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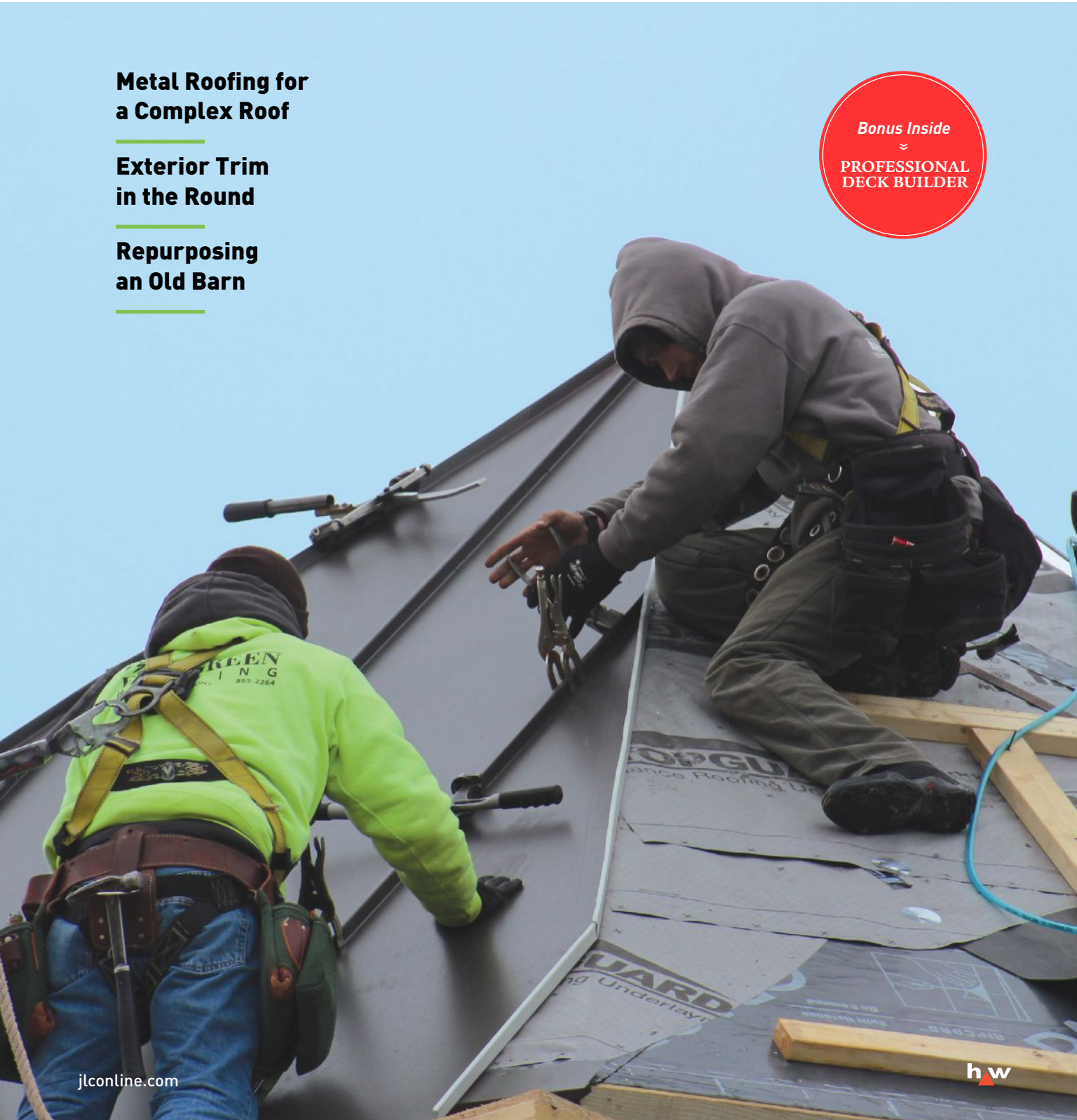

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On the cover: Dusty Morrits (left) and Dalton Haskins (right) of Evergreen Roofing, based in Colchester, Vt., install standing-seam roofing panels on a turret roof in Westford, Vt. Photo by Tim Healey. See the story on page 25.

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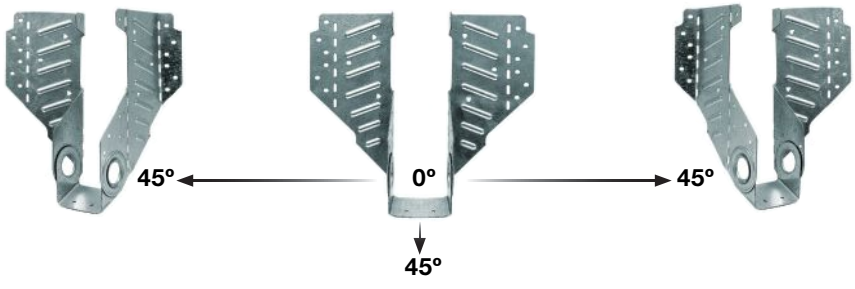

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BY STEVE BACZEK

Rainscreen Basics

Water is the biggest enemy for home builders, and for good reason: Water is the number one killer of buildings. Therefore, proper water management is essential for a building's survival (see "A Primer on Water Management," Jun/17). The word "management" suggests that we respect the basic laws of physics and play along, rather than trying to defy those laws. In my conferences, I often say, "Mother Nature is a heartless adversary, with a perfect win streak. She may lose a battle or two, but she has never lost the war." Against those odds, the only road to successful building systems is proper water management.

Proper water management always comes down to a rate question. Things get wet, and then things dry out. The goal is making sure that the rate of drying exceeds the rate of wetting. To believe that you can stop things from getting wet is a very dangerous way to think. So, if proper water management says that the rate of drying needs to exceed the rate of wetting, then we need to develop our building assemblies to do just that—dry out.

Rainscreens and draining. Rainscreen principles have been around for a long time because they work. Properly installed rainscreens both reduce wetting and promote drying—a win-win situation for the wall assembly. So what is a rainscreen, anyway? It is simply a concept applied to wall assemblies where the cladding (siding) is separated from the underlying wall sheathing by an air space.

This air space functions in a couple of different ways. First, it is a drainage space **(1)**. Any water that makes its way into the wall assembly encounters this space, and because of gravity, the water falls. If a means of exit is provided at the bottom of the space, then the water drains away. Draining away any water that enters the wall assembly suggests that things inside will get less wet; in other words, the better a rainscreen is at draining water away, the more it reduces the wetting potential. Less water means less drying is required (remember, water management is a question of rate). The beauty of this part is that gravity is the mechanism for delivering success.

Photos by Steve Baczek

Drain and dry. A rainscreen is an air space between the cladding (siding) and the water-resistive barrier (WRB). In these examples, the rainscreen is created by attaching the cladding to furring strips fastened to the wall framing. The red arrows in the left-hand photo **(1)** show the direction water drains—down and out—through the space via gravity. Just as important, a rainscreen allows air to enter to dry out both the WRB surface and the reverse side of the cladding **(2)**.

Manufactured or site-built. The most common type of manufactured rainscreen is a mesh that attaches between the cladding and the WRB **(3)**. Vertical furring strips are a good way to create a rainscreen space **(4)**. Screening at the bottom of the space keeps out pests **(5)**. For vertical siding, furring strips can be mounted on the diagonal to allow for drainage **(6)**.

The drying factor. The second function of a rainscreen air space is to promote drying **(2)**. While I highly respect the draining capacity of a rainscreen, I believe that a rainscreen's function of promoting effective drying is probably more important. This is because the drying potential of the rainscreen space works on both sides of the space. In other words, the ventilated space can dry the cladding from the back as well as dry the wall frame assembly on the other side of the air space. Because of the added drying potential from a properly installed rainscreen, some building codes allow you to downgrade the vapor-retarding system if you incorporate a rainscreen into the wall assembly.

Stability and longevity. Finally, the air space of a rainscreen increases the level of stability for the cladding. Every type of cladding lasts longer when it experiences similar conditions on all sides. When one side of the board experiences different moisture conditions than the other side, those different conditions promote a level of instability that usually leads to undesired movement such as warping, twisting, and cupping. The air space on the reverse side of the cladding helps to maintain an equilibrium, which in turn increases the durability of the cladding's finish. The lifespan of a painted finish on cladding can be lengthened significantly when the challenge of moisture on the back of the cladding is greatly reduced.

Manufactured rainscreens. There are numerous materials on the market designed to provide a drainage and drying space between the cladding and the framed wall. One of the most common products is a plastic mesh blanket that attaches to the sheathing **(3)**. The cladding then installs over the mesh, which compresses, leaving the all-important air space between the cladding and the sheathing. Mesh systems such as Obdyke's CedarBreather work well for cedar shingles that require a lot of fasteners.

Many companies are making drainable housewrap products. Those products work in two ways by creating a water-resistive barrier (WRB) with a rainscreen on the outside surface. They have a

Closed vs. open rainscreen. Wood clapboards are an example of a closed rainscreen system, where each layer of cladding laps over the layer below **(7)**. All the ventilation in a closed system comes via the openings at the bottom of the rainscreen. In an open system, gaps between the siding boards allow increased ventilation to enhance drying **(8)**. Before rainscreen is installed, the building should be 100% airtight, weathertight, and water managed **(9)**.

raised texture with a bumpy pattern or some sort of three-dimensional surface to create the drainage space behind the cladding.

Site-built rainscreens. For the buildings I typically design, the simplest rainscreen is created with wood furring strips or strapping installed over the WRB **(4)**. The cladding then attaches to the furring strips (see "Installing Effective Rainscreens," Oct/18). An important detail with this site-built system is installing some sort of screen at the bottom of the air space that lets water drain away while keeping insects and rodents out **(5)**. In the case of vertically oriented siding such as board and batten, I have the builder orient the strapping diagonally to provide means of attachment while allowing for drainage and drying **(6)**.

Closed vs. open systems. For me, rainscreens come down to two basic types: closed systems and open systems. As the name suggests, with a closed system, the siding is installed with some type of closed lap joint, or simply installed as lap siding such as clapboards **(7)**. With a closed system, all the ventilation behind the siding comes from the openings at the bottom.

An open rainscreen system has spaces left between the installed planks **(8)**. While I have used both systems many times, my preference is for the open plank system. If ventilation is good, then more ventilation is even better. Both the open and closed systems rely on the same assumption: that the underlying sheathing and window installation are airtight, weathertight, and properly water-managed **(9)**. Before installing the rainscreen, you should solve for airtightness and water management 100%. Think of the rainscreen system and cladding as exterior "makeup," but makeup that drastically reduces the challenges and risks to the sealed building within.

Steve Baczek (stevenbaczekarchitect.com), of Reading, Mass., is an architect specializing in energy-efficient design and certified passive homes. Follow him on Instagram @StevenBaczekArchitect.

For a more detailed discussion of rainscreen basics, go to **www.jlconline.com/training-the-trades/rainscreen-basics**.

Q What's the best way to install exterior flat-stock trim around a flanged window?

A *JLC* Staff responds: The trick to installing exterior flat-stock trim around a flanged window is having the trim sit flat (in plane with the wall) while the trim's outer face is proud of the siding for aesthetic reasons. If you just use 1-by stock (3/4 inch thick) and rabbet the back inside edge to go over the flange, the edge thickness won't completely cover up most lapped siding (such as side-wall shingles that are 3/4 inch where the layers overlap).

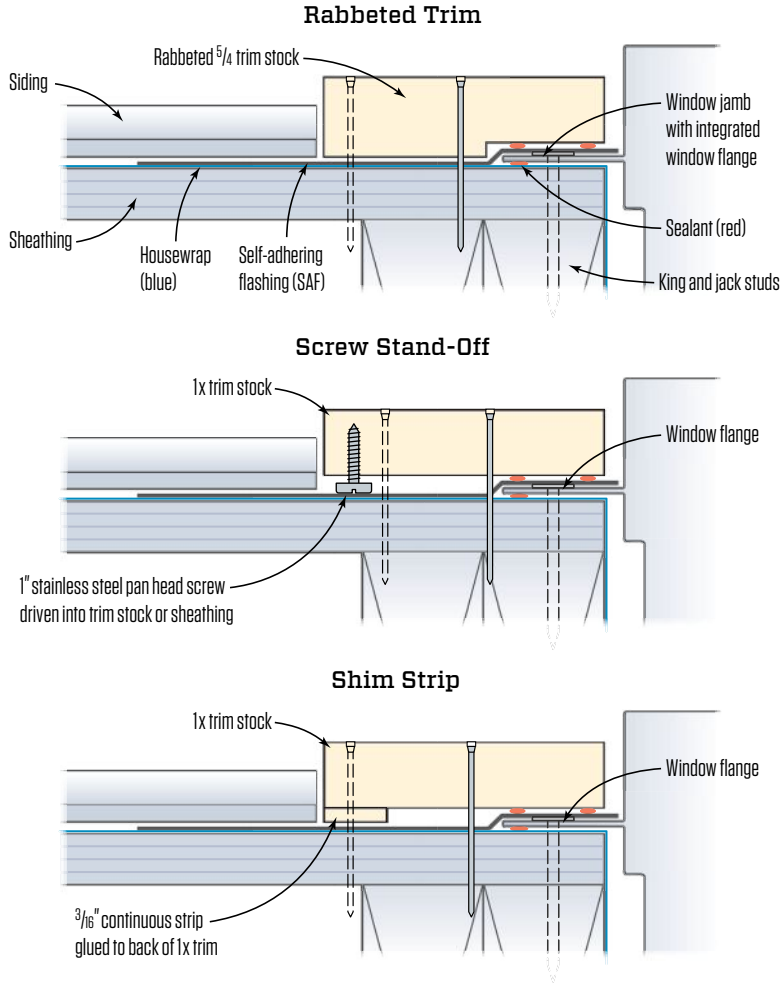
The first and most obvious solution is to rabbet 5/4 stock (with a nominal thickness of 1 inch) for the trim. The first drawback to that method is cost: 5/4 stock is more expensive than 1-by stock. The second problem is the added weight of 5/4 stock. It might not seem like much until you have to carry a bunch of large preassembled trim kits up the ladder for second-floor windows. In addition, there is the time and energy of rabbeting the stock, which typically requires two passes on a table saw—easy enough, but the extra time adds up.

An alternative to using thicker stock is installing some kind of backer or shim behind the 1-by trim to keep it in plane while it rests against the window flange. One type of backer is a thin strip of material attached to the back outside edge of the trim stock. While this method can work well, it still requires ripping material—most likely on a table saw—and then attaching the strip to the trim stock with either glue or tacks or both.

Manny Silva, a frequent contributor to *JLC*, drives stainless steel pan-head screws either into the back of 1-by trim stock or into the wall just inside the outer edge of the trim. He leaves the screws proud of the trim or the wall about the same amount as the thickness of the flange. The large, flat surface of the screw heads lets them function as adjustable stand-offs, keeping the trim in plane with the wall. If you try this method, drive the screws every 8 to 12 inches, depending on the flexibility of the trim stock, and use a straightedge to make sure the trim stays flat.

The easiest and most effective way to trim a window is to build a "picture frame" on the ground, assembling the pieces with pocket screws. Bed the trim frame to the flange with a good-quality adhesive caulk before fastening it in place with stainless steel nails or screws. If you've used Silva's stand-off screw method, mark where the screws are located and drive fasteners near those locations to keep from distorting the trim while driving the fasteners.

Trimming Out a Flanged Window



To keep flat stock trim in plane with the wall while creating a place for the siding to die into, either rabbet thicker trim over the flange or hold 1-by stock off the wall with a shim strip or stand-off screws.

Illustration by Tim Healey

Q My clients want to put a conventional masonry wood-burning fireplace and chimney in their Energy Star home. What are the code requirements for controlling outside air?

A Glenn Mathewson, a code educator and consultant from Colorado (buildingcodecollege.com), responds: Before we dive in to the code, let's define the terminology. Fire requires oxygen, so any fireplace with real fire from a source such as wood or gas requires a renewable supply of incoming air. This is often referred to as "fresh air," though the IRC also calls it "combustion air."

The code lists different methods for getting this air to the fire, the most common of which is from outside the house, so the IRC uses terms such as "outside air" and "exterior air." There is other air that can be part of combustion air, such as "ventilation air," which is used to ventilate or exhaust an appliance (or fireplace), and "dilution air," which mixes with the exhaust gases to dilute them. The code also references "make up air" and "inside air." But let's clear the air and just call it "exterior air," which is the title of the code section we'll be discussing.

Chapter 10 of the 2018 IRC is the most up-to-date source of information on this topic. (Bear in mind that local and state governments often amend the IRC when they adopt it. It's always good to stay current with your local code.) Section R1006, titled "Exterior Air Supply," includes only five short sections and a differentiation between factory-built and masonry fireplaces.

For factory-built fireplaces, the IRC leans on a familiar phrase: "... in accordance with the manufacturer's installation instructions." Fireplaces, their vents, and their exterior air are all governed this way. The only IRC requirement that applies to both factory-built and masonry fireplaces is that the outlet for the exterior air coming into the fireplace must be at the back or side of the firebox chamber or outside of the box, at the height of the hearth, and not more than 24 inches away from the firebox.

The final requirement in this section first appeared in the 1992 CABO Code and hasn't changed since. Compared with many of today's provisions, this one seems rather vague: "The outlet [at the firebox] shall be closeable and designed to prevent burning materials from dropping into concealed combustible spaces." In other words, you need to be able to close off the exterior air supply, and it must be configured to prevent burning material (think coals popping off a burning log) from entering the supply duct.

For masonry fireplaces, the area of the exterior-air passageway must be at least 6 square inches but not more than 55 square inches. There is no sizing criteria that relates to the size of the firebox or chimney, just the range of minimum and maximum sizes for each. If you're ducting the air to the firebox, the most flexible installation will come from a listed combustion-air duct installed per the manufacturer's instructions. For an unlisted duct, a minimum 1-inch clearance to combustibles is required for the first 5 feet of the duct length, measured from the outlet at the firebox. The inlet end of the duct can terminate outside the house or in a ventilated attic or crawlspace. The inlet must have a minimum of 1/4-inch, corrosion-resistant mesh covering the opening to keep out debris and critters.

