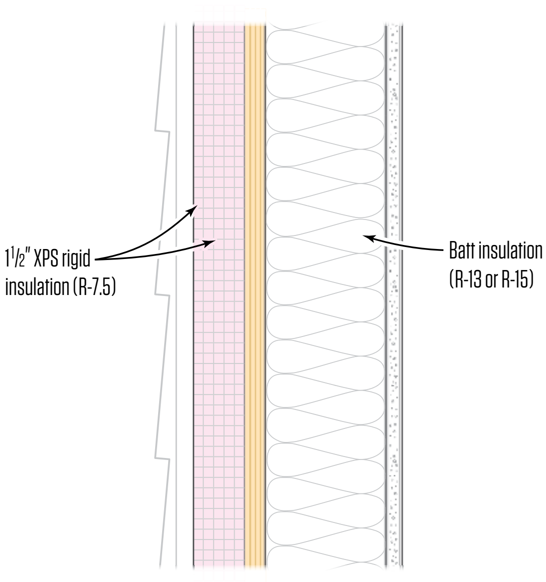
How much is enough? The minimum R-values for continuous insulation are provided in Table 702.7.1 (see excerpt, above). Note that when continuous insulation is installed over a 2x6 wall in climate zones 6, 7, and 8, the amount of continuous insulation needed to control condensation is more than the amount of insulation required to meet the building thermal envelope requirements (Table R402.1.2; see excerpt at top of page). In other words, if you follow only the insulation requirements in Chapter 4 of the IECC (which are the same as Chapter 11 of the IRC), you may be building a risky assembly (see "Condensation Potential in Exterior Walls," previous page). If you are only seeking code compliance, the safe bet for any wall *regardless of the type of vapor retarder you install* is to follow the recommendations for continuous insulation provided in Table R702.7.1.

The risk of not adding enough continuous insulation—or, more precisely, of unbalancing the wall with too much cavity insulation relative to the amount of continuous insulation—is even more critical to understand if you want to go *beyond* code. For example, what if you add only an inch of rigid foam to the exterior of an R-20 wall in climate zone 5 or Marine 4? If R-5 is allowed for the 2x4 wall, wouldn't adding R-5 to a 2x6 wall be even better? No, because compared with the 2x4 (13+5) wall allowed in these climate zones, the interior of the sheathing would be cooler in the 2x6 wall because there is more cavity insulation. As a result, the sheathing is still likely to reach dew point.

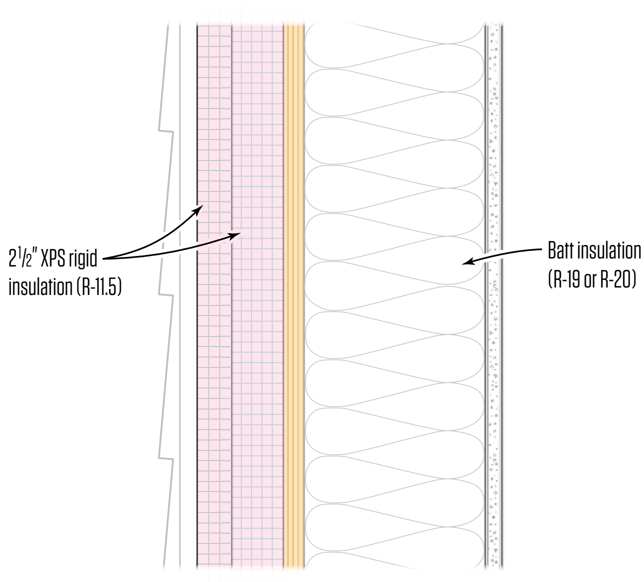
The simplest way to build better walls is to use Table R702.7.1 as

Safe Continuous Insulation Thickness for Cold Climates

Insulated Sheathing With R-Value ≥ 7.5 Over 2x4 Wall



Insulated Sheathing With R-Value ≥ 11.25 Over 2x6 Wall



In climate zones 6, 7, and 8, where the risk of condensation in walls is highest, the IRC requirements for using a Class III vapor retarder specify a thickness for continuous insulation that is greater than the insulation requirements in Chapter 4. This thickness provides a safe wall system, regardless of the type of vapor retarder you install. Note: Chapter 7 guidance does not differentiate between a high-density and a more conventional batt. In a 2x6 wall, a higher-density, R-20 batt may bring the temperature of the exterior sheathing close to dew point. This suggests that an R19 batt is a safer option when using the minimum thickness for continuous insulation.

Illustration: Tim Healey

a baseline and add more continuous insulation outboard of the wall cavity. But if you are serious about going beyond code and avoiding wet walls, calculate the thickness for the given climate conditions and cavity insulation using the method described in John Straube's seminal article "Controlling Cold-Weather Condensation Using Insulation" (BSD-163; buildingscience.com). Ted Cushman's article "Robust Walls" (Nov/06) explains the calculation using specific examples for Boston conditions (climate zone 5).

WHY VAPOR RETARDERS?

According to John Straube "cold-weather condensation is primarily the result of outward air leakage. Diffusion usually does not move sufficient quantities of water vapor fast enough to generate a problem." Why then does the code still require a Class I or Class II vapor retarder as a "base case" in wet walls? It's likely a symptom of the approach building codes have of assuming absolute compliance. Code assumes that if you comply with the air-sealing requirements, you won't have warm, moist air migrating through walls, leaving a very small potential for vapor diffusion, against which you mount a barrier defense. Code is not good at letting go of its barrier defense strategies. It needs to get better at writing in belt-and-suspenders approaches to moisture control and creating safeguards to address problems that arise from incomplete compliance.

