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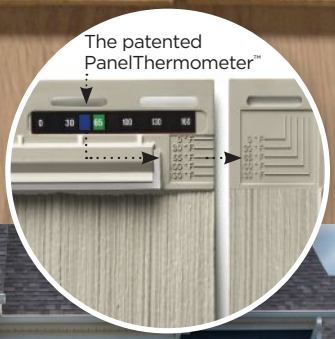

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Contents

On the cover: Danny Kinsley and Jeremy Harple, of Stewardship Slate (based in Burlington, Vt.), wear fall-arrest equipment while slating a historical building's roof in Montpelier, Vt. See the story on page 24. Photo by Tim Healey.

FEATURES

DEPARTMENTS

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WEATHERIZING A DOUBLE-WALL METAL CHIMNEY, *Q&A*, DEC/2017

Rick Vlahos, Executive Director of the National Fireplace Institute (1/2/2018): With any metal flue pipe, you *must* maintain proper clearances around the pipe. There should be nothing but an air space. Do *not* wrap the pipe with insulation. It will change the heat-distribution characteristics of the pipe and violate the safety listing.

Clearances are based on an air space with nothing combustible or noncombustible in the intervening space. There are documented cases and lawsuits from installations where heat transferred from the pipe through noncombustible insulation to combustible framing. The rule is simple: Clearance = air space.

I have been on a mission to stamp out the term "zero clearance" for long time. While there were zero-clearances fireplaces for about two years in the 1950s, they are long gone. The safety labs quickly realized that "zero clearance" is not a viable option. I don't know of any wood-burning product in the hearth industry that can accurately be classified as "zero clearance." The preferred term is "factory-built." Of course, some of the brightest minds in our industry still use the term "zero clearance." (I didn't say I was winning the mission.)

Not masonry. There are significant differences between masonry and factory-built chimneys. The main difference is that a factory-built chimney is a manufactured product that goes through intense safety testing. A masonry chimney is site-built, so you can't test them consistently. Each one is built a little differently. Here are points to consider:

• Virtually all of the factory-built chimneys used for wood-burning stoves require 2 inches of clearance. There are some in Canada that are listed for 1 inch. Gas and pellet venting systems will also fluctuate between 1 and 2 inches.

• Masonry chimneys need to be built according to the local codes. The National Fire Protection Association publishes "NFPA 211 Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances." It is the document that most of the national codes, local codes, and installation manuals in our industry are based on. It calls for 2-inch clearances for interior masonry chimneys and 1-inch clearance if they are on the exterior of the house.

One of the standing jokes in our industry is that 99% of the masonry chimneys are built incorrectly. Some go so far as to say they have never seen a masonry chimney built correctly.

To be clear. There are not many documented cases where fires were caused by the placement of insulation in the required air space. The cases revolve around a few lawsuits brought against one manufacturer for those types of installations. I was contacted by that manufacturer and asked to try and get the insulation industry to take note of the problem. (The case specifics were locked up in settlements and the company was not willing to share the specifics.) I reached out to the insulation trade association and wanted to have it add training similar to what it provides for recessed lighting. I was able to get it to accept our little technical bulletin, but that was about it.

I used to do the safety testing for a fireplace and wood-stove manufacturer. The safety listings of our products all specify minimum clearances. It is the safety labs that insist that those clearances are met with air space; nothing combustible or noncombustible may be in that space to meet their requirements.

Sealing the venting. I did a training class for the state of Indiana building officials, and one question they asked was if the tape that is used to seal around [a chimney vent] pipe at the firestop had to be UL listed. Firestop [in this application] is usually a metal plate designed to keep the pipe stable as well as define the proper clearances. The hole in the metal plate is usually about 1/8 inch larger that the outside diameter of the vent pipe. They didn't like my answer: The pipe should not be sealed to the firestop. They do not seal the pipe to the firestop during the safety tests. Therefore, sealing it will violate the safety listing.

We can install products only the way the manufacturer recommends, and the manufacturer is bound by the procedures and limits defined in the safety standards and the safety tests they perform.

Yes, some "green" building codes require or recommend sealing [the air leak that the required air space creates in the building envelope]. But those recommendations don't alter the fact that doing so violates the safety listing. Also, most factory-built chimney is built with stainless steel. Stainless will expand and contract when heated. Therefore, if you seal it, the seal is good for one or two fires in the stove or fireplace. Then, the expansion and contraction will break the seal anyway.