Wood-burning masonry fireplaces are nice but come at a cost. No matter how well they're integrated into a building's thermal envelope, they don't offer much resistance to heat loss when not operating. Most masonry fireplaces also don't burn as cleanly and efficiently as factory-built units, and local ordinances often prohibit new installations or restrict days they can be operated. Factory-built fireplaces, on the other hand, often include catalytic converters that help with emissions. These alternative fireplaces can be built into enclosures that give the same rustic feel as a classic masonry fireplace.

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Tiling a Three-Season Porch

BY TOM MEEHAN

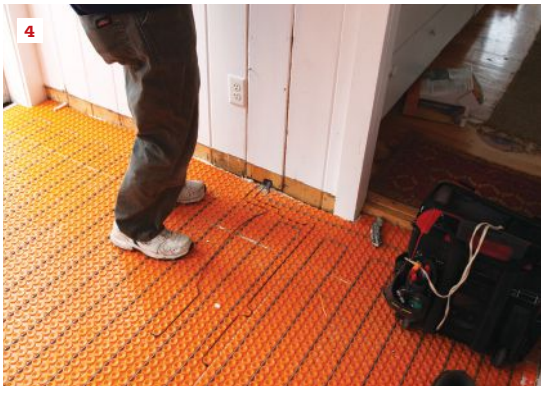
We install tile in many Cape Cod beach cottages that began life as uninsulated summer places. With this particular cottage, the owners had just completed a winterizing project to make it ready for year-round occupancy. Part of the project had been converting a screened-in porch to a three-season porch. They had replaced the screens with storm windows and now wanted to tile over the old decking to seal the floor against winter drafts.

Although the porch floor was solid, it was uneven and not level—pretty common for these homes. The clients chose a rustic terra-cotta tile to hide the unevenness and give the floor an old-world look. The hexagonal terra-cotta tiles for this floor came presealed at the factory, but they still had a rough hand-made look and would hide the unevenness of the floor and stand up to sandy feet in the summertime.

The existing porch floor was standard treated 5/4 bullnose planking that I covered with 1/2-inch plywood. Because of the seasonal temperature changes that the floor would be exposed to, I opted to install an uncoupling membrane to make it stress-crack resistant. I chose Schluter System's Ditra-Heat, which provided an uncoupling membrane along with electric in-floor warmth. Insulating fabric on the back of the membrane would provide a thermal break. (For a more detailed look at the membrane installation, please go to jlconline.com.)

Tom Meehan, co-author of Working with Tile, *is a second-generation tile installer who lives and works in Harwich, Mass.*

The author installs 1/2-inch plywood to reinforce the existing floor **(1)**, then covers it with a layer of modified thinset. To embed the sheets of uncoupling membrane in the thinset, he applies pressure with a wooden float **(2)**.



Wire for the Ditra-Heat system snaps into the raised studs on the membrane **(3)**. After testing the continuity of the heat mat and setting the sensors, the electrician wires the system to the house panel **(4)**.

Photos by Roe Osborn


5


6


7

A crew member does a dry layout across the floor, adjusting the grout joints for an even layout **(5)**. To set the starting point for the installation, he scribes the tiles that will be installed at the main doorway into the house **(6)**. Before installing the tile, he measures from the wall to keep his installation guide—a long level—parallel with the wall **(7)**.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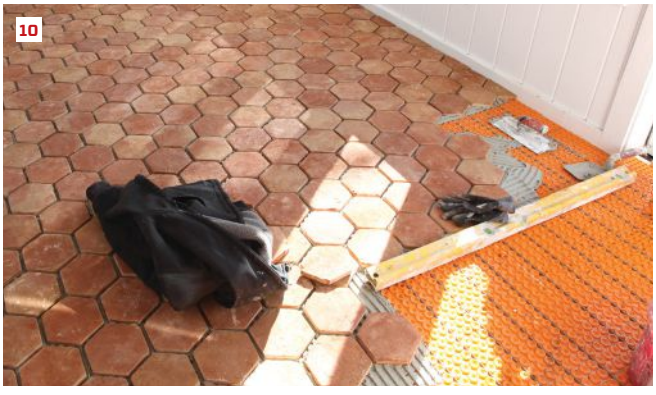
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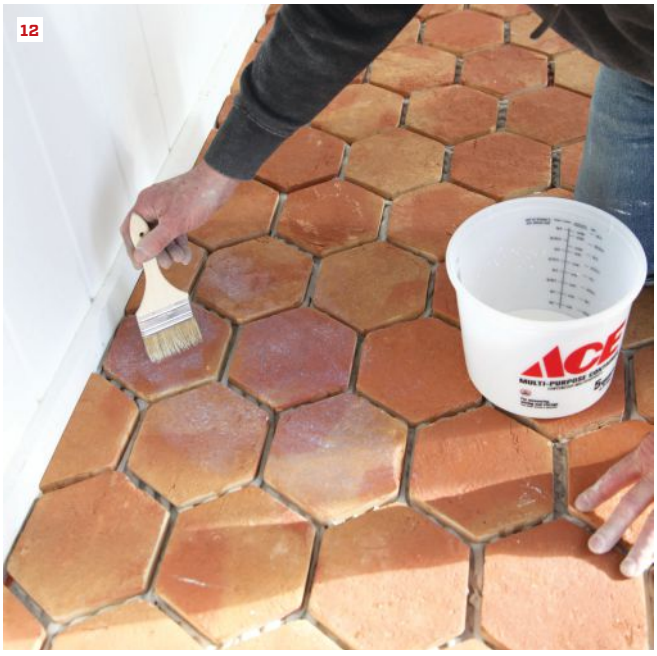
11

After spreading unmodified thinset with a 3/8-inch notched trowel, a crew member installs the tile using the level as a straightedge against the outermost course **(8)**. In the corner, he scribes and cuts the jamb profile at a closet doorway **(7)**. All cuts are made with a wet saw. Switching to a shorter straightedge, he works his way back across the room **(10)**. A short strip of wood aligns the last tiles at the entry door **(11)**. A threshold will be installed later to protect the tile at the entry.



Even though the tile was presealed, the author applies water-based sealant before grouting **(12)**. He fills the joints in the usual way, grouting about 20 square feet at a time **(13)**. When the grout has set, he wipes the floor down twice with a sponge and water, starting with a fresh bucket of clean water each time **(14)**. Because of the rough finish on the terra-cotta tiles, he doesn't try to remove all of the grout haze at this point.

After letting the grout cure for a few days, the author cleans the remaining grout haze from the rough surface of the terra-cotta with a muriatic acid wash, which he uses only in extreme cases such as this. To protect his skin and eyes, the author wears heavy-duty gloves and safety glasses. After dampening the tile with clean water, he wipes a 10:1 water-to-acid solution over the tile, causing the grout areas to foam white as the acid cleans the residue from the tile **(15)**. Working with the acid solution in a small area, he thoroughly soaks the tile with fresh clean water, letting the water puddle on the tile to neutralize any residual acid before he soaks up the solution and wipes off the tile with a clean sponge **(16)**. He later returned and sealed the whole floor.

Finishing Oblique Drywall Corners

BY SYLVAIN BELIVEAU

I've been in the drywall trade for 40 years, hanging and finishing drywall in Connecticut for most of my career. Now, I primarily do subcontract work as a drywall taper and finisher—or "mudder," as they say here in Vermont, where I currently live—for a large construction company, which specializes in interior finishing.

Last summer, I worked on a large custom home on the shore of Lake Champlain. This modern-style house was built to Passive House standards and featured numerous 45- and 135-degree angled walls, which were located in high-traffic areas of the home (the hallways) to help direct flow. When I first showed up on site, I knew the 45-degree corners would be easy enough to finish, but the 135-degree oblique angle corners would be another matter.

A challenging home to drywall. Besides the angled walls, the home had tall ceilings, hidden pocket doors, and lots of electrical and mechanical penetrations to work around. Upping the ante, there were strict rules regarding hanging and cutting the drywall on the exterior walls for fear of tearing the home's well-sealed vapor control barrier—the first drywall crew quit when they arrived on site and discovered that they couldn't work "business as usual" and just buzz out the electrical and mechanical penetrations with their RotoZips.

From my perspective as the mudder, the replacement crew did a good job overall hanging the drywall. But when it came to the 135-degree walls, they cut the drywall short on four of the home's five oblique corners, so I needed to build out the corner to a sharp point (per the architect's and homeowner's "vision") as well as was possible (see illustration, right).

GETTING THE POINT

In my experience, oblique corners are rare, though not totally unheard of—more of a white rhino than

The author applies joint compound to a 135-degree oblique corner in preparation for applying a length of No-Coat 450 Flex Corner **(1)**. Four of the home's five 135-degree corners needed to be built out with compound and the paper corner bead; on one corner, the drywall was cut perfectly, which made finishing it quick and easy.

Oblique Corner Build-Out

(Plan View)

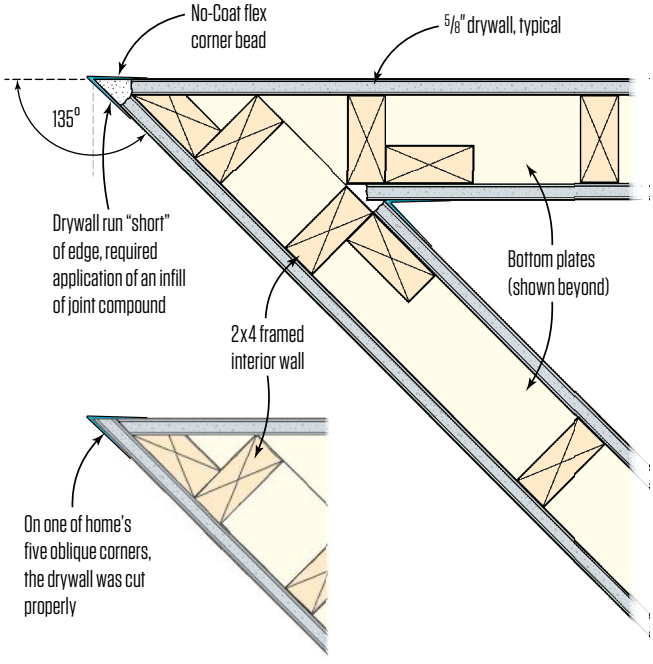


Illustration and photos by Tim Healey

a unicorn. I've come across them only a few times in my many years in the trade. So, it's understandable the drywall crew didn't cut the drywall at the corners correctly. To achieve the sharp corners desired by the clients, I used the same materials I used throughout the house to apply the three-coat finish; no specialty items were needed.

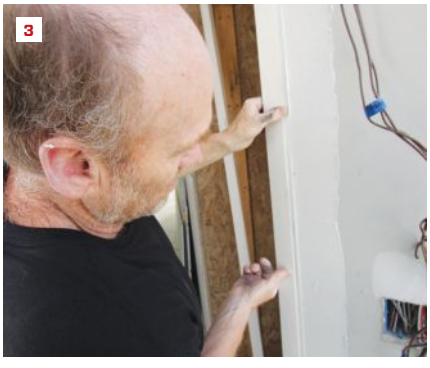
Corner bead. Paper corner bead has become ubiquitous on jobsites these days, and the company I do work for likes to use No-Coat 450 Flex Corner (certainteed.com). For 90-degree corners, I prefer to use metal corner bead because it allows you shape the metal and straighten a corner, compensating for out-of-whack framing. But with the 135-degree corners (and 45-degree ones, as well), the No-Coat corner bead is better to use because of its flexibility—the metal bead is tough to shape to these angles. Also, the No-Coat bead is surprisingly strong and resists impacts well.

Joint compound. For the project's seam work and patching, I used ProForm Multi-Use Joint Compound (nationalgypsum.com). This is a standard mid-weight joint compound, which bonds well to drywall and is durable enough to provide the deep fill I needed to shape the sharp corners. It comes premixed, but it's easier to work with and reduces pin-hole bubbling if it's re-mixed. Another option would have been to use a setting-type joint compound, such as Durabond 45 or 90, which dries more quickly and is a little more durable.

Filling the corner. I first applied a deep fill of compound to shape the corner, then applied additional compound on the adjacent drywall surfaces to receive the corner bead. With the compound shaped and smoothed out to my liking, I installed the No-Coat corner bead, precut to length, then pressed it firmly into the compound, top to bottom. Next, I tooled the corner bead and compound squeeze-out flat with my knife and completed the built-out corner's first coat (of three).

On the corner where the drywall was cut short the most, two layers of No-Coat bead and compound were needed.

Sylvain Beliveau is a drywall finishing contractor based in Jay, Vt.



The author applies a deep fill of joint compound to shape the corner **(2)** and then additional compound to the adjacent surfaces (as shown in photo 1) to receive the corner bead. With the compound shaped to his liking, he installs a No-Coat 450 Flex corner bead, pressing it firmly into the compound **(3)** on both sides of the corner **(4)**. Then he uses a 6-inch drywall knife to apply the first of three coats of compound to smooth out the acute joint **(5, 6)**.

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BY TED CUSHMAN

California and the Quest for Net Zero

With almost 40 million people, California is the most populous state in the Union. It's big enough to be a country, and not a small country at that: California's economy is the fifth largest in the world. So when California makes policy, there's a ripple effect.

Starting in 2020, houses in California will be required to meet a Zero Net Energy standard, including solar panels on the roof. That means the house, taking on-site power generation into consideration, will have to produce as much electricity each year as it uses. The details are a little squishy; the mandate is for modeled energy performance, not actual operation, and there are some exceptions. Still, the requirement is serious, and it's going to mean serious changes for the state's builders.

Some builders are ready. Meritage Homes, for example, builds almost 2,000 homes a year in California and 7,000 homes a year nationwide. In March, *JLC* talked with Meritage vice president of innovation C.R. Herro. "We have been building net zero for eight years," Herro says. "We were the first big production builder to build to Energy Star, and we've been voluntarily building well ahead of compulsory code in California and all throughout the country for quite a while. And so for us it was a much shorter putt to get our homes to zero."

Still, not every house Meritage builds is a zero-energy house—far from it. Even for Meritage, building every house in California to the state's Zero Net Energy standard will be a stretch. The company buys the goal, says Herro: "Energy efficiency and renewable energy is the right financial thing to do at everybody's price point, from entry level to luxury." But Herro is concerned about the way the policy is being implemented. Inevitably, a zero-energy house with solar panels on the roof will cost more to buy than an existing home that was built before the mandate took effect. The houses will cost less to operate than comparable houses without zero-energy details, of course, and Herro believes the net-zero house is a better deal for the buyer in terms of the total cost of ownership. But he's concerned that buyers won't realize the advantages, without help.

Photos courtesy Meritage Homes and the Imery Group

Solar panels on the tile roof of a Meritage home

Says Herro, "California and everybody else that has been pushing an energy-efficient and renewable-energy agenda isn't enabling it. What I mean by that is that they're not differentiating the value of this energy-efficiency and renewable-energy benefit in the transaction. The evolution from my perspective is, we have to change appraisals and underwriting and possibly go to a labeling system that captures both the selling price of the home and the operating cost of the home. I consider that the true cost of ownership. That way, buyers can make more informed decisions."

There's a lot more to a zero-energy house than a solar array on the roof. C.R. Herro ticks off a whole panoply of upgrades that go into the package: "We do literally dozens of things. We put in high-performance windows, we do advanced framing details to reduce thermal bridging, we do better insulation, we do better air-sealing details, we do more efficient lighting, more efficient heating and cooling systems, more efficient water-heating systems, more efficient appliances. What you look at is how many kilowatts you reduce for every dollar you have to spend. And there's a lot you do that is more financially responsible before you get to solar."

'REDUCE BEFORE YOU PRODUCE'

Another California builder who's ahead of the Zero Net Energy curve is De Young Properties, based in Clovis, in California's Central Valley. De Young now has three developments in progress devoted to net-zero housing, all with building-integrated solar on every house. But company vice president Brandon De Young says the company took the pathway "reduce before you produce," beginning with improvements—such as more efficient heating and cooling systems, higher-performing windows, and LED lighting—that could be made without changing the construction process. "My job over the last decade has been optimizing the energy-efficient features of our homes, to become the most cost-effective possible," says De Young. "And of course you do a lot of bidding to figure out what is the most cost-effective of all these different choices that you make."

Changes that affect construction workflows came later in the process. "Once you've gotten past the low-hanging fruit, and you're starting to have to make some important design changes in how

A net-zero house built by the Imery Group

you actually construct the home, that's where it starts to become more challenging," says De Young. For example, it took around two years to convert the company's wall-framing practices from the conventional California method of 2x4 studs 16 inches on-center to an "advanced framing" system of 2x6 walls 24 inches on-center. "It involved a lot of changes in drafting, and re-engineering, and of course going through the plan submittal process with all the jurisdictions we build in, making sure that they can re-approve all the plans with the new engineering designs," says De Young.

Trades had to learn some new practices also, such as three-stud wall corners. And at interior wall intersections with exterior walls, instead of lumber-intensive stud backing, "we went to having the interior wall stop short about a half inch or so, about the thickness of a sheet of drywall, and then you attach that to the exterior wall by hardware up at the top plate," says De Young. "Now that wall cavity is totally free of lumber and you can fit a whole bunch of insulation in there. You don't have hot and cold points in the exterior wall at the intersections."

De Young Properties also made a major change in its attic designs, switching to the "High Performance Conditioned Attic" system from Owens Corning, which involves blowing fiberglass insulation behind netting suspended from truss top chords. "In summertime around here, it can be 100°F for 30 days in a row," says De Young, "and in the attic it can be above 140°F." Traditionally, air conditioners and ductwork have been located in that hot attic environment, with an associated penalty for system performance and occupant comfort. The firm looked at a number of strategies for bringing the equipment and ductwork into the conditioned space. "We decided to insulate the underside of the roof and basically encapsulate the whole attic space within the thermal boundary, so that we didn't have to mess with where our HVAC equipment goes," explains De Young.

Like Meritage, De Young Properties strives to stay ahead of the code. "Here in California, the Title 24 energy code is what rules," says De Young. "Every few years they update it, and it gets more and more stringent. We know we're going to have to continually improve regardless, just to even pull a building permit. So how about we turn it into a positive? Instead of going into it kicking and screaming, how about we take the bull by the horns and make it a part of who we are? And so, since 2009 or so, even our non-zero-energy homes have exceeded the code significantly."