Rather than mandating a vapor-control strategy based on blocking moisture diffusion, the energy code might serve us by upping the continuous insulation requirements for climate zones 6, 7, and 8 to align with its vapor-control recommendations. Then it might consider killing the vapor-retarder requirement altogether.

Clayton DeKorne is the editor of JLC.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Using a Sheet-Metal Brake

For more effective flashings, bend them on site

BY GREG BURNET

Many exterior contractors know the crucial role that sheet metal can play for creating effective flashings, drip edge, and even trim. With a sheet-metal brake on site, you can save time and money by custom making or reproducing the shape you need.

Brakes are fairly simple machines. The sheet metal slips into the throat of the brake where an upper jaw clamps it firmly in place **(1)**. A lower jaw pivots on a continuous hinge to bend the material to the desired angle **(2)**. Shapes are created by making a series of predetermined bends in a specific sequence.

Brakes can range in length from 2 to 14 feet and have a throat capacity of up to 18 inches **(3)**. Many manufacturers make brakes, but the different brands all function similarly. These handy machines are portable and set up on a jobsite in minutes.

While the basics of using a brake are pretty straightforward, there are nuances to using one successfully. Perhaps the biggest challenge is visualizing the shape you need to form and then sorting out the order in which the bends need to occur, especially when you're working with a material that has a finished face **(4)**.

CHOOSING THE RIGHT BRAKE

If you are looking to add a brake to your tool arsenal, select one sized to fit the type of work you do most often. Roofers can often get away with shorter brakes because much of their custom bending work is chimney flashing, for which the pieces aren't terribly large. Siding contractors, on the other hand, work with longer pieces, so they generally prefer longer brakes. The trade-offs for the additional length are big increases in weight and cost. As an example, I recently priced both a 4-foot 6-inch brake and a 12-foot 6-inch brake in the same series from the same manufacturer. The shorter brake weighed 63 pounds and cost $940, while its big brother tipped the scales at 153 pounds and cost almost $1,600.

Photos by Sue Burnet

To use a sheet-metal brake, first slide the stock into the machine and clamp it with the upper jaws **(1)**. The lower jaws lift and bend the material to the desired angle **(2)**. The depth of the throat determines the width of the material that can be bent **(3)**. To avoid confusion, clearly mark the finished face on the material to be bent **(4)**.

Length isn't the only consideration with a sheet-metal brake. Some manufacturers also offer brakes with deeper throat capacity, which may be necessary for certain applications, such as forming standing-seam roofing panels. There are also larger, heavier-duty models suited to working with heavier-gauge metals like galvanized and stainless steel. Most contractors, however, only need to bend standard soft aluminum stock (up to .030 inch thick) or lightweight (up to 16-ounce) copper, so a standard-duty brake should work just fine.

MATERIALS FOR FORMING IN A BRAKE

There are three basic materials that I form on a brake: aluminum, copper, and bendable PVC. These products always have a finished face, so handle them accordingly. Aluminum is particularly susceptible to scratching and denting if not handled carefully, while the oils from your hands can discolor copper. The metals also have sharp edges, so I always try to wear gloves when handling them—both to protect the material and to keep it from slicing up my hands. I also avoid dragging material across anything rough, such as a debris-laden worktable or even a lawn, that could mar the surface.

Aluminum is the material that I bend most often. I bend it to make flashing, fascia, and many other profiles, including window cap and door trim. Aluminum comes in a variety of widths, colors, thicknesses, and finishes. In our area in the Midwest, it is commonly available in 24-inch-wide by 50-foot-long rolls.

For exterior brake work, I use a minimum of .019 or .022 thickness (.024 is even better, if available). Lighter-gauge aluminum can be more difficult to work with, and it is more susceptible to "oil canning," or deforming, after the material is installed. Heavier-gauge aluminum is also available, but this material (often referred to as gutter stock) is thicker than needed for most residential jobs, and the thicker stock may require a heavy-duty brake for forming.

Aluminum stock usually comes prefinished, with either the same or a different color on each side and with either a painted or a PVC-coated finish. Some contractors claim that a PVC coating makes the material more scratch resistant, while others say the thin PVC coating can crack and chip off during forming—especially in colder weather.

One note of caution: Never put aluminum in direct contact with treated lumber. The chemicals used in the process of pressure

5

Spring clamps help to keep rolls of aluminum stock under control **(5)**. Map out the bends for every shape and total up the dimensions **(6)**. Mark the dimensions on one end of the stock and then fold the piece over on itself to transfer the dimensions to the other end **(7)**. Short slits with tin snips register the dimensions on both ends of the stock **(8)**.

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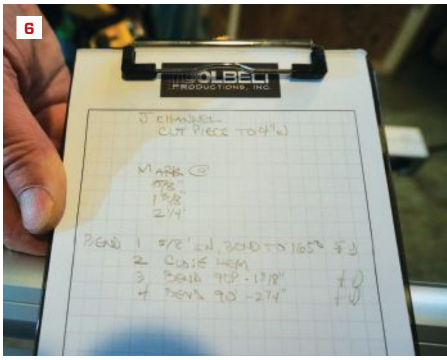

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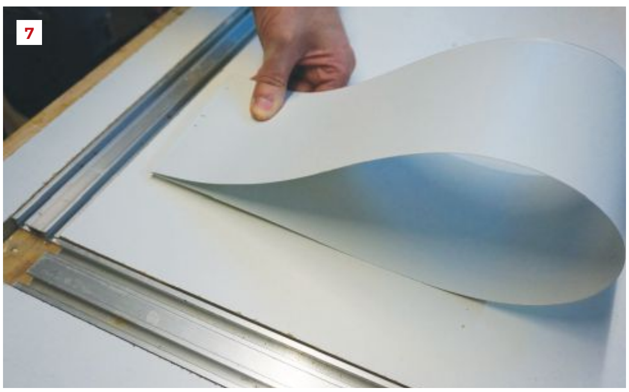

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treating wood can cause the aluminum to degrade. It is also wise to isolate aluminum from materials that have a high alkaline content, such as fresh mortar and concrete. And because salt can lead to serious corrosion, it's a good idea to avoid using aluminum in areas close to salt water.