After I scraped the building officials up off the floor, I started to second-guess my own answer. So, at an industry trade show, I went around and talked to every factory-built chimney manufacturer that was there. They all agreed I was right—not popular, but right.

"WORK SCOPES, DESIGNS, AND CONTRACTS," JAN/2017

Kent Garber (online 1/19/18): Kyle Diamond's approach is practical, but how does he respond to a small job, like someone wanting to install a storm door?

Author Kyle Diamond responds. For the most part, we don't do small jobs like a storm-door install. If someone calls who is responding to a review or was referred by a previous client, we let them know that we have a minimum charge of $200 to visit a site, instead of the work scope agreement. But this approach requires a balanced view, not an absolute rule. Sometimes, small jobs net large projects. For example, on a horse farm where we initially were called to repair a roof, we ended up completing more than a million dollars in work. Often, more questions are needed to see if it is simply about one project or they have more planned. I think developing a dialogue with the prospect helps discern if it might be something real or just a waste of time.

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BY JOHN SPIER

Jack of All Saws

One of the first and most versatile power tools a new carpenter is likely to buy is a reciprocating saw. Milwaukee didn't invent the tool, but for many years, the manufacturer's reciprocating saws have been some of the best, and its trademarked name, Sawzall, has become a generic term for the tool.

Most professional-grade recip saws are powerful 5-amp to 8-amp beasts with orbital action, adjustable feet, variable speed, and other helpful features. In recent years, cordless technology has improved to the point that I often leave my corded recip saw in the shop, in favor of a cordless version on the jobsite **(1)**.

BASIC OPERATION

There's no science to using a recip saw—just get a good grip on the tool and cut away. As with any other type of power saw, keep the physics of the saw in mind, cutting so that the kerf doesn't pinch and bind up the blade. And stick your head around the other side of whatever you're cutting to make sure there are no pipes, wires, or gas lines in harm's way. Use the foot to push against the work, to keep the saw from shaking and to transfer maximum cutting power to the teeth. I often start a cut with a circular saw because it's faster and cuts straighter. Then I use the recip saw to finish the part of the cut that the circular saw couldn't reach.

Many recip saws have adjustable feet that you can extend or remove altogether. Adjusting the foot out in increments lets you use a fresh part of the blade as the teeth wear out from cutting metal or other hard materials. Also, taking the foot off altogether can give you that bit of extra reach with the blade, but be careful not to damage the blade-fastening components or the end of the tool body when using a recip saw with the foot removed.

While we are on the subject of blade-fastening components, the keyless chucks that most recip saws are equipped with now are a huge improvement over the old set-screw attachments. But keyless chucks are relatively delicate mechanisms that can load up with dust quickly. Periodically

The reciprocating saw on the right in the photo is a corded version from the 1980s, and the cordless saw on the left is much newer and comes with a quick blade-change mechanism **(1)**. An assortment of blades can also be seen in the saw cases. A recip saw can be used to clip the nails at the top and bottom of the studs **(2)** so a framed opening can be removed in one piece **(3)**.

Photos 8, 10, and 12 by Jen Brady; all others by Gabriela Gazo.

The author slices through a plate to shorten a wall **(4)**. A recip saw makes quick work of removing a stud without damaging it **(5)**. Using wedges to hold the boards apart, the author clips nails to remove a jack stud **(6)**. A recip saw can also cut out a rough sill **(7)** and make a notch in a stud **(8)**. A metal-cutting blade can slice off a bolt **(9)**, or cut through pipe quickly **(10)**.

blasting them out with compressed air and then spraying in some lubricant will keep them functioning smoothly for a long time.

BLADES

Most hardware stores stock a wide variety of blades and other attachments for recip saws. I keep a collection of blades in the truck, mostly bi-metal blades in 6-, 9-, and 12-inch lengths. For cutting through framing, I typically choose bi-metal blades made for wood cutting or general-purpose cutting. They can cut right through nails you encounter as you slice through existing framing. These blades will "clip" nails or drywall screws if you want to remove framing without tearing out the drywall or sheathing. I find that some of the thicker, heavier blades specifically designed for demolition are occasionally useful, but they're also slower. Thinner kerf blades cut much faster, and because recip-saw blades cut on the pull stroke, thinner blades work fine for demolition as long as they don't bind in the work.