After squeezing as much out of the home's energy demand as it could cost-effectively manage, De Young Properties turned to the supply side: solar panels on the roof. "Our solar partner is Tesla," says De Young. "We've been working with them for about six years. They help us a lot with analysis of our consumption, and then the targets that we have to try to achieve on an annual basis for solar generation. We have a wide range of home sizes—one story, two story, 1,500 square feet all the way up to 4,000 square feet—so obviously the range of solar system sizes is wide. But we are usually around 4.5 to probably 9 kilowatts, depending upon the size of the home."

A Meritage net-zero model home in California

SELLING THE DREAM

All of those improvements carry advantages beyond the simple energy-bill calculation. From durability to health to comfort, advanced homes are typically better than ordinary code-compliant houses. But how to communicate that value to a home buyer? At the Department of Energy, Sam Rashkin has been working on that problem for years. Rashkin is chief architect of the Building Technologies Office in the Office of Energy Efficiency and Renewable Energy, and point man for DOE's Zero Energy Ready Homes (ZERH) program. Homes certified under the DOE program don't have to be actual net-zero houses—they just need to have Home Energy Rating System (HERS) ratings low enough that solar panels on the roof would be able to bring the house to net zero. So what Rashkin is selling isn't so much a low energy bill (although the houses do have that) as a better home, period.

The DOE program is having a national impact. In Arizona, for example, production builder Mandalay Homes certifies every house under the ZERH program. "But those houses aren't net zero," says Mandalay chief technology officer Geoff Ferrell. "That program is just some cool details and resources, prescriptively and performance path, that help you build a fundamentally better home that is more energy efficient and has some simple details that allow the builder or a future owner to go and make it net zero by adding PV to it."

The DOE program requires houses to comply with EPA Energy Star standards, the EPA's Indoor Air Plus specification, and the EPA's WaterSense program. Rashkin breaks out the elements of a certified ZERH house into six categories: advanced water-management systems; an optimized comfort system; a complete indoor-air-quality system; an optimized enclosure system; efficient components throughout the house; and a solar-ready system (meaning conduit and electrical panel pre-positioned for solar installation at a later date). Rashkin says, "The ZERH program is a way for the homeowner to get this transformational experience by simply looking for a logo."

If only it were always that easy. Atlanta-area custom builder Luis Imery certifies most of the homes he builds as Zero Energy Ready, and he has several houses to his credit that operate at net zero or better. But he says, "Certifications, at least in Georgia, don't sell homes. The reality of our marketplace is that it's not an efficiency-driven or healthy-driven market at the moment. The masses are not in tune with seeing the value of owning an energy-efficient home."

So while Imery gently steers his clients in the direction of net zero, he does it through a process that puts the customer first. "We start our projects by asking our clients one single question: 'What is your budget for this beautiful home that you have in mind?' And we partner with our clients early. We have a framework that we take our clients through to ultimately arrive at a plan with specs and a budget that hits their target. It's a collaborative process instead of trying to force things that we think are great, but may be not too important to our clients. But in that initial preconstruction process, we're weighing all the options to be as close to Zero Energy Ready as we can, if we can hit it with the client; and if we can't, we have that conversation with the client. So, our goal is for all our homes to be Zero Energy Ready. We are 80% there."

Imery's latest net-zero project is a home for Mitsubishi executive Mark Kuntz near Atlanta. The home earned a HERS rating in the low 40s without on-site power; an 8.1kW, 30-panel array on the garage brought the HERS score down to -13. The construction was above code, but not extreme: staggered-stud 2x4 walls on a 2x6 plate with R3 Zip-R sheathing, wall cavities insulated with R21 cellulose, and flat-ceiling truss roofs with R50 cellulose. Triple-glazed windows were chosen at the customer's request, although Imery says that was overkill. The blower-door test came in at about 2.6 ACH50, a disappointment to Imery (caused, he says, by a subcontractor who completed insulation work before air-sealing a few critical junctures). The home is heated and cooled by Mitsubishi mini-split equipment. The ERV is a Broan Sky Series Fresh Air System, which has controls that limit the air intake when outdoor relative

A modern-style net-zero home built by the Imery Group

humidity is excessive. For supplemental humidity control, Imery installed an UltraAire MD33 in-wall dehumidifier.

For Imery, it's not about selling a label. "On our website, you have to drill down to find any mention of labels," he says. But he says clients become converts as the preconstruction and construction processes continue. "We even go under contract for construction and our clients are clueless that behind the scenes, we're making every effort to make their home DOE Zero Energy Ready," he says. "So as they commit more to the relationship with us, we slowly unveil that this house is third-party verified. What happens is that through that process, they get excited, and they want to make it DOE Zero Energy Ready. So just changing the timing of that education and conversation has helped tremendously, because they're not getting hit by a fire hose at the beginning."

"All our homes are third-party verified," says Imery. "Even if [the clients] don't want to pay for it, we pay for it. Because that's the assurance to the homeowner that 'Listen: You trusted your largest investment in your life to us, here's our product. But by the way, don't believe only us, your home was verified by this person that came through at all these different stages of construction to verify.' And they're like, 'Awesome!'"

THE NEAR-ZERO HOME

Meanwhile, in Arizona, production builder Mandalay Homes is aiming to build hundreds of Zero Energy Ready homes at a price point that competes with lesser-performing houses in its market. "In our climate, our houses would qualify for the DOE program with a HERS rating of about 57," says Mandalay's Geoff Ferrell. "The way we choose to build takes us down to a HERS 47 on average, without renewables."

So what's different about Mandalay's envelope? "The first thing is slab edge insulation," says Ferrell. "We gain six or seven HERS points simply by doing a good slab edge detail." Wall and roof insulation and air-sealing also boost the score, he says. "We are insulating the walls with an inch of continuous exterior EPS foam, and then we use open-cell spray foam in our walls and our cathedralized sealed attic. And then we air-seal with AeroBarrier. We are sealing all of our homes down to 0.7 ACH50 or so."

For Mandalay, Ferrell says, the Zero Energy Ready label is a significant value in the marketplace. "It's brand recognition," he says. "One of the other builders in our area builds to Energy Star. To the buying public, we build the same house. Which is [baloney]—a Mandalay home is far superior to that home because of these other programs. So these other programs help us further differentiate the things that we've done to make our buildings healthier, more durable, and more water resistant, and then tie that to an independent certification that validates that it's not just talk. The house really does perform better than the other guy's."

With a small solar array on the roof and a power storage battery in the garage, Mandalay's average home rates about a HERS 29, not zero—and that's by design. Says Ferrell, "Unless a customer specifically comes in and requests it for whatever reason, we will probably never build a HERS zero home again. Because in our climate zone, with our utility not paying for exported energy, HERS zero saves the customer no more money than like a HERS 20 house would. If you don't have net metering, like we don't in Arizona, unless you can store and use 100% of the energy that you generate and need throughout an average year, you're not going to get a HERS zero."

Ferrell explains, "What a lot of the country does, because of net-metering policies, is they basically put a big solar array on the rooftop, the home uses what it can use when it can, and then when it can't, any excess gets exported into the grid, and then the consumer gets to buy it back at a later time, non-sunny hours or whatever, on a one-for-one import-export basis. Here in Arizona, we don't have that scenario."

The reason Arizona doesn't have net-metering programs that buy solar power from homeowners at full retail value is that in Arizona, there's already too much solar on the rooftops. On sunny days, rooftop systems produce more power than the utility knows what to do with. And California is looking at a similar problem—which is why the new solar mandate in California includes a proviso about batteries. Starting in 2020 in California, if builders install battery storage systems in houses, they can cut back the amount of photovoltaics by 25%. That may not be enough incentive to push batteries into the mainstream in California, but it's a sign that the power mix of the future is sure to include storage along with on-site generation.

Brandon De Young says his company is taking a close look at batteries. "We are actually installing one of these systems in a model to test it out as part of our partnership with EPRI (the Electric Power Research Institute) and PG&E," he says. "One thing to keep in mind, Mandalay is building in Arizona where the utility has 'demand charges'; we don't have this kind of a charge for residential here (at least yet). The value proposition for batteries in Arizona looks a lot better due to this demand charge."

Ted Cushman is a senior editor at JLC.

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Metal Roofing for a Turret

EPDM teams up with standing seam at a complex intersection

BY SAM SMITH

I am the general manager of Evergreen Roofing, and a second-generation roofing contractor, in Vermont. About 90% of my company's work is commercial membrane roofing; the other 10% is high-end standing-seam metal roofs for custom homes.

Last winter, we were called in to apply a standing-seam metal roof on a custom home (designed by architect Melissa Fletcher, of MGF Designs Architecture, in Shelburne, Vt., and built by Hayward Design Build, currently based in South Burlington, Vt.). One interesting wrinkle was that we had to cover an octagon turret roof. To ensure a good, durable, watertight result, we chose to combine a fully adhered single-ply EPDM membrane in the valley with standing-seam metal on the turret.

In this story, I'll discuss how we applied the membrane in the valley, made the custom angle cuts on the metal roofing, fabricated the seams for this specialized architectural shape, and fastened the metal roof in place.

MATERIALS

We used both of the materials that make up our typical stock in trade: fully adhered EPDM membrane and heavy-gauge Kynar-coated steel. We went with our usual choice for the EPDM: RubberGard from Firestone (firestonebpco.com), my preferred brand. For the metal roofing, we selected 24-gauge Kynar-coated steel supplied by Englert (englertinc.com). In the market where

Photos by Tim Healey

The builder's crew had already applied roofing underlayment to the main roof and the octagon turret roof **(1)**. The metal roofing arrives on a 2,000-pound roll **(2)** and is fed through a pan-forming machine, then cut off with a guillotine blade **(3)**. Crew leader Kevin Morrisette chalks a taper onto the panel and cuts the line with metal snips **(4)**, then bends up the metal at the cut using a Wuko bender **(5)**. He adds a lip to the bend using a set of 45-degree hand tongs **(6)**.

I work, many contractors offer a 26-gauge product, but I'm not willing to apply the lighter material.

The metal roofing has an expected lifespan of 80 to 100 years. The EPDM, in this application, will probably last 50. But if we were to cover the valleys in this location with metal instead of EPDM, we would have to fabricate a lot of short seams and intersections that would all have to be sealed with silicone caulking, which needs to be maintained and renewed every 10 years or so. The EPDM valley gives a much longer-lived solution.

Because the sun heats metal roofing up to high temperatures, we require high-temperature underlayment. In this case, the builder's crew had already applied RoofTopGuard II underlayment over the roof sheathing (rooftopguard.com). This is one of the best underlayment products you can get. When we apply the underlayment, we often choose Titanium UDL, which is also tough and provides good grip underfoot (owenscorning.com). When budget is an issue, we may spec RhinoRoof U20 (interwrap.com). One thing I don't recommend anymore is using regular asphalt felt paper, because it deteriorates quickly when exposed to sun and rain and is too likely to rip and tear on a windy day.

The builder's crew had stapled the underlayment in place. For added security, we renailed the material in some locations using roofing nails and 2-inch circular aluminum "tin tabs."

EQUIPMENT AND TOOLS

Metal roofing work requires a major investment in gear. The metal roofing comes on a 2,000-pound coil that has to be fed into an industrial pan-former that bends the vertical legs into the material.

Instead of being roofed with metal, the valleys are covered with EPDM, which extends 18 inches up each side of the roof deck **(7)**. After folding the RoofTopGuard underlayment down over the EPDM, the crew begins to set metal pans **(8)**. They fasten the pans in place using vise-grip clamps, and make the first-stage bend by hand **(9)**. Clips that allow for movement are installed using galvanized roofing nails **(10)**. Occasional gaps at the bend may be sealed using 100% silicone caulk **(11)**.

A guillotine on the pan-former is used to shear the metal off at the required length.

On the roof, we use an electric seamer supplied by Englert to create the double-lock bends between sheets of metal. But for the custom angles required for this turret job, we also had to use hand tools to cut and bend the metal. For cutting, my crew likes metal snips from Midwest Tool and Cutlery Co. (midwestsnips.com). Snips are available in right-turn, left-turn, and straight varieties; my crew tends to prefer the left- and right-turn snips.

For making custom bends, I've supplied my crew with a Wuko Duo Bender (wukoinc.com). This tool is designed to make quick bends in long, straight sheets of metal. It can be precisely set to create the dimension of leg that we need in a given bend. But it does require multiple passes of the tool to make each bend. So even with the Wuko, making the custom bends for a long, angled piece of steel takes time.

The crew carries other specialized hand tools as well, including a set of 45-degree hand tongs and a first-stage locking seamer for making the initial bend on a panel joint.

ON THE ROOF

The first step on this job was sealing the valley, using the fully adhered EPDM membrane. Before we install the membrane, we apply a coat of EPDM bonding adhesive to both the roof sheathing and the underside of the EPDM membrane. In warm weather, the adhesive is ready after about five minutes, but in colder weather, it may take 20 minutes to fully flash off. After the adhesive is tack-free, we lay the membrane onto the roof and smooth


12


13


14


15


16

The electric seamer, viewed here from below **(12)**, is capable of efficiently bending long runs of 180-degree folded seams in panel joints **(13)**. Views of the completed turret roof **(14)** and the finished main roof **(15)** show how the metal transitions to the finished EPDM valley. The completed roof **(16)** has a neat, regular appearance and will last for many decades.

it out using a stiff bristle broom.

With the EPDM in place, we were ready to attach metal roofing. The crew cut the long tapered sections on the ground using metal snips, and bent the legs on the cuts using the Wuko bender and a pair of 45-degree hand tongs. Then we went about assembling the panels together onto the roof.

The metal pans are attached to the wood deck using clips at about one foot on-center. We typically use expansion clips, which allow the pans to slip back and forth or up and down the roof in the dimension of the roof plane. That way, when the sun heats up the roof and the metal expands and contracts, there's less chance of "oil canning," and the material will stay flat on the roof.

We use vise-grip clamps to position the metal pans precisely before we begin to fold seams. Then we start by making the first-stage lock by hand, using the first-stage locking seamer. Once a short run of the first lock is done, we position the electric seamer at that starting location and run it up or down the roof to make the 180-degree double lock. Now the joint is strong and thoroughly watertight.

My work is commercial-grade, and it is priced accordingly. For a house like this, our metal roofs typically cost somewhere from $9 to $12 a square foot. I don't really compete with some of the other roofers in my market who are willing to incorporate cheaper details into their roofs. On the other hand, I know that my product will last for almost a hundred years.

Sam Smith is the general manager of Evergreen Roofing, a family-owned roofing contractor based in Colchester, Vt.

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Photos by Nathaniel Eldon

Exterior Trim in the Round

PVC parts have the flexibility for curved details

BY NATHANIEL ELDON

A new home that my company built this year included a two-story radiused porch, the framing of which I described in the article "Framing a Half-Round Porch" (Apr/19). This distinctive structure is attached to a corner of the home and is highly visible from a nearby street. The original elevations showed a railing between the posts, but the client requested that I use a recessed flat-panel knee-wall design that I have used on a few other homes. The design is relatively simple—in many regards, simpler than a railing system. The biggest challenge would be executing the design on a curve.

Before working out the details of the knee walls, we installed finished surrounds on the steel support columns with adequate blocking inside the surrounds for attaching knee-wall framing and screen panels. At the time of writing this article, we had already completed the curved panels on the second floor, which gave us a chance to work out the kinks in the process.

Every curved detail of the porches worked off one center point, which was key to the framing process as well as to laying out and cutting the travertine tile for the finished floor of the lower porch. But the mark was covered by the new floor, so we first had to draw on our high-school geometry to re-establish that point. Once we'd found the center of the circle, finishing the rest of the steps for this eye-catching curved detail was pretty straightforward.

Nathaniel Eldon owns Eldon Builders (eldonbuilders.com), a custom home building and remodeling company in Cape May, N.J.


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The original center point that the crew had used for laying out and framing the circular porch was covered by the new travertine tile on the porch floor. To re-establish that point, crew members mark a pair of chords, or straight lines, that connect two random points along the outside arc of the stone floor. Then they mark the center point of one chord **(1)**, plot a 3-4-5 triangle from that point **(2)**, and snap a chalk line from the centerline along the triangle leg that is perpendicular to the chord **(3)**. The process is repeated on the other chord, and the intersecting point of the two snapped lines is the center, or pivot, point of the circle. After laying out where the 2x4 framing meets the posts, the crew measures the distance from the pivot point to the layout. While one person holds the end of the tape at the pivot point, a second person scribes both the outside **(4)** and inside **(5)** radius for framing the railing.

The crew cuts the curved plates from 3/4-inch treated plywood, using a router mounted on a strip of plywood to act as a trammel arm **(6)**. First, a crew member cuts the outside arc in two passes, and then he resets the pivot point to cut the inside arc to complete one of the plates **(7)**. After measuring between the layout points on the primary posts and cutting the plates to length, he installs intermediate 4x4 posts on stainless steel post bases that have been attached to the travertine with concrete anchors. He then frames the knee wall on top of PVC blocks that allow space for drainage below the framing **(8)**.

The base layer of the flat panels is 3/8-inch-thick PVC sheet stock. For the outside of the curve, the crew cuts the sheet to length and width and then clamps the sheet to the framing. After drawing vertical lines to mark the stud locations, a crew member attaches the sheet to the framing with stainless steel screws, working progressively from one end to the other while keeping the free end clamped in place **(9)**. For the inside panels, the crew cuts the sheet stock to length and then springs it into place between the posts. As with the outside panels, the crew marks the locations for the studs **(10)**, and then drives stainless steel screws to anchor the sheet stock to the framing **(11)**.


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The rails for the flat panels are fashioned out of stock PVC boards, 1x6 for the bottom rails and 1x4 for the top rails. The 1-by PVC stock is flexible enough to bend to the curve of the knee walls without breaking. For the rails on the inside, a crew member cuts the boards to length, then springs each one into place at the top of the paneled wall **(12)**. He taps the bottom rails down to the bottom of the panels using the rubber handle of a hammer **(13)** before fastening them in place with stainless steel screws. The top rails spring into place and the crew levels them using a laser level. Stainless steel screws hold them in place as well **(14)**.