Copper is sold by weight (ounces per square foot of material) instead of thickness, and it bends well in brakes. Copper is commonly used for flashing, especially on roofs and around chimneys. Typical weights for copper in residential work range from 16 ounces to 24 ounces. Most good-quality brakes can handle 16-ounce copper, but always check the recommended capacity of your machine before attempting to form any material.

I've also noticed that because of its thickness, copper puts extra wear and tear on the brakes we use. As a result, we have less time between "tune-ups" and we need to more frequently replace various parts on the tool that can wear out.

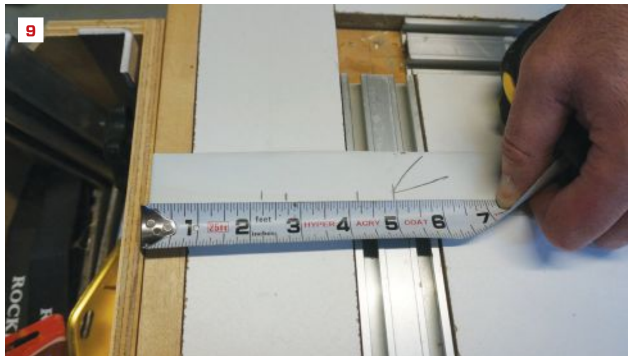
PVC is favored over aluminum by many contractors (particularly in coastal regions), but it can be quirky to work with. My company prefers to use PVC (sometimes referred to as "bendable vinyl") to make rigid sill pans for windows and doors. While durable, metal pans can create a thermal bridge between interior and exterior surfaces, which can lead to condensation on interior surfaces in colder climates. On the other hand, PVC doesn't conduct heat as readily, and because joints in PVC can be glued instead of soldered, I usually choose PVC ahead of metal for sill pans.

Another advantage to PVC is that it does not react to the chemicals in treated lumber, so it's a good choice for shapes such as deck-ledger flashing.

PVC coil stock isn't as susceptible as the other types of coil stock to damage from rough handling, but bending it does require a slightly different approach. First of all, PVC does not "score and snap" like the metal coil stock that we bend. Instead, you need to score all the way through the material when cutting it to width, which requires a firm, steady hand to keep the blade from drifting away from the brake's jaws. Cutting PVC stock requires multiple passes with the knife before it separates from itself.

In addition, because PVC has "material memory" and springs back slightly when bent, we usually need to lift the brake's hinged jaw multiple times to bend the material to the desired shape. This material memory also prevents PVC coil from being hemmed (bent back on itself).

A hook strip is helpful for marking multiple pieces. Mark the dimensions on the strip **(9)**, then hook the strip over the stock to transfer the marks **(10)**. Score stock by clamping it and running a knife along the fence **(11)**. Always map out the bends on the stock before you begin the bending process**(12)**.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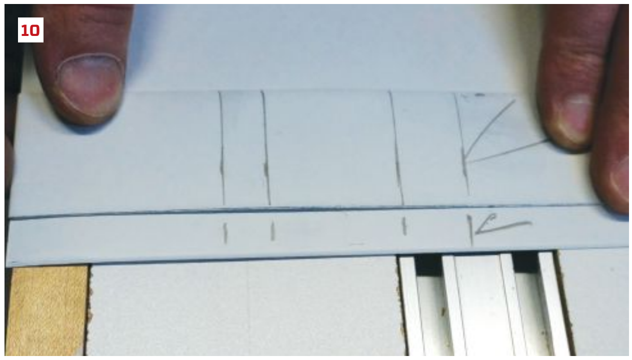
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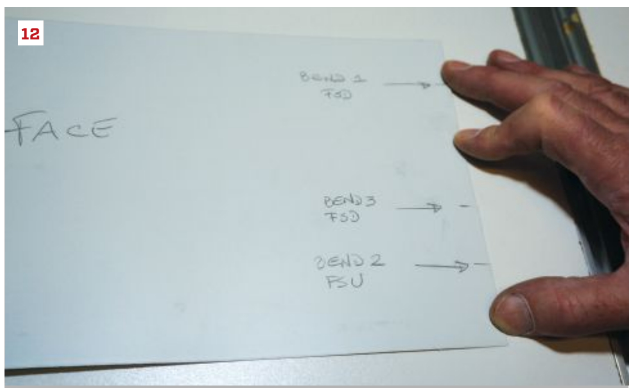

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SETTING UP SHOP

Brakes work best when set up on accessory stands, placed on sawhorses, or semi-permanently mounted to a bench inside a truck or trailer. My company chose the latter, both to keep the tool out of the weather and to make it less visible to thieves. However you choose to set it up, place the machine at a comfortable working height and provide enough room to feed material in and out of the jaws. I also try to set up a worktable or some other space nearby for laying out material and for storing finished components before installation.

Working with coil stock can be like wresting an octopus, especially on a windy day. To combat this, I try to keep the coil confined in its original box for as long as possible. Rather than ripping the box open and removing the coil, I often cut a slot along one corner of the box and use it for dispensing the coil stock. Be careful when cutting the box to avoid scratching the stock.

If I do need to remove the entire coil from the box, I immediately clamp the loose end to the coil with a spring clamp to prevent it from unspooling **(5)**. I also keep several spring clamps handy to clamp finished pieces to the worktable as they come out of the brake, before the wind can take them away.