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For the rails on the outside curve of the knee wall, the crew installs the same dimension top and bottom rails as on the inside. After cutting the bottom rail to length, a crew member screws it through the flat panel and into the knee-wall framing, working from one side to the other **(15)**. As with the sheet stock, one end of the 1x4 top rail can be clamped in place while a crew member secures the rail in place with stainless steel screws **(16)**.

The cap for the curved panel walls is cut from 3/4-inch-thick PVC sheet stock. With the router mounted on the same trammel arm that he used before, a crew member first sets the radius for the outside of the curved cap rail and drives a screw to secure the pivot point **(17)**. Making multiple progressively deeper passes, he cuts the outside radius for the cap rail **(18)**. After resetting the pivot point, he makes the cut for the inside radius of the cap rail **(19)**.

After measuring a straight line between the posts for each arc, the crew transfers the measurement to the radiused cap **(20)** and snaps a chalk line between the end points **(21)**. Having snapped the same line on top of the knee wall, a crew member measures the angle between the snapped line and the post **(22)**. He then transfers the angle to the radiused stock and draws straight lines for the end cuts of the cap **(23)**.


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To lay out the location of the intermediate post, the crew snaps a line from the pivot point through the centerline of the arc **(24)** and marks the post location **(25)**. After dividing the top cap into two pieces by cutting along the centerline, a worker uses a jigsaw to cut out the post **(26)**, then screws the cap to the knee wall **(27)**.


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PVC panel molding completes the paneling outside **(28)** and in **(29)**. The crew wraps the intermediate posts in PVC using the same method described in "PVC Miter-Fold Post Wraps" (Jul/16). The PVC wraps nail directly to the 4x4 posts **(30)**. The final step is caulking all the joints, filling the fastener holes, and prepping for the painter **(31)**.

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Photos by Jesper Kruse

Rescuing an Old Barn

Long past its prime, a wreck is reborn as a restaurant

BY TED CUSHMAN

Rural New England is full of old, broken-down barns. Many of them are destined to be torn down and burned. But every once in a while, one of those decrepit barns gets a second chance at life. This is one of those stories.

Jesper Kruse and the crew of Maine Passive House recently took on an old barn in Oxford, Maine, whose owner wanted to repurpose the aging structure as a restaurant and tasting room for a craft brewery. The budget was tight. But with help from Portland, Maine, architect Leslie Benson, Kruse was able to suggest envelope upgrades that brought the old building into the 21st century. Says Kruse: "It ended up being a project we could be proud of."

"The clients thought the barn would be simpler than it was," says architect Benson. "We had to tell them it was far more complicated than they imagined. But it's going to be such a cool space in the end that it's worth it."

A NEW FOUNDATION

When the owners first suggested using the old structure, says Kruse, "I took a look underneath it and said, 'Did you know you had a lake down there?'" The existing foundation "was just a few big rocks," says Kruse. Water pooling under the barn had exposed the floor and the bases of the barn posts to moist conditions, causing significant deterioration. As it sat, the area beneath the barn

(text continues on page 43)

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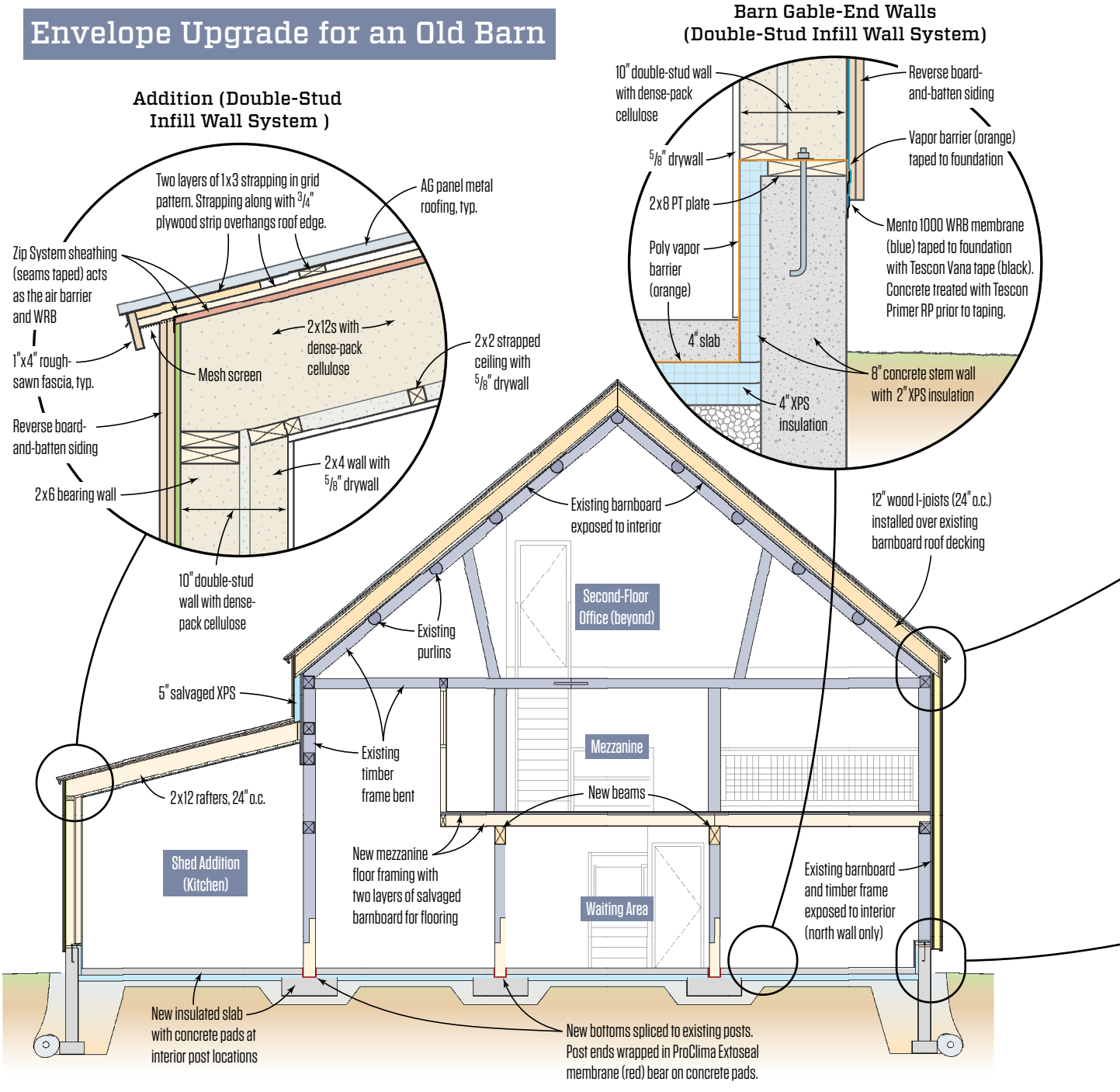
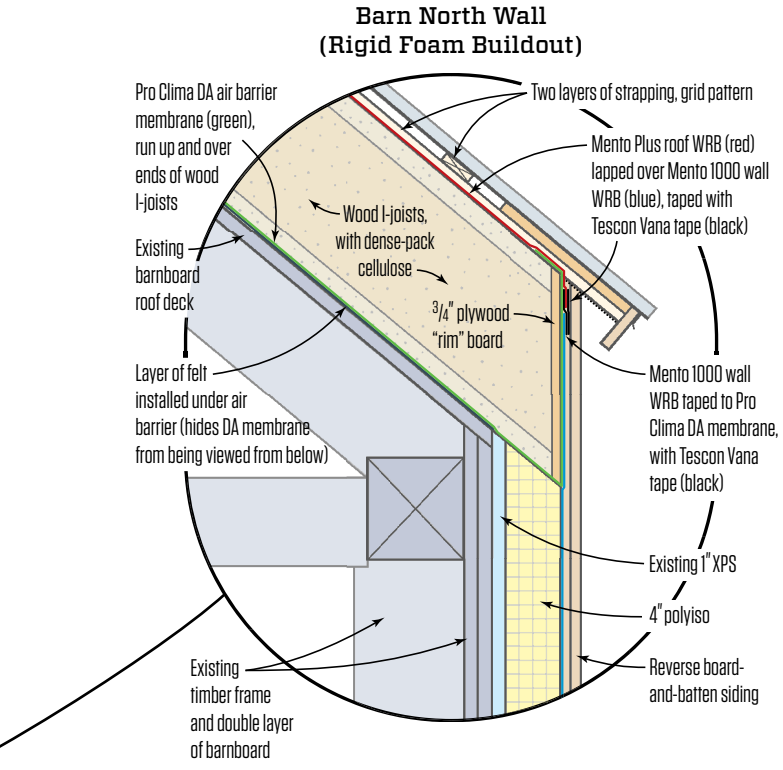
The barn's original frame and board siding had more charm than integrity **(1)**. To expose the foundation, the barn was jacked up and moved back off its location **(2, 3)**. Thick concrete pads were placed to support the interior post ends **(4)**, and a concrete perimeter foundation was placed **(5)** to elevate and support the walls. Inside the building, posts needed to be spliced for length, as well as to replace the deteriorated post ends with sound material **(6)**.

A shed addition **(7)** adds to the building's volume with modern insulated construction. Working from the new shed roof, the crew stripped off old metal roofing and built up a wood I-joist roof on top of the existing barnboards **(8, 9)**, starting with a layer of felt paper to prevent the green Pro Clima DA air barrier membrane from telegraphing through the gaps between boards. A cross-hatch of strapping ventilates the new roof buildup from above **(10)**. Wall membranes taped to the roof membrane and to the addition's Zip sheathing **(11, 12)** create an airtight envelope around the entire volume.



In order to accomplish a well-insulated airtight envelope on a tight budget, Maine Passive House relied on a combination of advanced membranes and recycled existing materials. Existing barnboard was left exposed on the roof underside and on one wall. The built-up I-joist roof system above the existing timbers is completely enclosed in vapor management membranes.



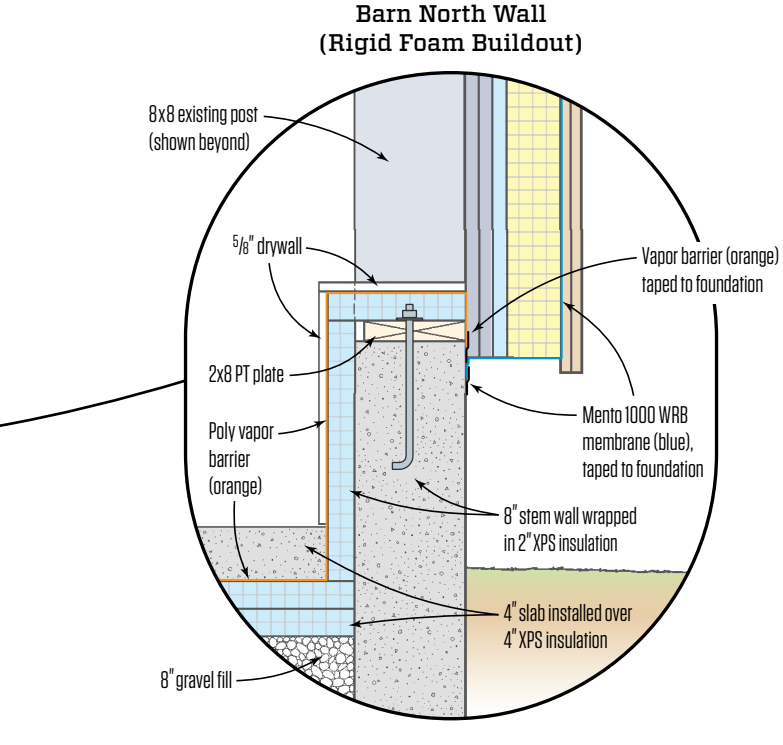


Illustration: Tim Healey

(continued from page 39)

couldn't be made dry, so the decision was made to lift the barn up and move it back, excavate for a new insulated slab foundation, and move the barn back into place.

"The whole barn frame got raised up about 16 inches from its original elevation, onto a new concrete stem wall, because there were some headroom issues with the original barn," explains Benson. "Some of the tie beams were so low that they didn't even have code clearance for walking under them, so we had to address that." Post bottoms had to be spliced for two reasons: to replace unsound wood, and to raise the elevation of the lower portion of the barn. The new post ends were wrapped in Pro Clima Extoseal membrane and set on pads; a new 4-inch slab over 8 inches of gravel and 4 inches of XPS insulation locked the post ends in place.

AN ENVELOPE UPGRADE

Then there was the envelope to consider. Kruse's crew added a wood I-joist buildup to the barn roof, a double-stud infill wall system to three of the building's sides, and a rigid foam buildout to the barn's back wall (leaving original barnboard exposed on the interior side of that one foam-clad wall). A shed addition, which would hold a new wood-fired pizza oven, was framed with double studs and a wood I-joist roof. Crucially for building performance, all the building's exterior planes were covered with an airtight, vapor-open membrane skin and vented rainscreen cladding.

The owners had to be talked into the envelope upgrade, Benson and Kruse note. "Originally, it wasn't going to be a double stud wall system," says Benson. "It was just going to be working with what was there. They were trying to not add any insulation to the building at all. It was going to be 2x4 walls infilled around the exterior on three sides. But eventually, the client came around and agreed to the double-stud cavity."

"One of the eaves walls is left with the exposed barnboards to the inside," says Benson. "That already had an inch of rigid foam on the exterior, and then they're adding 4 inches of rigid foam to the exterior there, to get it to be a little more equivalent to the other walls. But the reason the client was so enamored of keeping this old barn is that they just loved the patina of the weathered old wood."

"The cool thing about preserving this one wall with those barn boards is that you get to see all the framing and the bracing, and it's a nice rhythm," says Benson. "It's like a truth window—it's a way to see the bones of how this barn worked before."

Ted Cushman is a senior editor at JLC.

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PHOTOS OF PRECAST PIER: ROB ROSE

Precast Pier Jig

by Rob Rose

It's straightforward to set a precast pier in place using a backhoe (above left), but positioning the pier and maintaining its exact position while backfilling around it can be tricky. The setting jig shown (above right) helps solve that problem. To center the insert in the top of the pier to receive a 6x6 post anchor at the exact dimension needed, I replaced the eyebolt I had used to set the pier in place with threaded rod that extended higher than the top of the ledger. Then I drilled a 9/16-inch-diameter hole in a 2x4 precisely where I wanted to locate a 6x6 anchor, screwed the 2x4 to the top of the ledger, and dropped the outboard end over the threaded rod, making adjustments to the pier until the 2x4 was square to the ledger. Then I braced the 2x4 with a 1x4 fastened on the diagonal to both the ledger and the 2x4 with screws, checking with a magnetic torpedo level that the threaded rod was plumb. I left the torpedo level in place to help support the 2x4 jig so that it was level with the ledger, and to make sure the position of the pier didn't shift as I backfilled.

I duplicated the same technique for the opposite corner of the deck, then stretched a reference line from corner to corner. That made setting the other four piers a breeze. ❖

Rob Rose owns RP Rose Construction Co., in West Poland, Maine.

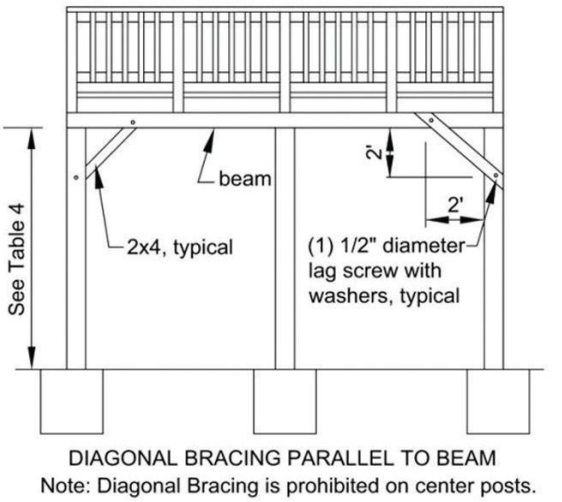
Send Us Your Tips

We want your best deck-building tips. We're partnering with DeWalt to give away a power tool each issue to the reader who sends the best tip to prodeck@hanleywood.com. The prize for the July 2019 issue is a 60-volt cordless wormdrive saw kit. So, write up those tips. Don't sweat the grammar or the spelling—that's what editors get paid for. Take a photo (your camera's best setting, please), or send a sketch on the back of a napkin.

Why Is Diagonally Bracing a Center Post a Bad Idea?

Q To differentiate my company from our competitors, I like to explain to our customers that we go "beyond code" when we build decks. For example, my company typically includes diagonal bracing at each post, which I feel results in a much stiffer deck. But recently I noticed a note to Figure 10 in DCA 6 that prohibits diagonal bracing on center posts. Why is this a bad idea? On a wide deck with multiple intermediate posts supporting the beam, would it still be true that only the corner posts should be braced?

Figure 10. Diagonal Bracing.



Because center and intermediate posts carry higher vertical loads than corner posts, they should not be diagonally braced, according to Figure 10 in DCA 6, the *Prescriptive Residential Wood Deck Construction Guide.*

ILLUSTRATION COURTESY AMERICAN WOOD COUNCIL, LEESBURG, VA.

A Andrew Wormer, *PDB* editor, responds: To get an answer to your question, I reached out to the American Wood Council, the organization that publishes DCA 6 (the *Prescriptive Residential Wood Deck Construction Guide*). According to Loren Ross, who is the manager of engineering research with the AWC, the prohibition in DCA 6 against diagonal bracing on center posts is to address concerns of potential overstress from lateral loads on the center posts, which receive more vertical load than the posts at the corners.

I was a little skeptical, so to get an independent third-party perspective on this question, I also contacted Paul Bennett, who is principal engineer office director for Exponent, an engineering and scientific consulting firm in Denver, Colo. When I asked Bennett if he thought bracing the center posts to make the deck feel stiffer would actually put those posts at risk of buckling, his answer was a little surprising to me. He said, "We ran some sample scenarios and concluded there is concern with bracing—which supports the AWC comment to not brace it."