GETTING READY TO BEND

No matter what material or shape I'm forming, my approach is the same. On a piece of paper, I first write the dimensions for every part of the shape and then add those numbers together to give me the overall width of the stock that I'll need **(6)**.

If the shape I'm making is too wide or too complex for my brake, I try to break it down into smaller, more-manageable sections. For example, a wide frieze typically has several projecting layers, so I usually start at the bottom and form stock for each vertical face of the frieze, being sure to create interlocking overlaps where each layer meets the next.

Whenever I'm asked to make a shape to cover wood (known as capping), I keep in mind that the shape I form will likely be straighter than the wood it's covering. For this reason, I always leave a little extra room at each bend so the shape can "float" over the wood. Achieving a skintight fit between the two materials is not the objective; attempting to do that would cause a lot of frustration if the wood prevented the stock from lying flat.

By the way, capping is notorious for causing rot in the wood

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14

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The two most common bends are the 90° and the 45°. The handle in the relaxed position is 0° **(13)**. Bring the handle parallel to the floor for a 90° bend **(14)** and halfway to parallel for a 45° bend **(15)**. "Hem" is the term used to describe material that's bent back on itself to make a finished edge **(16)**. Hems are often part of another shape, such as this drip edge.

that it covers, so whenever I do cap wood with sheet metal, I always add weep holes to help drain away any moisture from behind the metal.

Once I know the total width of the material I need for the shape, I transfer the bending-point measurements to the stock. When I have only one or two pieces to make with the same shape, I don't measure and mark both ends of every piece; instead, I mark the measurements on one end, fold the coil onto itself end-for-end, and transfer the marks to the opposite end **(7)**. Of course, the marks end up on opposing faces, so I then hold the pieces together and make a small slice at each mark with tin snips **(8)**, transferring the marks from one face to the other while raising small tabs on the stock. These cuts should be no more than 1/2 inch long. The tabs act as positive stops to register the stock accurately in the brake. The obvious drawback to this method is that the face of the stock is marred by the slits, but that shouldn't be an issue if the pieces get trimmed to length or if the ends overlap or are concealed during installation.

If I need to make multiple pieces at the same shape, I make what is known as a "hook strip," which is essentially a mini story pole for the shape. I start with a piece of aluminum stock about 2 inches wide and cut it to be as long as the overall width of the profile, plus a couple of extra inches. I fold one end of the strip around the edge of a piece of coil to create a hook that's about an inch long and square to the edge of the strip. Measuring from the hook end, I mark out all the bending points and the overall width of the shape on the hook strip **(9)**.

When I've cut the stock to length, I slip the hook strip over each end and transfer the cutting and bending marks to the piece **(10)**. I usually use a pencil for marking aluminum and PVC, but I generally prefer a fine-point permanent marker when working with copper.

After I've laid out the bending points for the shape, I shear the material to width by clamping the stock with the cut line or the tab registering against the upper jaw of the brake at both ends of the material. Using the edge of the upper jaw as a guide, I score across the material with a sharp utility knife **(11)**. I score from both ends and pull the knife towards the middle. Cutting from either end towards the middle prevents overcutting, which can damage the surfaces of the brake. Multiple passes are often required to score the material deep enough to break cleanly.

A drip edge consists of a 90° bend, a hem, and a 45° bend **(17)**. Make the 90° bend first **(18)**, then make the two bends to form the hem. The second bend closes the hem **(19)**. Finally, add the 45° bend for the kick out along the bottom edge of the drip edge **(20)**.

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After scoring the material, I bend it up to between 45° and 60°, and then I push it back down until it's almost flat. I repeat the process until I hear a snap and the piece breaks off.

BENDING 101

When I'm ready to create a shape, I first decide how to orient the material in the brake so that the proper side faces out on the finished piece. Because the tool bends material in only one direction (upwards), I review the bending sequence to make sure the material's finished side is facing out. I clearly mark the face and the back of the stock in pencil, and next to every bending point I indicate in shorthand whether the bend should be made with the face up or down **(12)**. (By the way, any marks made lightly in pencil should wipe off easily with a damp rag and mild cleaner). Here are the types of bends and some simple shapes we make.

90° bends and 45° bends. Judging exactly how far to make a bend can be confusing. The easiest way for me to remember is that the lifting handles for operating the brake's lower jaw are always perpendicular to the floor when in the "relaxed" or 0° position **(13)**. To make a 90° bend, simply swing the handles up a quarter arc until they are parallel with the floor **(14)**.

A 45° bend is similar to a 90° bend, but rather than swinging the handles to the parallel position, stop midway between perpendicular and parallel points of the arc **(15)**. With practice, a brake operator can quickly and accurately eyeball the approximate angle being bent. If you're not comfortable judging angles, some manufacturers offer an accessory angle gauge that attaches to the tool and displays the degree of the bend, much like the bevel scale on a miter saw. This relatively inexpensive device can be helpful when you're working to tighter tolerances or with materials like copper that are less forgiving of over- or under-bending.

Over-bending and under-bending. Depending on the shape you are forming and how it will be used, bending either slightly past or slightly shy of a specific intended angle can often help with the installation of the material. An example of an overbend would be pieces of coil stock bent to fit around a square column. Just as back-beveling the abutting edges of wood components creates a tight corner fit, over-bending—or bending the material slightly past 90°—allows the pieces to be slightly wider than the underlying column surfaces for an easy fit, while letting them snap into position. The spring force from over-bending keeps the seams tight and

J-channel is a simple shape with two 90° bends **(21)**. A drip edge uses two 90° bends, with a hem to strengthen the finished edge **(22)**. On this modified drip cap, under-bending the leg that attaches to the wall adds a drainage slope **(23)**. Casing shapes are also possible with a brake. This flat casing with a nailing flange is three 90° bends **(24)**.

makes them less conspicuous. Underbends can be used on inside corners such as step flashing, or they can add slope to drip cap.