According to Bennett, the issue is that although a braced column's buckling capacity is increased (because the bracing effectively makes the column shorter), it also is susceptible to increased lateral loading due to wind loads. So while a braced post results in a stiffer deck, the post will be more susceptible to buckling under wind loads, which are very specific to each deck's geometry and location.

Are wind loads really a concern on a deck? Research by Don Bender, an engineering professor at Washington State University, suggests that even storm-force winds don't create particularly high loads on decks (see deckmagazine.com/design-construction/framing/wind-loads-and-decks_o). But as Bennett pointed out, there could be many different loading scenarios, with no one-size-fits-all solution, which is why AWC makes this recommendation against center-post bracing. "The bottom line is that every situation and deck is unique, which is why a deck builder should really consult with an engineer when in doubt (I know that's not an answer anyone wants to hear). In this case, I think AWC is erring on the side of caution (as would I), since a deck failure could potentially result in the loss of life," said Bennett.

When installing diagonal (or "knee") bracing on those corner posts, remember to follow DCA6 guidelines, in which the brace is fastened to the post and the beam with ½-inch-diameter lag screws (or the equivalent), with the fasteners placed at least 2 feet away from the post-to-beam intersection, as shown in Figure 10 in DCA 6 (see illustration, above).

Is There a Way to Prevent the Ends of Composite Deck Boards From Swelling?

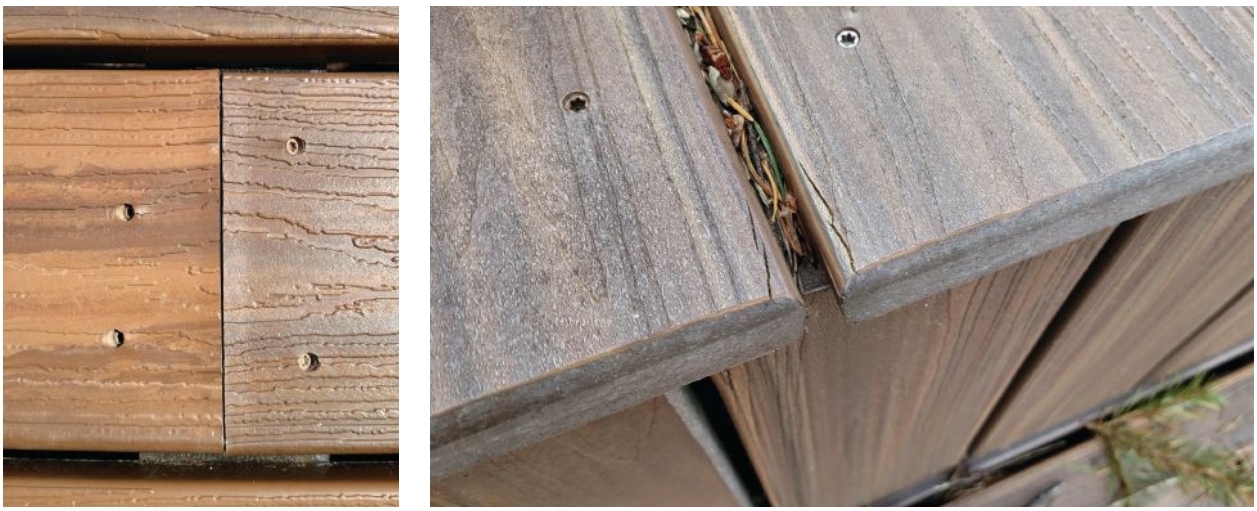
Q When I installed the capped composite decking on my clients' 30-foot-wide deck, I needed to use butt joints. Since then, my clients have noticed a slight swelling at the ends of the deck boards where the butt joints are located. Is this normal?

A Kim Katwijk, a deck builder in Olympia, Wash., and a *PDB* contributing editor, responds: I recently encountered a similar situation with a project that I had installed a few years ago. Because I don't believe that decking should swell after it has been installed, I contacted the decking manufacturer to file a warranty claim. Even though I've installed thousands of lineal feet of this particular product with virtually no problems (and good customer support the few times when there were), my conversation with the company's tech department reminded me that it always pays to carefully read each deck manufacturer's installation instructions.

For this particular capped composite decking, the instructions call for 1/16-inch-end-to-end spacing between boards for every 20°F increment, to account for shrinking and swelling caused by temperature changes. So, for example, if the decking is installed on a 50°F day, at least a 1/8-inch gap would be required in anticipation of the days here in the Pacific Northwest when temperatures soar into the 90s. Of course, temperatures here in the winter dip into the 30s and lower, in which case the gap could reasonably be expected to grow to 1/4 inch or more.

These gaps—while perhaps unsightly—aren't necessarily a bad thing, because they allow water to drain away from ends of the boards, which aren't protected by the caps that protect the sides and tops. However, pine needles and other organic debris can become trapped in the gaps and hold moisture, which can then be absorbed into the ends of the boards. And make no mistake: Most composite decking absorbs moisture when exposed to enough of it, which is why the ends will swell (**Figure 1**).

Another often-overlooked detail is the recommended placement of end fasteners. Again, for this particular decking, end fasteners aren't permitted



PHOTOS: KIM KATWIJK

Figure 1. Butt joints in composite decking that aren't properly gapped to allow for expansion can lead to swollen ends (above left). When the break occurs over a single joist, it's impossible to drive fasteners vertically into the joist so that they are perpendicular to the board face while maintaining proper clearance from the ends. Organic material that collects in the gaps between deck boards will trap moisture that can be absorbed by the decking (above right).

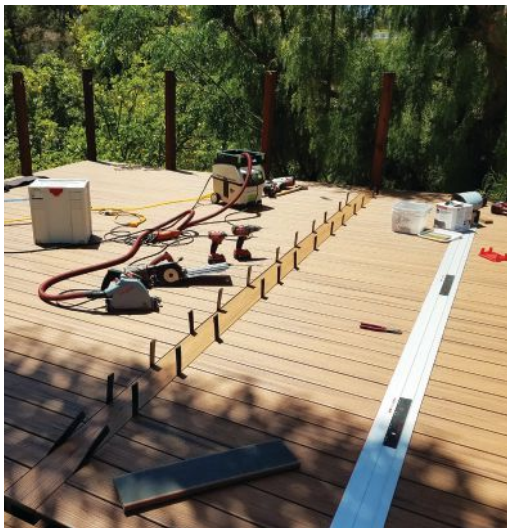


Figure 2. You can avoid the need for butt joints by installing a seam board in the middle of a wide deck. Here, California deck builder Michael Walter used shims to create consistent gaps between the seam board and the ends of the deck boards.

PHOTO: MICHAEL WALTER

within ¾ inch of the end of a board, and must be installed perpendicular to the board surface. So, even without the required gap, a 1½-inch-wide single joist just doesn't offer enough surface area to fasten the ends of two deck boards without angling the fasteners in toward the center of the joist. That means that a doubled joist should be installed wherever there will be a butt joint. That's a costly measure for deck builders (like me) who like to randomly locate the butt joints, instead of lining them up along one or two joists. It also creates a wider platform for collecting and trapping moisture and debris.

Unfortunately, there's no easy solution. My manufacturer suggested regular removal of the debris in the gaps to help reduce the swelling, but that's impractical in my area—where trees are almost continuously shedding their needles—and it's a maintenance burden for the homeowners. Another option is to install a seam board that interrupts the long run of decking and eliminates the need for butt joints (**Figure 2**). If you use this detail, you'll still need to provide a proper gap per the manufacturer's recommendations between the ends of the decking and the edge of the perpendicular seam board. ❖

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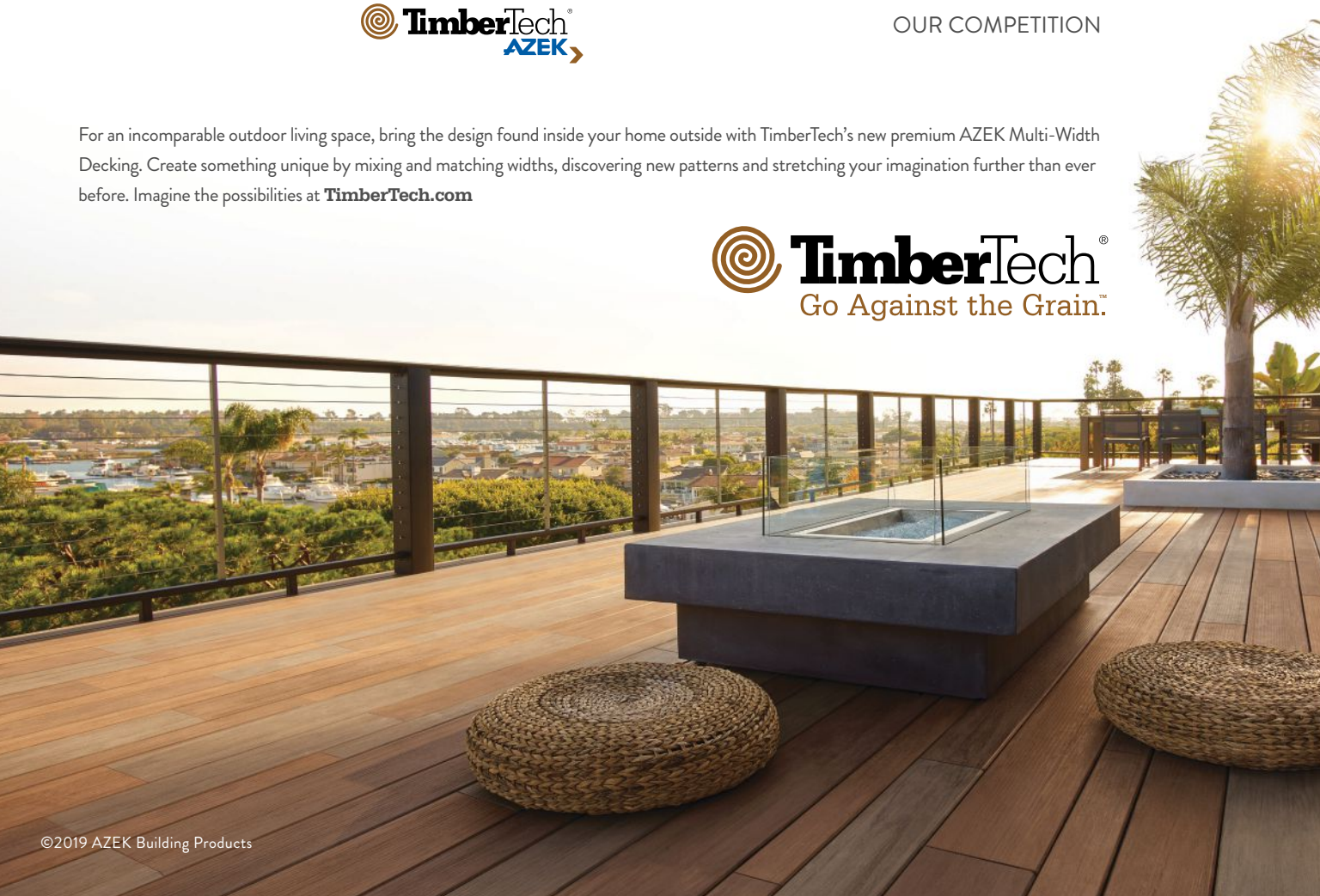

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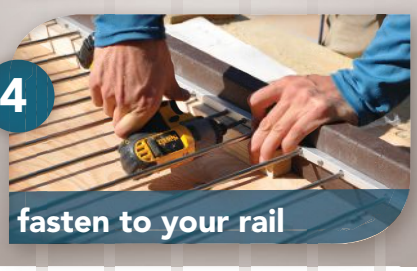

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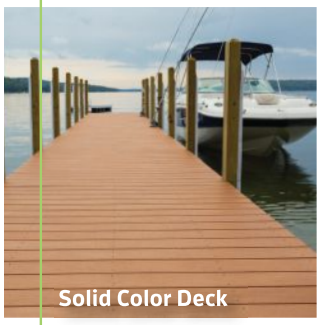

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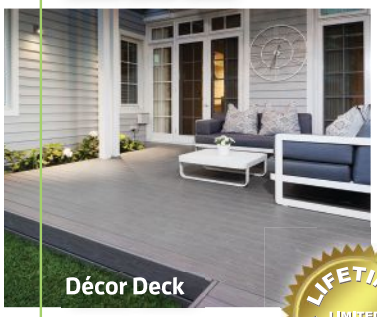

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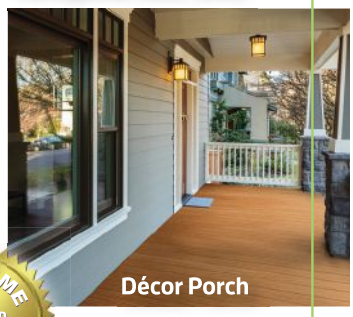

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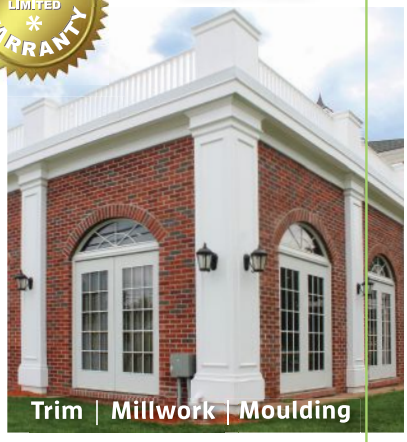

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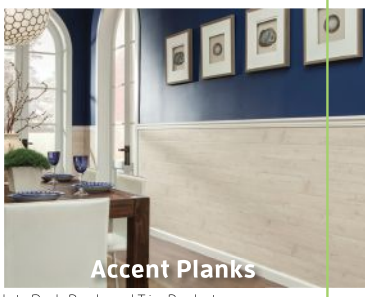

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A Timber-Frame Pavilion Crafted in the Amish Tradition

by Johnny Miller

PHOTOS BY OAKBRIDGE TIMBER FRAMING/KRIS MILLER PHOTOGRAPHY

Dozens of tough hickory pegs pin together the mortise-and-tenon joints used in the construction of this 18-foot-by-19-foot timber-frame pavilion, located on Lake McClintock in Lima, Ohio. But hidden in the white-oak frame is a single peg made of purpleheart (a tough, colorful hardwood also known as amaranth).

Typically inscribed with the name of a cancer survivor or someone with particular significance to the family, we call this the frame's "giving peg." Every frame that our company builds includes one of these giving pegs as a reminder to everyone involved on the project to give back to the community. Tradition, faith, family, community, and sustainability are core principles in our family-owned business and in the Amish community of Loudonville, Ohio, where we live and work.

I raised my first timber frame with my dad in 1986, and I've specialized in traditional timber-frame construction ever since. Most of our projects are custom homes, where the frame is handcrafted in our woodshop, then loaded onto a flatbed trailer and trucked to the jobsite. But we occasionally build pergolas and other outdoor structures too, including the timber-frame pavilion featured in this article, using the same traditional timber-frame techniques.

Crafted in the Woodshop

Like 70% to 80% of our projects, this frame was crafted from white oak, a locally sourced, weather-resistant species. In the woodshop, our workers rely both on hand tools—like hammers and razor-sharp chisels—and on pneumatically powered machinery to create these frames. The goal is to make the tightest joints possible, so that the frame will still look good long after we've left the job.

Toward that end, one technique that we've learned over the years is to cut the tenon shoulders at 90.5 degrees instead of 90 degrees from the face, to compensate for the slight rounding of the timber

Family and friends are always invited to help assemble the company's timber frames. Here, the pavilion's purpleheart "giving peg" is being hammered into place.

Once the components have been assembled on the ground, a crane lifts them into place, where they are installed by the OakBridge team.

Crafted from 8x8 white-oak timbers with 8x12 plates, the 18-foot-wide frame has a 10-in-12 pitch roof. Above, a king post-and-strut truss is being lifted into position.

A 6x12 ridge beam ties the two end trusses together. For temporary protection, the pieces were coated with a water-based finish back at the woodshop.

that occurs as it ages (the rounding is caused by the surface of the timber drying out more quickly than the center).

In addition, unlike most timber framers, we use the "draw bore" technique when creating pegged mortise-and-tenon joints, offsetting the peg hole in the mortise and the peg hole in the tenon by about 1/8 inch. When the joint is assembled, the two holes are still slightly offset. Driving a strong hickory peg (stronger than oak) through the hole creates tremendous pulling power that draws the joint tightly together, even after the pieces dry out and shrink a bit. The technique is a must for tight-fitting joints.

Once we've completed the joinery, we brush on a temporary water-based finish that lasts about eight months, plenty of time to protect the wood from the elements while we close in the frame once it's been assembled on site. Then we pack all the pieces up, load the frame onto a flatbed trailer, and truck it to the site.

Raising the Frame

Typically, we send a small crew of three or four workers to the site along with the frame to prep it for raising. The next day, in what is truly a community event, most of our workers gather together with family and friends to assemble and raise the frame.

Later (if it's a home), a separate OakBridge panel crew covers the frame with SIPs (structural insulated panels), after which a local contractor oversees the finish work. On this project, a local team took over after we had completed our work, installing a tongue-and-groove white-pine roof deck and overseeing the extensive masonry work that helps anchor the pavilion to the site.

Like the joinery, timber-frame terminology—king and queen posts, bents and

After OakBridge workers installed the dormer face truss and remaining 8x8 rafters to finish up the frame, a local crew installed a white-pine tongue-and-groove roof deck.

The project is located on Lake McClintock, a small reservoir in central Ohio.

girts, summer beams, purlins, and (yes) relishes—is steeped in tradition. But even after the more than 33 years we've been in business, our three generations of workers continue to learn new things about wood and about the woodworking business. We rely on the power of the internet to connect with customers and sell our frames all around the country. Many of our projects are architect and builder referrals, but sometimes customers—like these—find our company online, starting us off again on another adventure. ❖

Johnny Miller owns OakBridge Timber Framing, a three-generation family business in Loudonville, Ohio.

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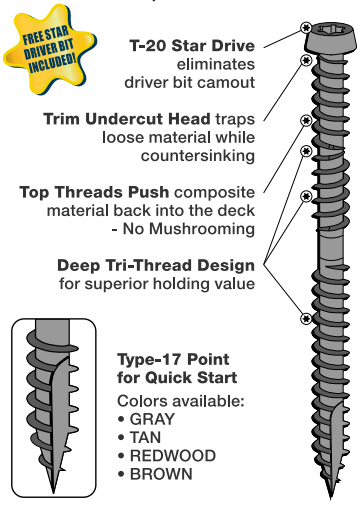

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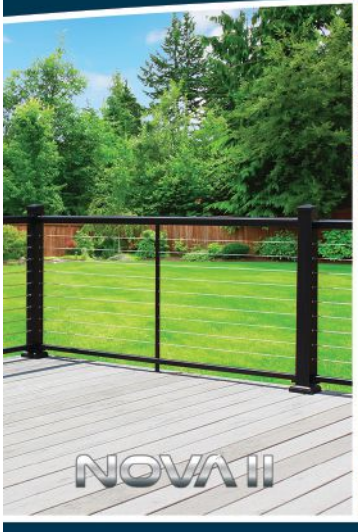

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The Tree Deck

Tucked into a wooded hillside, this deck's graceful curves hug the landscape

by Mark King

I often tag-team with a landscaper buddy of mine who called last year saying that he wanted to introduce me to his clients. They were an older couple who wanted to replace their old redwood deck with one that would require a lot less maintenance. Because they were flexible on the overall design of the deck, I was able to take advantage of the home's unique setting as I figured out the sizing and placement of the deck and how it would relate to the layout of the hardscaping.

The home was located on a sloped site and surrounded by woods, with a prominent tree—that the homeowners wanted to preserve—right next to the house. The new hardscaping was designed to complement work that had already been done on the property and featured a lot of organic shapes. I wanted the deck design to work with that, so I designed the deck with curves rather than as a rectangular shape with sharp corners. And to help it feel like a part of the landscape, I wanted the deck to wrap around that tree.

Foundation and Framing

When we removed the old deck, we discovered that the existing ledger had a number of problems that had led to significant rot in the home's sheathing and framing. Before we could start framing the new deck, we had to remove the old ledger and repair the damage. Fortunately, we found that the old deck footings were sound and could be reused. While we still had to pour a handful of new footings, this saved us quite a bit of time digging down into the site's rocky soil, especially considering frost depth here is 42 inches.

The site slopes down toward the back of the house where the deck is located, so we needed to keep the framing close to the ground. At the same time, we needed to be able to cantilever the joists over dropped beams in order to create the curves. This resulted in a series of double 2x10 dropped beams to support 2x8 joists, which we installed 12 inches on-center.

Curved Details

Our usual approach when incorporating a curved detail into one of our decks is to first mathematically calculate the

PHOTOS BY MARK KING

radius of the curve, then heat-form decking to that radius in our shop for a picture-frame border. We bring the curved lengths of decking to the jobsite to use as templates, laying them out across the cantilevered—but uncut—joists and tracing the curves right in place. Then we cut the joists to length, adjusting the cut line to account for the thickness of our rim joist and fascia and for the amount of overhang desired (**Figure 1**).

Usually, we build up the rim joist out of three layers of ½-inch PT plywood ripped to the width of our framing. To strengthen the assembly, we use plenty of PL construction adhesive between layers, and staple the plies together as well as fastening them to the joists. This is the detail we used on most of the curved deck sections.

Part of this deck curves around a hardscape feature, however. There, we simply installed infill blocking between the joists to create the concave curved rim. Because the edge of the deck is actually in contact with the ground and the loose stone wall surrounding the patio, there was no need to finish this section of the deck with fascia.

We also needed to frame a square opening around the trunk of the tree, allowing plenty of clearance for growth. Then we filled in the corners to create an octagonal frame to support a circular deck detail planned for the opening.

After installing flat blocking around the perimeter of the deck to support the curving picture-frame detail, we covered the tops of the joists and blocking with G-Tape SAF tape. We've tried many different flashing tapes, but G-Tape performs well in our climate, with great adhesion even in cold weather.

Decking Installation

We installed the field decking on the diagonal using ConceaLoc hidden fastener clips. We ran the decking long so that it overlapped the area around the perimeter where we planned to install

Figure 1. The author installed cantilevered joists over dropped beams, running the joists long (A) and then laying his heat-formed borders over the joists (B) to define the curves. After the joists were marked and cut to length, workers installed blocking as needed (C) and framed the opening around the tree trunk (D).

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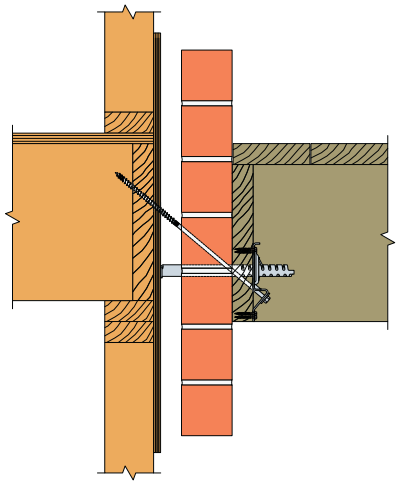

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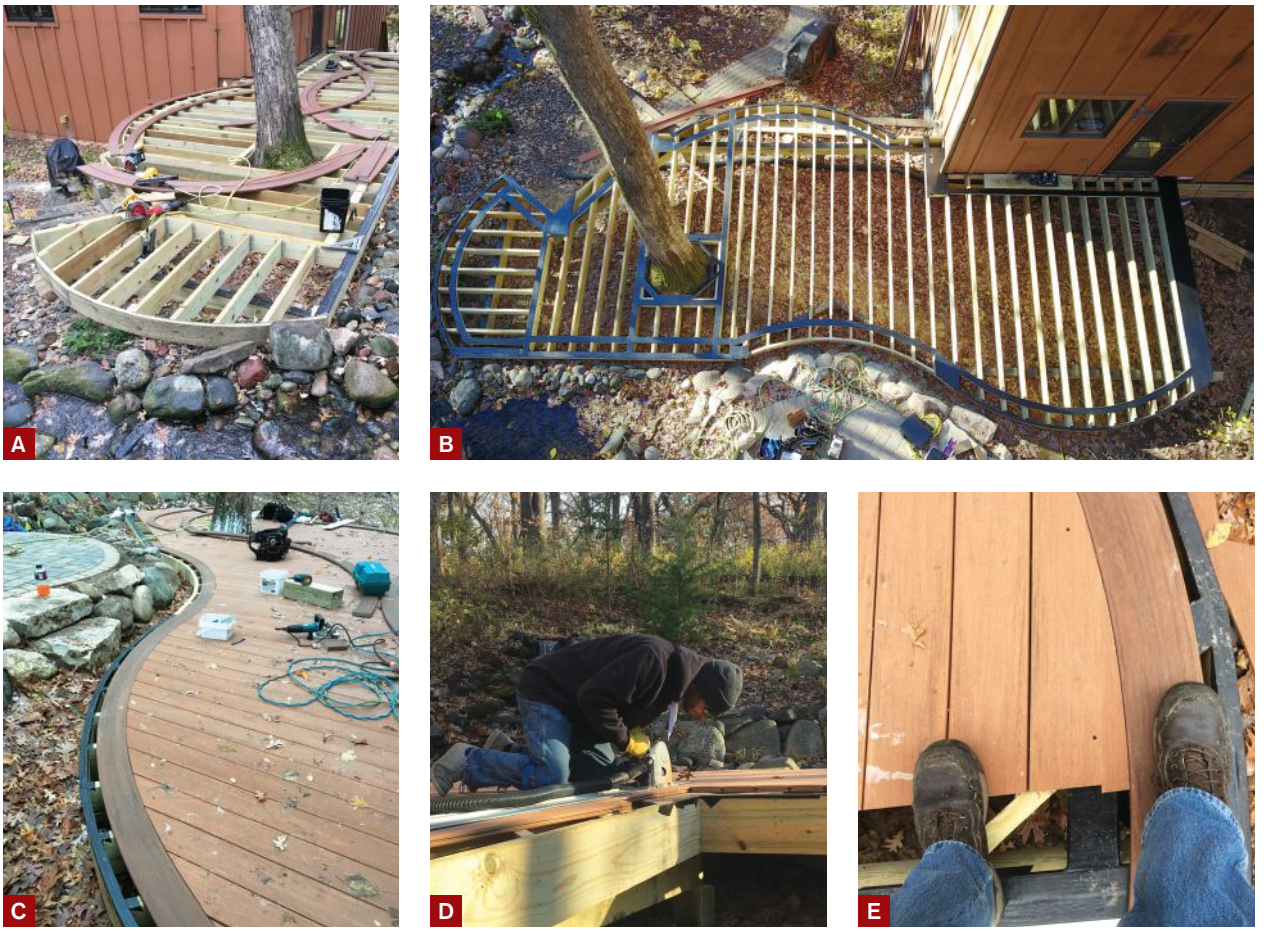

Figure 2. Where the curved edge would receive fascia trim, the author built up the rim joist with three layers of 1/2-inch PT plywood ripped to width (A). After flashing the top surfaces of the framing (B), the crew installed the field decking with hidden fasteners (C), tracing the curved border onto the decking and cutting it in place. A track saw was used to trim straight sections of decking (D). Biscuit joinery came in handy where a little extra board width was required (E).

the picture-frame border (**Figure 2**).

As I mentioned above, we had heat-formed the curved picture-frame decking in our shop prior to framing. To do this, we laid down several sheets of 3/4-inch MDF onto the shop floor and drew out the desired radius, which we had calculated based on the deck's field-verified dimensions. Then, using fine-thread drywall screws, we fastened 3/4-inch-by-1-inch PVC strips to the MDF, following the curves that we'd laid out. We've found that this size of PVC ripping bends smoothly and easily to most of the radii that we work with. Because the picture-frame border consists of two rows of decking, we formed both the inner and outer rows in the same double-wide form.

The PVC decking that we used on this project—Azek Vintage (cyprus for the field color and mahogany for the perimeter)—is pretty easy to work with when forming curves once it has been heated to the right temperature with HeatCon heating blankets. And after the decking cools down and has been removed from the form, it retains its new shape.

Forming the circular decking border to fit around the tree well was a little more challenging. Because of the circle's 16-inch inner radius, we couldn't use our PVC strips to create the form. Instead, we screwed down 1-inch black polyethylene irrigation pipe to form the inner and outer circumferences of the circle. The black plastic pipe had the right combination of flexibility and rigidity to conform to the circle without deflecting and creating flat spots, making it a simple matter to form a perfect 32-inch-diameter circle with the decking (**Figure 3**).

After the field decking was installed, we placed the curved sections of the border that we had formed at our shop over the decking and traced the outline. We used a straightedge to mark the straight sections of the border.

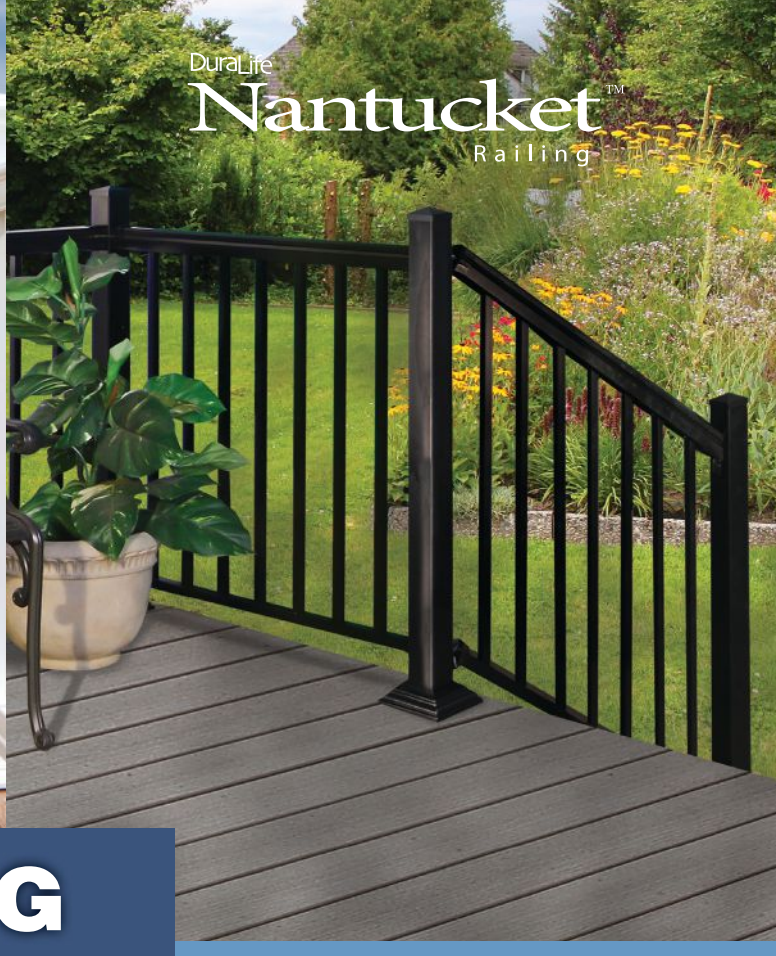

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Figure 3. The author screwed black plastic pipe to MDF backing to make the form for the 16-inch-diameter trim ring around the tree well (A, B). It took two workers to pry the ends of the trim ring apart as they slipped it over the tree trunk, like putting a key on a key ring (C).

Cutting in the border. On the straight sections of the deck, we cut to the line with a track saw, and we used a cordless 6 ½-inch circular saw with a Diablo blade to cut the curved sections. To keep from cutting through the flashing tape on the framing, we set the saw's depth of cut so that it was about 1/16 inch shallower than the thickness of the decking, then broke away the cut end of the deck board and cleaned up as needed with a multi-tool.

Around the tree trunk, though, we had to use a router to cut the tight radius. As with the perimeter border, we had used the actual circular border formed in our shop to mark the decking. Then we made a plywood jig that wrapped around the outside edge of the cut, offset by the distance between the router base and the cutting edge of the bit. We made the cut in a couple of passes, again not cutting all the way through the decking to avoid damage to the membrane.

We used the Cortex screw-and-plug system to install the borders. At the mitered corners, we wanted to make sure the joints didn't open up, so we reinforced the joints with PVC biscuits and glued the miters together with Azek's proprietary fast-cure PVC adhesive.

Finishes

To finish up, we installed a custom-fabricated powder-coated-aluminum railing from Railcraft, a Canadian supplier. We like this particular railing because we can get the panels bent to our specified radius, and we can fit the assembly with a continuous top rail that has a graspable profile, which our building inspector likes. The railing is a surface-mount system, so we're careful to install blocking wherever the rail posts are lag-bolted to the framing. ❖

Mark King owns Infinite Decks, in Minneapolis.

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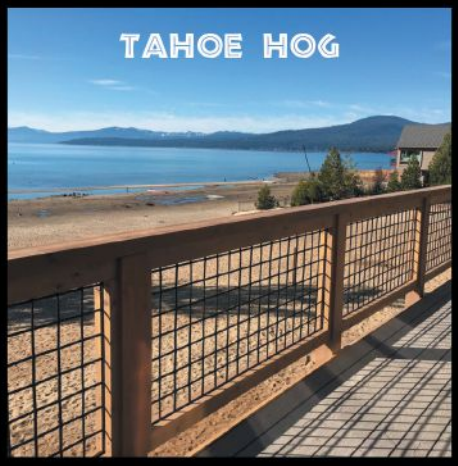

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Front Porch With a Purpose

This replacement porch provides both shelter from the elements and a welcoming entry for the homeowners

by Joseph M. Constantine Jr.

Every once in a while, my custom-home building company gets a call to do a small job, which we almost always decline. It's not that we don't like smaller projects, but with our overhead, we usually find that we're priced out of the small-job market. Additionally, these jobs end up costing me more than they are worth because we tend to incorporate expensive details into everything we build. Unless the customer has way too much money—and they never do—it just isn't worth our effort.

But this call was different. No, this client didn't have an endless supply of money, but she did have a purpose for doing this job that is near and dear to me. Her husband has Alzheimer's disease, and she wanted to add a covered porch to her home to provide a little shelter from upstate New York's rain or snow. And why is that special to me? My mom has Alzheimer's too, so I understand the desire to do everything possible to make a loved one feel safe and comfortable. I took the job.

Developing the Plan

An added bonus for me was that, in addition to wanting the practical benefits of a covered entry, the owner wanted her porch to look nice. She was looking for something that would stand out, yet blend both aesthetically and proportionally with the home she loves.

To come up with a design, I asked her to send me photos of porches that she liked. Based on those photos, I sketched out a few options, and we quickly settled on a basic plan. After tweaking the final design and coming to terms on price, my company got down to work.

Helical Pier Foundation

I pulled a permit at the local building department and called Dig Safely New York (811), the underground utility marking service, and then I contacted

PHOTOS COURTESY CONSTANTINE BUILDERS

our local Techno Metal Post installer. I like its helical piles for this type of project for several reasons. For one thing, I'm 62 years old, and I like to avoid digging deep holes by hand. Even better, helical piles are super strong and have a verifiable bearing load. They're "fast and quick," as I like to say, and once they're installed, you're immediately ready to start building. Finally, building inspectors like them because they come with a report from the installer stating the load capacity, depth, and all the necessary information that allows an inspector to sleep well at night.

After we demolished the old concrete steps and the Techno Post crew had installed their two P2 piers, we ran a 4-inch-diameter solid drainpipe along the foundation behind where the new porch would be located. We needed to be able to collect the rainwater that would have been collected from the gutters that would now be interrupted by the new porch roof. We connected the pipe into an existing drain that is connected to the town storm sewer (**Figure 1**).

Figure 1. After the existing precast concrete stairway was removed, the author prepped the framing under the entry door to receive the new ledger (top). To keep rodents from burrowing under the enclosed porch, 12-inch-wide strips of diamond lath were nailed to the bottom of the framing and buried in the ground before the plywood sheathing was installed (bottom).