A hem refers to folding the material fully back onto itself **(16)**. It not only provides a clean, straight edge that's free from burrs, but it also adds rigidity to a formed piece. A hemmed edge can help prevent oil-canning, especially on longer or wider pieces of aluminum, such as fascia or frieze boards. To form a hem, make a mark 1/2 to 1 inch from the edge of the material, place it face down in the brake, and swing the handles as far as possible, which usually creates about a 160° bend. Unclamp the material and place the hem (which is still open) in the hemming slot located along the front edge of the tool. Clamping the upper jaw onto the stock then closes the hem.

Drip edge, which directs water away from fascia and rake boards, might look intimidating in cross section **(17)**, but it's easy to bend. I begin by marking the width of the "up-roof" leg, followed by the hem part that projects out past the fascia. Then I mark the vertical part of the drip edge, and finally, the kick at the bottom. I first make the 90° bend for the vertical leg with the finish face up **(18)**. Next, I flip the piece over and make the first bend for the hem. I reverse the piece end-for-end to close the hem **(19)** and then bend the 45° kick at the bottom of the vertical leg **(20)**.

J-channel, a type of accessory trim shaped like a "J," creates a pocket for the ends of siding to tuck into. To form J-channel, form a hem, followed by two 90° bends **(21)**.

Drip cap is flashing that diverts water around wall interruptions such as window trim, deck ledger, or water table. Most building-supply houses sell preformed drip cap, but these pieces are usually flimsy and not the correct dimensions for most applications. Because drip cap is easy to make—it requires just two 90° bends **(22)**—I form most of it for our projects. Some modified drip caps include an overhanging hem; for this variation, I usually under-bend the leg that goes behind the siding to give the shape a slight slope for shedding water **(23)**.

Flat casing is U-shaped in cross section, although some installers add an additional flat leg on one side as a nailing flange to minimize exposed fasteners **(24)**. Only three 90° bends are required to make this shape.

Greg Burnet is a Chicago-based window and siding contractor and a presenter at JLC Live. Greg gratefully acknowledges help on this article from Tom Struble, a siding contractor from West Milford, N.J.

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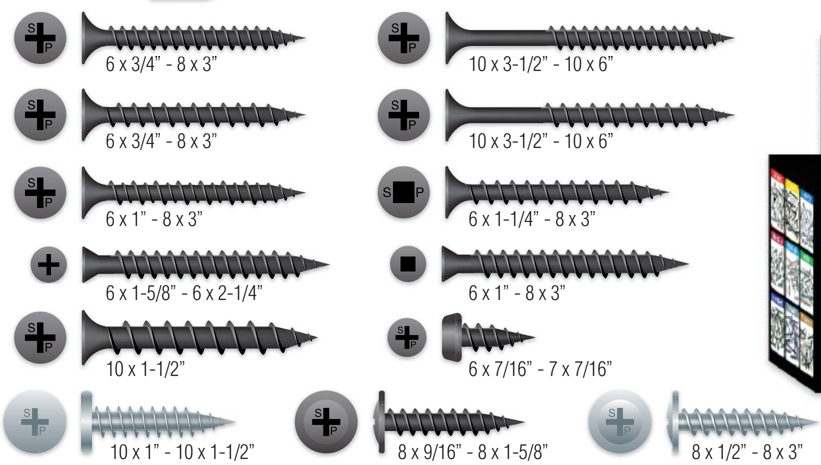

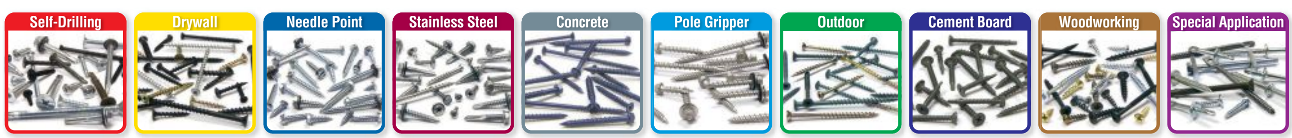

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Products

BY LAUREN SHANESY

1

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4

1. Sturdy Kitchen Organization

Homeowners are often looking for more storage in the kitchen, and they value cabinet organization that's built in. The base cabinet "No Wiggle" Pullout Cabinet Organizer is equipped with four shelves, two of which are adjustable. The manufacturer says that a top-mounted bracket hidden under the first shelf eliminates side-to-side movements and sag. The unit is available in four widths—5 inches ($195), 8 inches ($235), 11 inches ($268), and 14 inches ($327)—and one standard height. hardwareresources.com

2. Decorative Ventilation Fans

Broan's "Sensaire Sense-on-Rise Technology" is now available on the company's Invent Series ventilation fans, providing a way to manage humidity without sacrificing design. According to Broan, sensors that are hidden in the light fixture detect moisture in the air, automatically turning the fan on when a rapid rise in humidity is sensed or when humidity rises above a programmed set point. Broan says the unit helps clear fogged mirrors, manage moisture, and improve indoor air quality. Prices range from $300 to $500. broan.com

3. An Industrial-Inspired Kitchen Faucet

The Danze Foodie Pre-Rinse Kitchen Faucet swivels 360 degrees to give users the flexibility to put the water stream right where they need it. The model features a spring-action wand similar to those found in commercial kitchens; a twist of the spray head allows the user to toggle between a single, steady water flow and a powerful spray. The Foodie has a 20 9/16-inch-high spout and an 8 7/8-inch spout reach and operates at a 1.75 gallons per minute flow. Pricing starts at $310 for a chrome finish and increases to $450 for satin black. danze.com