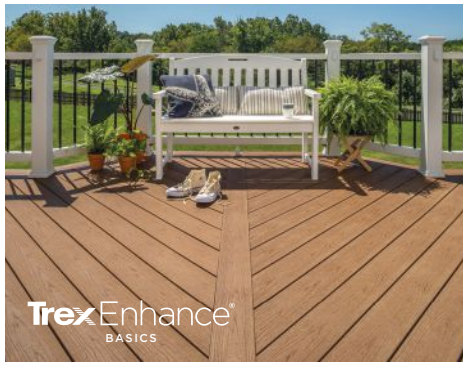
Framing

To create a solid attachment point for the porch ledger, I removed the old siding and trim from under the door, exposing the rim joist and a ledge formed in the foundation to support the brick cladding. I also removed the old rim joist, so I could more easily tuck the top flap of my SAF membrane under the door threshold. Then I replaced the rim with new PT material, securely fastening it to the house framing with lag screws and covering the assembly with SAF membrane, lapping the top flap over the lower layer.

Next, I lag-bolted two 2x10 PT boards to the rim joist to build the assembly out flush with the brick face, followed by a third 2x10 ledger equal in length to the width of the porch. This ledger extends beyond the door opening by 16 inches on either side over the brick cladding, with the ends of the ledger supported by PT 2x4 cleats anchored to the block foundation with expansion bolts. This way, we avoided placing any loads on the brick cladding.

We framed the porch floor using typical deck construction and flashing details, though with oversized framing considering the deck's small proportions. For example, we used 6x6 rather than 4x4 posts to support the triple 2x10 flush rim beam. And even though the joist span was only 84 inches, we used 2x10 joists 16 inches on-center so that the porch would feel solid and sturdy underfoot.

We like to plan for the fact that wet pressure-treated wood will shrink after installation. One of our strategies is to stockpile as much PT lumber as we can at my warehouse so that we'll always have



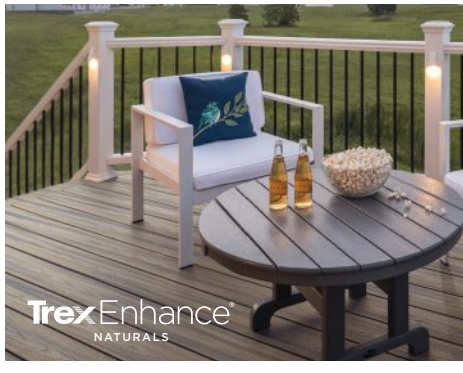


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Figure 2. The porch framing was sheathed with PT plywood, wrapped with both SAF membrane and felt paper, and then covered with diamond lath prior to installation of the stone veneer cladding (above left). To minimize twisting and warping, the porch columns were framed with three 2x6s laminated together, rather than solid PT posts (above center). Part of the eaves had to be removed and pockets cut into the brick cladding to allow the headers that support the roof framing to be securely connected to the house's double top plate with inset joist hangers and lag bolts (above right).

some dry boards for our exterior stairs, headers and beams, and other critical framing members.

When we have to work with wet lumber, we frame with shrinkage in mind. For example, we framed the flush rim beam so that its elevation was only 1/4 inch lower than the ledger rather than 3/4 inch. This was because we anticipated that the wet 9 3/4-inch-wide 2x10s would shrink to 9 1/4 inches wide once they dried out, giving us our desired 3/4-inch pitch. It's a bit of a gamble. The first winter following completion, there was some pooling on the deck, as the joists lost their moisture before the triple header did, but by summer, the rim beam finally dried out and stabilized at our anticipated dimension, eliminating the pooling.

We planned to wrap the porch and the bottom half of the columns supporting the porch with cultured stone veneer cladding. In preparation for the cladding, we framed a short knee wall underneath the rim beam and two outside joists, stapling up foot-wide strips of diamond lath around the base to keep rodents out. Then we sheathed the wall with 3/4-inch-thick pressure-treated plywood glued and screwed to the framing (which also helped to reinforce the cleats supporting the ledger). To keep the plywood flat and dry, we stored it in our warehouse for several weeks prior to installation.

We wrapped the plywood with Grace Ice & Water membrane, followed by a layer of 15-pound felt paper. Since the cladding would extend halfway up the triple 2x6 PT columns supporting the porch roof, we used the same detail there. Then we installed the diamond lath, fastening it to the plywood with stainless steel roofing nails (**Figure 2**).

Porch Roof

To install the side headers, we had to cut away part of the eaves and create a couple of pockets in the brick cladding and 1-by shiplap wall sheathing. After lining the pockets with flashing membrane, we slipped the triple 2x8 headers into place, using metal hardware and lag screws to fasten them to the house's double 2-by top plate. Then we framed the roof with 2x8 rafters sheathed with 5/8-inch CDX plywood.

I like classical details and typically build cornice returns on almost all my houses. We dried the returns in with SAF membrane and copper flashing and finished them with some asphalt shingles that we had taken off the roof.

Next, we dried in the rest of the roof with SAF membrane, slipping the membrane under the existing shingles, which were only a year or two old. Then we

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Figure 3. Tapered PVC column wraps dress up the triple 2x6 posts that support the gabled porch roof, which features nicely detailed cornice returns (above left). Along with a new poured concrete walkway and slip-resistant stair treads, the covered porch creates a safe and welcoming entry to the home (above right).

called in our metal-roofing sub, who added his own brand of underlayment over ours and tied his valleys into the existing roof.

As we trimmed out the porch, we tried to match the home's soffit and eaves details as much as possible. We finished the porch ceiling with beaded vinyl, capping the ceiling at the gable end with a decorative arch cut from ¾-inch PVC trim. Then we Z-flashed the arch, and finished the gable with a couple of pieces of leftover vinyl siding and matching aluminum coil stock.

While we turned the standing-seam-metal-roof installation over to a sub, we tackled the stone veneer cladding that gives the porch such a distinctive look ourselves. One of our crew members worked for 18 years as a mason, so we often install stone veneer cladding like this on our projects.

Finally, we fabricated tapered columns out of PVC trim, which we installed over the built-up PT posts (**Figure 3**).

Floor and Stairs

People with Alzheimer's tend not to be very sure on their feet, so we researched our porch flooring choices carefully, focusing particularly on the COF (coefficient of friction), or slip resistance. In the end, we chose Koma's Plantation PVC porch flooring, a reversible 1x4 tongue-and-groove profile with a smooth surface on one side and a textured wood-grain finish on the other. The company was very helpful, sending me a testing report and allowing me to speak directly with a tester so that I could put our client at ease with our choice.

On the stairs, we installed 2x12 PT stair treads with premilled grooves, later adding sand to the stain finish for even more traction. We temporarily supported the stringers with blocking while we assembled the stairs, then poured a concrete walkway with a stained finish that extends under the stairs to create a smooth and solid landing.

A local welding shop custom-fabricated the wrought-iron railings. During framing, we had made it a point to install proper blocking so that the railing attachment points would be rock solid.

This was a good and worthy project, and the owners love the result. Based on the amount of traffic during the project, the locals love it, too. It does the job of keeping the owners safe and dry and gives them something nice to look at, too. ❖

Joseph Constantine Jr. owns Constantine Builders Inc., in Amsterdam, N.Y. He has been building custom homes and remodeling since 1981.

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The deck (left) is anchored to the hillside by custom-fabricated galvanized steel support posts, which bear on 12-foot-deep piers (top). Keeping tools and materials from sliding down the hill into neighboring houses was a high priority (bottom).

The Deck With the Million Dollar View

by Edmund Bourke

PHOTOS BY CARENA PHILLIPS/COURTESY BOURKE CONSTRUCTION

One of my company's more memorable projects was a 1,000-square-foot deck that we built recently in the hills overlooking Laguna Beach in southern California. This project stands out not only because of the size of the deck and the home's incredible view of the Pacific Ocean, but also because of the difficult site. Located on a steep, curving road that was too busy and narrow for a crane, the home offered no access for heavy machinery, so everything—including 700-pound support posts and heavy glulam beams as long as 35 feet—had to be hand-delivered through a 4-foot-wide gate.

In addition to being difficult to access, the site was tricky to work on. The steeply pitched backyard was impossible to stand on, so we had to set up scaffolding even to dig the footing holes. Not only that, we had to make sure that none of our materials got loose and slid down the hill; if they did, they would slide right into the homes at the base of the hill. For the massive 6x20 Alaskan yellow cedar glulams, this meant roping the beams to winches and slowly easing them down the hill as we worked to get them into position.

The city of Laguna Beach and the state of California also had something to say about how we ran the project. Being a beach town, the city has a zero-tolerance policy regarding runoff to drains, so we had to take great care to avoid spillage when pumping and pouring the concrete for the footings, and we needed to clean up any overage. And because the home is located in a high-risk fire zone, all lumber smaller than 4-by had to be certified flame-resistant.

The underside of the tall deck is clearly visible to the neighbors, so we primed and painted all of the framing a neutral gray before installing the Azek decking. Finally, we installed a glass-panel rail system that helps block the sea breezes without blocking the view. ❖

Edmund Bourke has owned Bourke Construction, in Orange County, Calif., since 1996.

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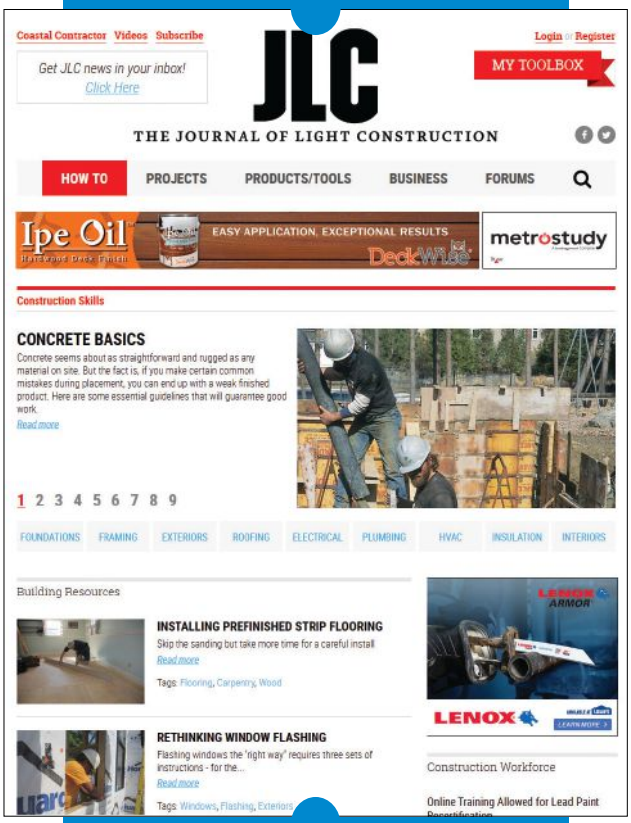

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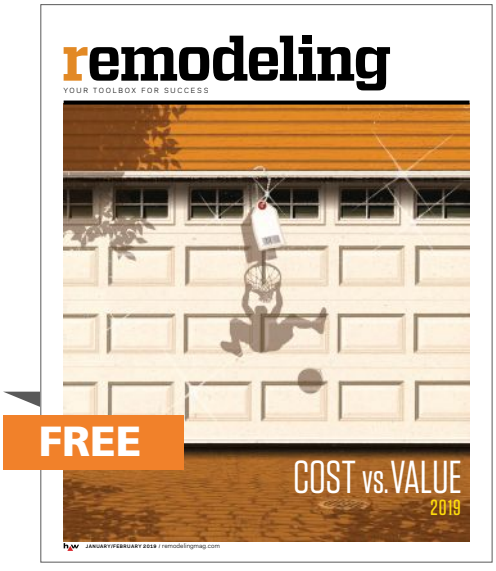

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BY SYMONE GARVETT

1. Stainless Apron Sink

German sink and faucet maker Blanco has modernized the look and function of a classic farm sink with its Quatrus R15 Ergon Apron Super Single sink. Made with 18-gauge stainless steel and measuring 33 inches wide, 20 1/2 inches long, and 9 inches deep, the Quatrus R15 Ergon has a rear-positioned drain hole and a high ledge for optional accessories, including a grid, steel colander, and wood cutting board. Pricing starts at $1,400. blanco-germany.com

2. Wide-Plank Paver

Belgard's newest outdoor paver, Madria Slab, is designed for outdoor spaces, including walkways, patios, and pool decks. The concrete planks imitate the look of wood grain using Belgard's Satura coating, which is resistant to stains, scratches, and fading and allows homeowners to forgo sealing their pavers for 10 years, according to the manufacturer. Pavers are 15 inches wide, 30 inches long, and 2 3/8 inches deep and are available in the Midwest market, in two colors: almond brown and pewter. Contact a local distributor for pricing. belgard.com

3. Efficient Gas Furnace

Bosch Thermotechnology's BGH96 Series is the company's first-ever condensing gas furnace. The Energy Star–rated BGH96 Furnace incorporates a two-stage gas valve that switches between high- and low-fire settings. It may achieve up to 96% AFUE heating efficiency, according to the manufacturer. The BGH96 furnace's low height and three-way multipoise design allow for ease of installation and replacement of existing furnaces. All units come standard with a natural-gas-to-LP kit. Contact a local distributor for pricing. bosch-climate.us

4. Glass Door Refrigerator

True Residential has expanded options for its True 48 refrigerators with the new True 48 Glass Door Refrigerator. The side-by-side refrigerator features a glass panel on the right-hand door and a solid panel on the left, with the contents of the adjustable shelves and produce drawers on display. Like the standard True 48, the refrigerator is made from 304 stainless steel, with 29.4 cubic feet of interior storage. It is available in all custom color and hardware options in the Build Your True collection. Pricing starts at $18,000 without custom finishes. true-residential.com

5. Contemporary Patio Door
Weather Shield Windows & Doors has a new sliding patio door in its Contemporary Collection that offers larger sizes, improved performance, and advanced sill design. With a 2 1/4-inch-thick door panel, the new door expands maximum panel widths up to 5 feet and heights up to 10 feet. The door has a multi-point locking system, TPE synthetic rubber weatherstripping, precision bearing rollers, and a low-profile 1 1/4-inch sill. It can be shipped assembled or loose and installs like standard sliders. Contact a local distributor for price. weathershield.com

6. Hands-Free Door Installation
The Door Stud is a hands-free device designed to simplify installation of doors on the jobsite. Made from 12-gauge steel, the Door Stud will accept a 1 3/8- or 1 3/4-inch door weighing up to 300 pounds and will hold a door slab upright in a jamb opening at the precise location to scribe and set the hinges and the passage or lockset. Or it can be used to set prehung units into rough openings using shims or clips. Wheels allow you to quickly and easily move the door in and out of the opening, and adjustments of the wheel height allow you to plumb the door by leveling across the device. A pair works for a single door installation; two pair for a French door. Retail is about $270 per pair. Larger models that can accommodate heavier (up to 600 pounds) and thicker (up to 3 inches) doors are available. thedoorstud.com

7. Deck Installation Tool
National Nail's Camo Stand Up Drive tool was designed to address key fastening and installing challenges faced by deck builders, including speed, versatility, and affordability, according to the manufacturer. The tool attaches to the installer's own drill and allows installers to stand up while they fasten deck boards. According to Camo, the Stand Up Drive can install decking much faster than other tools. Pricing starts at $170 and includes three end-fastening attachments, for face screws, Camo Edge Clips, or Camo Edge Screws. nationalnail.com

8. Clear Waterproof Sealant
Dap Products says its new Ultra Clear Flexible All Purpose Waterproof Sealant applies clear and stays clear, with no hazing, yellowing, cracking, or breaking down over time, in both interior and exterior applications. Ultra Clear is available in a 10.1-fluid-ounce cartridge and 5-fluid-ounce squeeze tube. Prices start in the $9 to $10 range. dap.com

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9. Automatic Bath Fan

Fantech's new Pro Plus series of bathroom fans offer features such as automatic motion and humidity detection. Sensors activate the fan when necessary and automatically shut it off when it is not in use. The motion sensor turns the fan on at half speed when someone enters the room, while the humidity sensor powers the fan to full speed. Pro Plus fans operate with a brushless DC motor and produce sound levels as low as 0.3 sone. Onboard speed control delivers between 80 to 140 cfm. Pricing ranges between $215 and $255. fantech.net

10. No-Mix Foam Insulation

Icynene-Lapolla has announced its first no-mix polyurethane spray foam insulation, Icynene OC No Mix. Designed to provide long-term energy-efficient performance and cost savings, the formula does not need to be mixed on site. It is recommended for use in a structure's critical insulation areas and creates a continuous air barrier once applied, according to the manufacturer. The formula may be used in any climate zone and applied across a wide range of temperatures. It firmly adheres to framing and substrates, and may be used to fill the gaps in stud wall construction. Installed costs vary by region; contact a local distributor for pricing. icynene.com

11. Concrete Deck Piers

Perma-Column's reinforced concrete deck piers, which come in 4x4 and 6x6 sizes and in 30-inch and 40-inch lengths, recently received International Code Council certification. The rebar-reinforced piers come fitted with a U-shaped 1/4-inch powder-coated steel bracket for elevating a wood post above the ground. A 40-inch-long 4x4 Perma-Column weighs about 50 pounds and costs about $50. A 6x6 pier the same length weighs about 105 pounds, and costs about $80. Uplift anchors and 12-inch column extenders are also available, for $17. permacolumn.com

12. Ivory-Inspired Brick

Eldorado Stone recently added a new color called Osso to its RomaBrick collection. It includes warm ivory tones, but stays true to the collection's wider-proportioned profile inspired by ancient Rome, with irregular shapes to provide visual interest. RomaBrick varies in length from 9 to 10.25 inches and 1.5 to 2 inches in height, with corners available. Pricing varies by project, but typically runs $7 to $9 per square foot. eldoradostone.com

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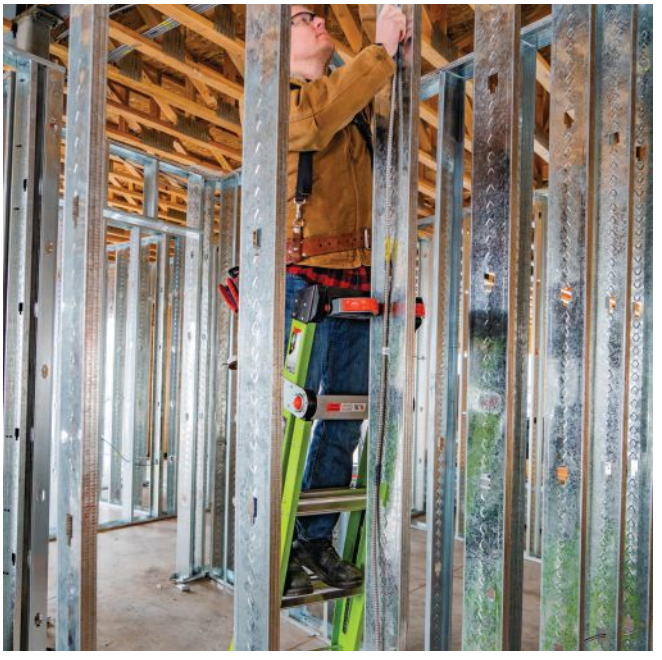

The King Kombo 3-in-1 ladder has an adjustable pad for holding on corners or studs. It meets Type 1AA standards and is rated at 375 pounds in all configurations.