4. Elegant Automated Lighting Controls

Legrand's new Radiant line of designer switches, wall plates, outlets, dimmers, and home automation controls brings technology and design together for a whole-home, connected lighting system. The cohesive line eliminates unsightly screws from wall-mounted plates and is available in eight color options, including six solid, neutral hues and two metallic finishes. Radiant's outlets also feature built-in USB chargers. Pricing varies. legrand.us

5. A Luxury Kitchen for Less

Combining the luxurious look of a stone countertop with affordability, Wilsonart debuted 24 new laminate surface colors this year: twenty stone designs and four woodgrain patterns, and a matte finish for six colors. The firm says its laminate is resistant to odor- and stain-causing mold and mildew, as well as scratches and scuffs, and is an environmentally-friendly and less expensive alternative to stone. The laminate ranges in price from $25 to $33 per square foot when installed. wilsonart.com

6. Heavy-Duty Fall Protection on the Jobsite

The Miller TurboLite Edge Series collection of personal fall limiters provides workers with new lifelines to protect from the dangers of falling over a sharp edge. The TurboLite Max model (shown) includes a durable web lifeline that Honeywell says is cut, abrasion, and chemical resistant for smooth edge applications. All models have an integral shock absorber, are compact and lightweight, and are rated for a 420-pound worker from overhead down to foot-level connections. Models are available in lengths of 6 to 12 feet in single and twin configurations. Pricing varies by distributor. honeywellsafety.com

7. Hardware for a Floating Vanity

Designed for contemporary bathrooms, the Titus Floating Vanity Support brackets support up to 100 pounds per arm, without visible hardware. The 11-gauge galvanized steel supports—which each have a single extending arm and seven predrilled fastener holes—measure 18 inches by 10 inches by 2 inches and are mounted on either side of the cabinet. Two supports are needed for an installation. We found the supports online for about $40 each (right and left sold separately). federalbrace.com

8. Wide Window Panes

The 1630 Vinyl Single-Slider window has dual-pane insulated glass and heavy-duty weather stripping for protection against wind, rain, dust, and noise. The manufacturer says a warm-edge spacer system maximizes energy efficiency and improves the seal performance of the insulated glass units while allowing an unobstructed view with expansive glass. The window is available in two- and three-lite configurations, comes in a white, clay, or almond finish, and costs approximately $270. miwindows.com


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9. Mildew Protection
Synavax's Crystal Clear Insulating Roof Coating can be applied to tile, wood-shingle, composite-tile, and metal roofs to protect against mold, mildew, moisture, and weathering from UV rays. Though the coating is described as "insulating," the company offers no R-value or description of how it reduces heat transfer. The water-based, nontoxic, and low-VOC coating has a matte finish and is priced at $117 for one gallon. Synavax says the coating can't be used on slurry or glazed tile. synavax.com

10. Improved Post Base
The MPBZ moment post base from Simpson Strong-Tie provides moment resistance for wooden columns or posts on structures such as fences and decks. The overlapping sleeve design encapsulates the post, reportedly keeping it from rotating around its base when lateral loads are applied from above. The innovation reduces the need for diagonal knee bracing, allowing for more design flexibility. Optional holes are provided for attaching additional trim material. Price ranges from $100 to $125. strongtie.com/mpbz

11. Keyless Touchscreen Lock
The Obsidian lock is sleek, modern, key-free, and "smart" and can be had in a stand-alone touchscreen model ($180) or connected to Z-Wave-enabled security and home-automation systems ($230). Homeowners can control the smart lock via a smartphone app or the touchscreen. When the lock is connected, locking or unlocking the door can trigger reactions from other connected devices, such as the lights or thermostat. For security, the lock prompts users to touch two random numbers before entering their code, so that they leave fingerprints across the whole screen rather than on the same four digits. kwikset.com

12. Intelligent Heating Controls
The Climate Control Zoning System II for radiant floor heating systems has an auto-balancing feature that boasts faster reaction times and greater energy savings. According to Uponor, the technology calculates the energy need of single rooms and adapts the heat output of each loop by controlling the actuator's on-and-off cycle, allowing the system to react to temperature changes faster and save energy. The system consists of a base unit ($350), an expansion module ($110), and digital ($115) or dial ($75) thermostats. uponor-usa.com

BY CHRIS ERMIDES

Photos: Courtesy of Hitachi

Two Hitachi Cordless Nailers

Last fall, Hitachi released three new cordless nailers: a 16-gauge straight finish nailer (NT1865DM), an 18-gauge straight brad nailer (NT1850DE), and a 15-gauge angled finish nailer (NT1865DMA)—all running on the company's 18-volt battery platform. In lieu of a flywheel, an "air spring" system runs the nailers, so there's no wind-up time. An internal brushless motor lifts a piston and the attached driver to the top of a sealed cylinder, compressing air behind it. When the trigger is activated, the compressed air drives the piston and driver into the nail. The motor immediately raises it back up to prepare for another shot. For the past six months, I've been testing the 15-gauge angled model while Mike Triller, a finish carpenter, tested the 18-gauge brad nailer.

ALL THE FEATURES YOU'D EXPECT

As with other battery-powered finish nailers, the Hitachi line has an on/off button and a trigger lock. The nailers stay on for up to 30 minutes when not in use and have an LED work light that stays on once the power is activated. The on/off functionality is quick to engage, unlike the buttons on other nailers on the market that need to be held down for several seconds.

These nailers offer sequential (the default mode) or bump-fire modes. The 15-gauge nailer has a dry-fire lockout feature and holds two full clips. The 18-gauge nailer doesn't have dry-fire lockout, which Triller found annoying. It holds two full clips of nails, as well.

The battery status lights change as the battery depletes, and we both found these to be somewhat elusive. You need to press and hold the battery indicator to check the status, so there's no telling when the lights change from two to one, or to blinking. The recharge time from zero to full took about 45 minutes.

On the 16-gauge and 18-gauge models, you can move the pivoting belt hook to either side of the gun housing. With the 15-gauge nailer, however, while the hook pivots, it is on the right side of the gun and can't be switched. Like Milwaukee's nailers, these Hitachi nailers all use the same body but incorporate different magazines for each of the various gauge guns. On the angled nailer, the magazine kicks out to the side and ties in where the belt hook would typically go. Having the magazine kick out to the left of the gun also puts the nosepiece at an angle to the work surface. That took some getting used to, but all in all, the line of sight is excellent on these nailers thanks to the low-profile toolless jam release.

The depth-of-drive adjustment takes some effort to spin with both thumb and forefinger; Triller said it best when he called it "cumbersome and vague." It's possible to unscrew the depth-of-drive pin so much that you unwittingly disengage it. There is no power adjustment dial on these nailers, but neither of us missed one. The nailers have plenty of power, even for hardwoods (Triller used the brad nailer on oak with no issue). Neither nailer jammed for us in regular use. I jammed the 15-gauge gun purposefully in my shop; it was easy to clear and the air spring drive system retracted the pin so I didn't have to set it.

The specs on the 15-gauge gun say that it will fire up to 1,100 nails on a single charge, depending on fastener length and material. When I ran 2-inch nails to install 1x6 poplar door and window casing, I went through close to 1,000 nails on a fully-charged battery. In my shop, I shot 2-inch nails through poplar into framing lumber in bump-fire mode. In this mode, I set about 850 nails before the gun turned off completely (I never turned the gun off during firing). Triller found that when running 2-inch brads into pine and poplar, as well as some oak, the runtime suggested by Hitachi (1,500 nails per charge) seemed accurate.

SOME RECOIL, BUT NOT A LOT

There is some recoil in the 15-gauge nailer—but it's easy to manage. There's hardly any recoil on the 18-gauge model. When firing in either sequential or bump-fire mode, you have to maintain pressure against the work surface throughout the full firing cycle. If you move too quickly, it's easy to get caught in a rhythm in which you're pulling the nailer up before the drive-pin fully sets the nail. I was firing in sequential mode through old, hard poplar and plaster, and I had no issue with the nailer's power.

Weighing in at 7.3 pounds, the brad nailer isn't the heaviest on the market, but it's close. However, Triller had the same experience that I did: The nailer's grip and balance make it feel lighter than it actually is. His take was that it is nimble and easy to use in tight conditions. The body design offers an excellent line of sight, thanks to a smallish nosepiece that sits behind the point at which the nail exits the gun—so you can see right where you're placing a nail. He liked the ease at which the nailer engaged, also; it doesn't require pushing firmly or at a specific angle to engage properly.

BOTTOM LINE

If you're in the market for a battery-powered nailer, this new line from Hitachi is worth serious consideration. The nailers have plenty of power and function and are similar to pneumatics in terms of their speed and ease of use. There's a bit of an adjustment period to get used to the minimal recoil, but you're going to have that to some degree with most battery-powered nailers. The recoil on the 15-gauge is minimal, and nearly nonexistent on the brad nailer. Triller and I both expect the 16-gauge nailer to perform similarly to these two. If the belt-hook size and location limitation (with the 15-gauge only) and the weight aren't deal-breakers, you can't go wrong with these. Hitachi did a nice job here. hitachipowertools.com.

Chris Ermides is the editor of Tools of the Trade.

Features at your fingertips and good sight lines. The power dashboard (top) sits just below the trigger and offers clear indicator lights. Battery status can be checked only when the nailer is on. Switching from single to bump-fire mode is a matter of pressing a button; a solid blue light shifts to blinking to alert you of the mode. Though sight lines are good, the nosepiece is canted on the 15-gauge gun (above left). On the 18-gauge brad nailer (above right), the push lever sits behind the nose, improving the line of sight.

SPECS

NT1865DMA 15-Gauge Angle Finish Nailer
Fasteners: 1 ¼ inches to 2 ½ inches (34-degree DA style)
Weight: 7.5 pounds
Runtime: up to 1,100 nails per charge
Kit includes: bag, gun, charger, and one 3.0-Ah compact battery
Cost: $370

NT1850DE 18-Gauge Brad Nailer
Fasteners: ⅝ inch to 2 inches
Weight: 7.3 pounds
Runtime: up to 1,650 nails per charge
Kit includes: bag, gun, charger, and one 3.0-Ah compact battery
Cost: $340

Photos: Chris Ermides

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Grundens Neptune is designed for fishermen and fit for the trades. Stretch polyester and neoprene cuffs make for a comfortable, watertight fit.

Helly Hansen Chelsea features Cordura fabric on common wear points like shoulders, elbows, sleeves, and hips.

Two Raincoats For the Trades

It rains a lot here in the Pacific Northwest, and my crew and I don't get to go home when the raindrops start falling (unless it is unsafe, of course)—if we did, we'd never make any money. So we need good rain gear. My last coat was a Grundens Petrus, which I wore for about two or three years, until it started wearing out and wasn't waterproof anymore. When I went online to order a new one, I found out that Grundens had stopped making the Petrus and replaced it with the Neptune. Right after I bought the Neptune, Helly Hansen sent me its new Chelsea shell coat for review, giving me an opportunity to compare the two coats.

Grundens Neptune 103 Anorak Coat. I like the pull-over style, and after having rain blow down my neck on so many days last year, I decided I wanted a coat with a hood.