Lean In, Step Up

BY MARK CLEMENT

Little Giant's new King Kombo is not quite a stepladder, not quite an extension ladder—and certainly not quite a gadget. It is a 3-in-1 combination ladder that drew a lot of people in from the aisles of the International Builders' Show. What seemed to attract the most attention to this green bad boy was its rotating wall pad. This pad enables you to lean the unit on a flat wall or, with a twist, on an outside corner or on a single stud. For framers, the biggest draw was its ability to be used as both a stepladder (for working overhead in the field of a joist span, for example) or for leaning it like an extension ladder to skedaddle down the wall installing hardware; one ladder serves two masters.

There are three models: 5-to-8 foot ($140), 6-to-10 foot ($160), and 8-to-14 foot (just introduced; pricing unavailable). The ladder is fiberglass, of course, and Little Giant says it's cost competitive with an ordinary stepladder while doing more. It's rated at 375 pounds and meets or exceeds OSHA and ANSI Type 1AA standards in all configurations. So whether you're climbing up a stepladder to cut out window sheathing or leaning it up to access an attic before the stairs are in, or standing it on an outside corner, one ladder gets it done. kingkombo.com

Pick Up, Punch Out

Just because your nailers aren't cordless yet doesn't mean your compressor can't be. I know framers who keep a small compressor handy for (depending on where you live) "pick up" or "punch out." Whatever you call it, there's missing blocking or a window opening that needs to be packed in or nails to be installed for drywall. If your compressor is cordless, you can bring it to the work and leave the cord—and mile of hose from wherever the main compressor is—behind.

DeWalt says its DCC2560T1 60-volt Max 2.5-gallon Flexvolt cordless air compressor will dish out 1,220 nails on a single charge. I'm assuming those are finish nails, but nevertheless, an hour or two of setting blocks or nailing off a sheet that got missed seems to be well within the wheelhouse of this compressor. The unit has a OneTurn regulator, which means there's no more dial to fight with, and, DeWalt says, pressure adjustments are fast and accurate. The motor is brushless and the pump is oil-free. For its 21.5-pound weight, I'd like to issue a personal thank you to DeWalt, as carrying compressors is among my least favorite things to do. It provides 1.2 SCFM at 90 psi. Oh, and it has a ball drain valve, which should be required equipment on any compressor. A compressor kit with charger and battery costs $300. dewalt.com

DeWalt's lightweight, 60-volt Max compressor can speed up punch-out work by making air more mobile.

Racing Through Rafter Connections

Simpson Strong-Tie's Quik Stik is a driver extension for setting rafter screws from the deck. It looks like it's one of those tools that pays for itself in one minute of not climbing up and down a ladder. Chucked into your impact or cordless drill/driver, the unit is designed to drive Simpson's bright orange SDWC Truss Screw in a variety of positions along the double top plate to accommodate different truss and rafter positions as they relate to the studs below. The bit holder secures the screw (which has a T30 drive) while it's raised to the plate. Positioning prongs and rockers enable you to put the screw where you need it, whether that's straight up through the bottom plate or angled in. For angled connections, putting both the positioning prongs and the rockers on the work optimizes the drive angle for that connection. The extension arm has a grip about halfway up to help you stabilize the tool in use and share the weight between both hands.

Simpson says the Quik Stik speeds up installation and increases worker safety, and it's readily apparent how that might be true. The tool is pretty simple to operate, so the new guy might even be able to do it without constant supervision. The fastener is code tested and listed. We found the tool online for about $180; a protective case is sold separately. strongtie.com

Read the full review at toolsofthetrade.net.

Simpson Strong-Tie's Quik Stik is an impact-driver extension that enables you to fasten through the top plate from the deck.

Kickin' Work Boot

Plywood, mud, ladder rungs, top plates, snow, rain ... a framer's feet see it all. Merrell says it has a new hiker-style work boot that can take the heat (and cold and rain and boiling hot summer days). Its new Moab Vertex Mid Waterproof Composite Toe Work Boot (J11515) has the usual alphabet soup of features that are supposed to make your feet more comfortable. This includes the ComfortBase contoured footbeds that "cradle your foot in comfort all day." The ComfortBase midsole technology is designed for increased shock absorption and cushion.

According to Merrell, each outsole has Merrell M Select grip rubber, which "tunes each outsole with durable traction." I'm not sure I need the outsole "tuned"; while I like to make the case that those of us in the trades are, in a sense, professional athletes, we're not place kickers in the NFL. However, I will say that what jumps out at me is the waterproof full-grain leather upper—which Merrell claims is breathable. I've had other new waterproof hikers in which my feet were swampy by the end of the day, so this is an especially appealing feature.

Other features include a "closure" with nonmetallic hardware and a bellows tongue to keep out debris. The rubber toe cap (over a composite safety cap) looks boss, as the toe is often the first thing to go on boots. The heel features Merrell's air cushion to absorb shock and add stability. There's a breathable mesh lining and molded nylon arch shank for midfoot support and flexibility. If it's hot out, or you're framing a house on an active volcano, the rated-heat-resistant outsole provides foot protection for brief periods of direct contact that meet or exceed 500°F.

Overall, this seems more like a legitimate work boot than a weekend hiker in tough-guy clothes. Cost: $155. merrell.com

Merrell's new Vertex with an all-leather upper and composite toe looks jobsite legit.

According to the maker, the TrussLox bracing system saves crane time and man hours when setting trusses.

Smash And Grab: Truss Edition

TrussLox lightweight, tough, and smartly designed truss clips look like they make all the sense in the world. Set for 24-inch-on-center spacing, they're reusable, TrussLox says, and they save crane time and man hours. They're safe and it looks to me like they wouldn't take long to pay for themselves. Take one end and smack it over the top truss cord on each pitch. Fly it in, put on layout, then tilt into place. The tapered end clicks and locks over the previous truss. The more I think about this, the more I realize that what looks like a simple head-slapper-why-didn't-I-think-of-that tool required some precise engineering and testing to work over and over again each time.

Made from heavy-duty plastic, TrussLox are reusable and are made by a mom-and-pop shop in the U.S. The maker calls them the "world's greatest temporary truss locking system." It might be on to something. Pricing is based on quantity and distributor availability. Check with TrussLox to find distribution in your area or to purchase direct. trusslox.com

Custom Toolbelt

If you haven't seen Diamondback's immutable reach into the toolpouch-wearing trades, then you must genuinely be off the grid. These guys are everywhere, it seems, and using social media to more than just megaphone, "Hey, we have a new product; hey, we have a new product." The company is using it to inform itself on how to build belts and services that it thinks can help its customers—us. "A lot of what we do is catching up toolbelt designs with modern techniques and tools," says Connor Crook from Diamondback. "Most guys are not carrying around 8s and 16s anymore. They have an impact with screws or a nail gun with sleeves or coils. The best ideas come from customers, because they actually know the gaps in the market and where belts can be improved."

Diamondback enables you to customize the belt and bags that hang on your waist. It's not a take-it-or-leave-it situation. More than any other maker, it seems to be able to get you a tool pouch (nail bag, whatever you call it) that works best for you. I know this is starting to sound like marketing copy, but I've seen it firsthand, and I think—as a wearer of a "Frankenbelt" my whole adult life—it's cool. What customers tend to do, says Diamondback, is to have a larger bag on the left for fasteners, which nets out to combos like Ox/Elias, WrangellXL/Elias, or Wrangell/Talon. And if you have bags or suspenders or a hammer holder from another brand, that's OK; they'll probably fit on the Diamondback belt or otherwise weave into its overall system. Oh, and these belts have a "gun loop," which looks ingenious for toting a spiker around and not have it banging off your legs. Diamondback says it has well over a million combinations. toolbelts.com

Diamondback bags are customizable. Use one bag from one belt and another from a different belt to craft your own system.

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BY CRAIG MILLEN

Tiny Baseboard Tip

Here's a little trick for those small pieces of baseboard where the casing is close to an adjacent wall. Usually this area has a terrible buildup of drywall mud or plaster that kicks the little piece of baseboard out of plane with the casing. To avoid this, I'll cut the little piece of baseboard and attach it with Dominos and glue to the base of the casing. It's a lot easier to install this piece of baseboard as an extension of the casing than as a separate piece of baseboard. If the baseboard piece is really small (less than an inch), I'll use flat stock instead of a profiled base stock, and just butt the intersecting baseboard into the flat stock. It's difficult to caulk and paint in that area, so the simpler the better.

This detail is more important on baseboard and casing that is installed flush to each other because there's no reveal to help hide your sins.

Alternatively, if the casing is already installed, you can preattach the small piece of baseboard to the cope on the long piece of baseboard with nails or trim-head screws and install the unit as one piece. This works especially well to keep the tiny baseboard from moving around and opening up.

Craig Millen owns CM Concepts, a design/build remodeling firm based in Ottawa, Ont. Follow Craig on Instagram @cm_concepts.

Photos of baseboard: CM Concepts

Send us your tips: *JLC*, in partnership with our sister publication *Tools of the Trade* and Milwaukee Tools, is giving away a power tool each issue to the reader who sends us the most ingenious or most useful trade tip. Next month, we'll give away Milwaukee's 22-inch Packout Modular Tool Box Storage System (see photo, right).

Send tips to JLC-Editorial@hanleywood.com with "Trade Tip" in the subject line. Any building trade qualifies. Don't sweat the grammar or writing. But please send us high-quality photos to explain your tip.

Classifieds

May Advertising Index

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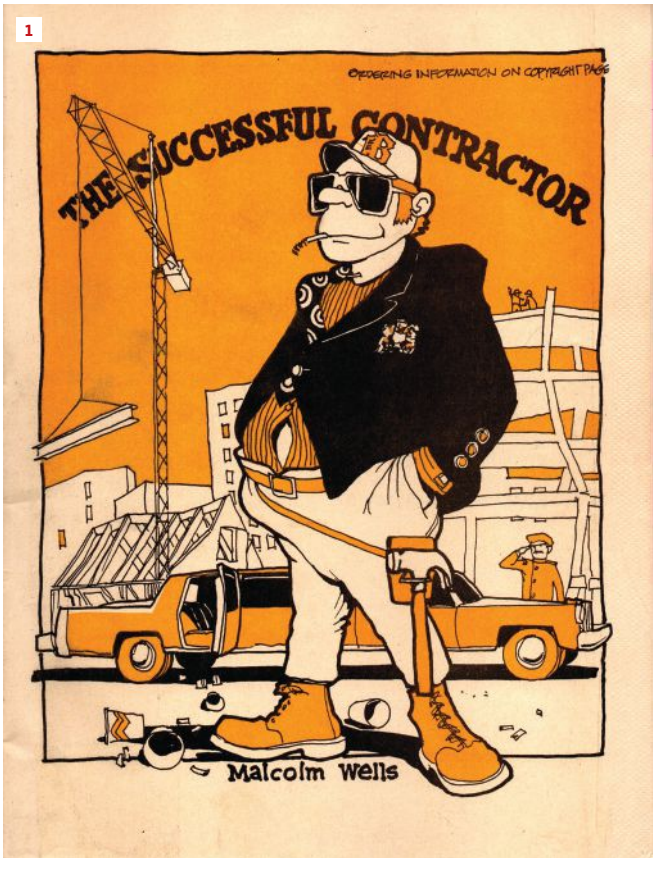
BY DON BOIVIN



A caricature of a "successful" contractor graces the cover of Malcolm Wells' book **(1)**. One of Wells' 50 Rules cajoles the would-be contractor to hire friends but renege on payments **(2)**. A smiling contractor is awash in a sea of coffee cups **(3)**.

The 'Not So Successful' Contractor

I was recently given a book entitled *The Successful Contractor (How to Make It Big in the Building Game)*. Its author, Malcolm Wells, widely recognized as the father of modern earth-sheltered design, was an architect, author, illustrator, speaker, and activist who lived right up the road from me until his death in 2009. I'd read one of his books, *The Earth-Sheltered House*, and had even seen him a few times at a local coffee shop, but I never had the guts to introduce myself.

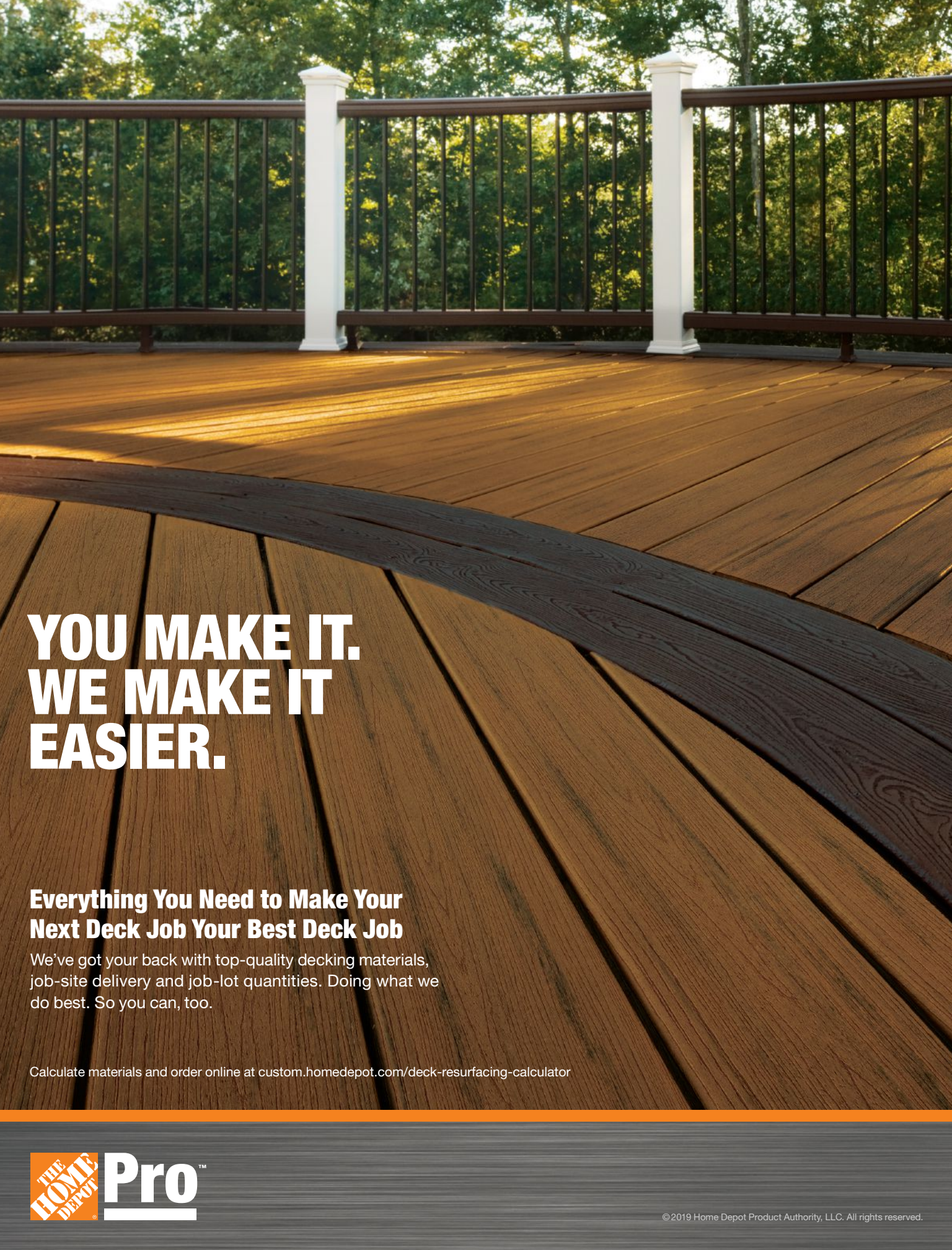
The Successful Contractor is Wells' delightfully irreverent response to his own "painful experiences" with the inevitable bad-apple contractors one is bound to run into as an architect, builder, or homeowner. The original cartoons accompanying each of the author's "basic rules" are priceless. Contractors who can laugh at themselves and at the stereotypes of our industry will thoroughly enjoy this easy and entertaining read. Here are a few excerpts from the 50 rules Wells spells out for those seeking success as a contractor—lest they end up as "just another nice guy nobody remembers."

- Success: "It's not how you build that counts... Success is having people think you're important."
- "Take any job that comes along no matter how big it is. Tell them you've done other jobs just like it."
- "Underestimate... Otherwise, you won't get the job."
- "Don't worry about taking on more work than you can actually handle; the customers will [always] wait."
- "Use your friends as subcontractors no matter how undependable or unskilled they are."
- "Your money comes before their friendship... Stay well behind in your payments to them till [sic] the work is complete. Then tell them their prices were too high. Offer them half."
- "Get rid of the architect."
- "Never answer the phone or return any calls."
- "Never, under any circumstances, say you're sorry. Apology is a sign of weakness."
- "Don't let a building owner get started on his list of complaints... YOU must do all the talking."
- "A happy job can be told by the number of coffee [cups] on the ground."
- "Everything that goes wrong on the job is someone else's fault."
- "Completion: It's any time that you say it is."
- "In the building trades, all materials and workmanship are guaranteed for a period of one year. It is imperative that you cut off all contact with the owner during those 12 critical months."

For the story behind how I came by this book, go to jlconline.com. *The Successful Contractor* is available at malcolmwells.com.

Don Boivin is a contractor and craftsman from Hyannis, Mass.

Cartoons by Malcolm Wells



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