The Neptune is made of a lightweight polyurethane stretch polyester that's comfortable even when I'm wearing nail bags. If the weather is cold and windy, I wear it as a windbreaker. This coat is 100% waterproof, with Radio Frequency (RF) welded seams and neoprene cuffs that stay tight around the wrist and keep the water from rolling down onto your arms. I've always recommended Grundens, and still do; I bought this coat on Amazon for $68 in hi-vis yellow.

Helly Hansen Chelsea Shell Jacket. The Chelsea Shell jacket is made of Helly Hansen's coated and breathable 100% polyester waterproof fabric and features Cordura fabric at the shoulders, elbows, sleeves, and hips. These are common wear points on coats that I've worn in the past, so the durable fabric should contribute to a longer-lasting coat. The zippers have a coating that keeps water from penetrating their teeth, which is nice protection for a phone, gloves, or the like. Even though the jacket is breathable, I still get warm quickly and my safety glasses fog up. I can unzip the armpit area to allow for better circulation. The jacket also has a drop hem, so it is slightly longer in the back, for better protection.

I was a little skeptical of this coat at first. I have always worn rain gear designed for fishing—when I was a teenager, that's what all the framers and siders wore, and I've had great success with it. But I've been wearing this jacket at work, with my nail bags on, and so far, I don't have any complaints, and I get a lot of compliments on it. At $200, its cost is more than double the Neptune's, but I only ever got two to three years out of my Petrus and I hope to get more than that out of this coat, with its Cordura reinforcements.

Tim Uhler is a lead carpenter for Pioneer Builders in Port Orchard, Wash., and a contributing editor to JLC *and* Tools of the Trade.


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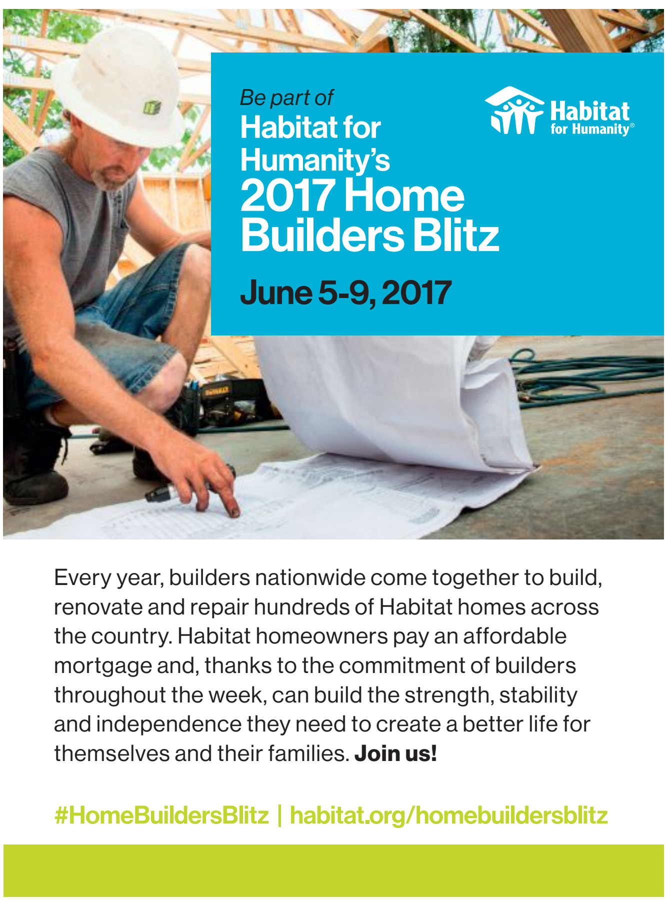
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hw

BY CHRIS YERKES

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Photos by Chris Yerkes

ORV Remodeling

Since spending a two-year stint as a teacher on a remote island off the southern coast of Massachusetts, I've found working in remote, hard-to-get-to places to be a challenge that I enjoy. So when a client approached me about a remodeling project on Pochet Island on Cape Cod, I jumped at the chance. The island is on the bay side of a barrier beach that faces the Atlantic Ocean. That part of the beach—including Pochet Island—is accessible only by over-sand vehicles or by boat.

As the seagull flies, Pochet Island is only a few hundred yards from civilization to the south, but that access is by boat. Instead, we chose the longer, over-sand vehicle route. Each day, the crew gathered at the head of the ORV trail and then truck-pooled to the site **(1)**. To get there, we drove down the ORV trail for more than a mile before heading west and crossing a small bridge over the creek that officially makes Pochet an island. We had to be mindful of ORV trail flooding during astronomic tides.

The project house, one of four houses on the island, sat on a small, grassy rise surrounded mainly by pitch pine, scrub oak, and native underbrush. Our mission was to replace the cedar-shake siding while taking care of any deterioration we discovered along the way.

Views from the house and property were spectacular, with the ocean and the dunes in the distance—one day we saw a pod of whales pass near the shore—but the other side of that coin was that the house had suffered from exposure to severe storms off the ocean. We weren't surprised to find areas of rot, along with places where members of the local rodent community had chewed through the exterior.

Because of the limited access, we had to tote tools and materials out to the site ourselves, although the local lumberyard did brave the ORV trail to bring us loads of material on occasion. But careful planning was a must—we couldn't just "run to the store" for an extra box of screws or a 2x4. The house itself was off the grid, so we used a generator to run our power tools **(2)**.

As we stripped off the old red cedar, we found that the horizontal board sheathing was in remarkably good shape, which made our job easier. As we came across broken or rotted trim, we replaced it, prepainting the new trim a dark green to match the rest of the trim on the house. All in all, the project took less than six weeks to complete, and once again, the little gambrel was ready to shelter the owners and fend off the ravages of its coastal environment **(3)**.

Chris Yerkes is the owner of Cedarworks (cedarworksonline.com), in Brewster, Mass.

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