For cutting metal, I also keep a collection of bi-metal cutting blades, which are most useful for cutting rebar, pipes, and bolts. Because of their finer teeth, I also use metal-cutting blades when I need to make the occasional clean cut in finish material. Rounding out my collection are scrolling blades that are good for cutting a tight radius and abrasive blades for cutting tile or glass. I even own a scraper attachment and have seen other attachments with anything from files and abrasive pads to a special attachment for removing grout from between tile.

JOBS FOR A RECIP SAW

Few tools are as tough and versatile as a recip saw. It's sort of a jack of all jobs, master of none. Recip saws are mainly used for taking things apart, and they're great for other stuff as well. But for almost every task we use one for, there may be another tool that can do it better, so be selective before automatically reaching for your recip saw. Here are some of the most common uses for these tools:

Making changes. When we make a mistake (or if the client or architect does), the recip saw is our go-to tool for fixing it. Unlike a sledgehammer or wrecking bar, a recip saw can let you disassemble things so that they can be put back together. Sometimes, I'll take an entire assembly out of a wall, such as a misplaced door or window frame, and then reinstall it in a different location **(2, 3)**.

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Rework. Similarly, we use our recip saw to make changes to existing work. If I want to add an opening, move or shorten a wall **(4)**, shorten a soffit, shift a joist, or do any of a thousand other modifications, I usually reach for my recip saw.

Demolition. A recip saw is a great tool for destruction, although I've had to show many people that an old circular saw will make most demo cuts much faster and more efficiently if you have access for using it. (There are few things that frustrate me more than seeing someone spend 10 minutes making a cut that I can do in 10 seconds with another tool).

Salvaging material. A recip saw makes it easy to cut out a stud and save it. Just clip the nails at the top and bottom **(5)**. With a couple of wooden wedges and a recip saw, I can take apart almost anything in a house and leave the pieces in re-usable condition **(6)**.

Removing sill plates at framing. Like most framers, I build and stand my interior walls with the bottom plates running through the openings. I always try to make courtesy cuts in the bottoms of the plates before they go up, but either way, the recip saw is the right tool for cutting the plates out of the openings later **(7)**.

Cutting sheathing from openings. If you can cut an opening from the outside, a router or circular saw does a better job. But we often need to make this cut from the inside, and a recip saw works just fine. I use a long blade and use the inside edge of the rough-opening framing to steer the cut so that the cut doesn't become an ugly, angled mess.

Cutting curves. A jigsaw offers more control, but a recip saw is faster. And for many of the curves we need to cut when we're framing, faster is better.

Making holes and notches. Nothing makes a GC cringe like the sight of a subcontractor with a recip saw; those guys can ruin good framing in a blink. That said, a carefully wielded recip saw is often the right tool for getting pipes, wires, ducts, and other components through a structure **(8)**. And sometimes it can be a great time-saver: You can spend a half hour ruining a knuckle-busting hole saw in a nail-infested rim joist, or you can cut a hole in two minutes with your recip saw.

Cutting pipes, wires, cables, bolts, rebar, and other odd material. With the right blade, a recip saw can cut almost anything and often in the most hard-to-reach places, such as a foundation bolt in a narrow bay **(9)**. I've also used a recip saw to slice into existing copper pipe. While a tubing cutter might make a smoother cut, the recip saw can make a quick cut in a pinch **(10)**. And the cordless version might be appreciated if there is water in the pipe. For some of these jobs, a recip saw might be the only tool that works.

Thieving shingles. In my area, almost every house is sided with cedar shingles, and we often need to make changes or repairs to those shingles. The traditional method for removing shingles from underneath overlying courses is to use a miserable hand tool called a thief. This long, flat tool slips up behind the shingle and hooks the nail; then you drive it down to "steal" the nail. But the electric version of this tool is a recip saw with a long bi-metal blade **(11)**.

Sanding or cleaning holes. I sometimes wrap sandpaper around a long blade, tape it securely, and use it to sand the inside of a hole or some other hard-to-reach spot, such as the inside of the dagger board trunks on my catamaran.

Pruning. A cordless recip saw is perfect for cutting pesky branches out of the way **(12)**. In fact, with one of the new specialized pruning blades, it could become a mainstay of a landscaper's arsenal.

Mechanical work. Many of the carpenters I know work on their own vehicles, and a recip saw will make quick work of a rusty exhaust system, corroded shocks, or seized lug nuts.

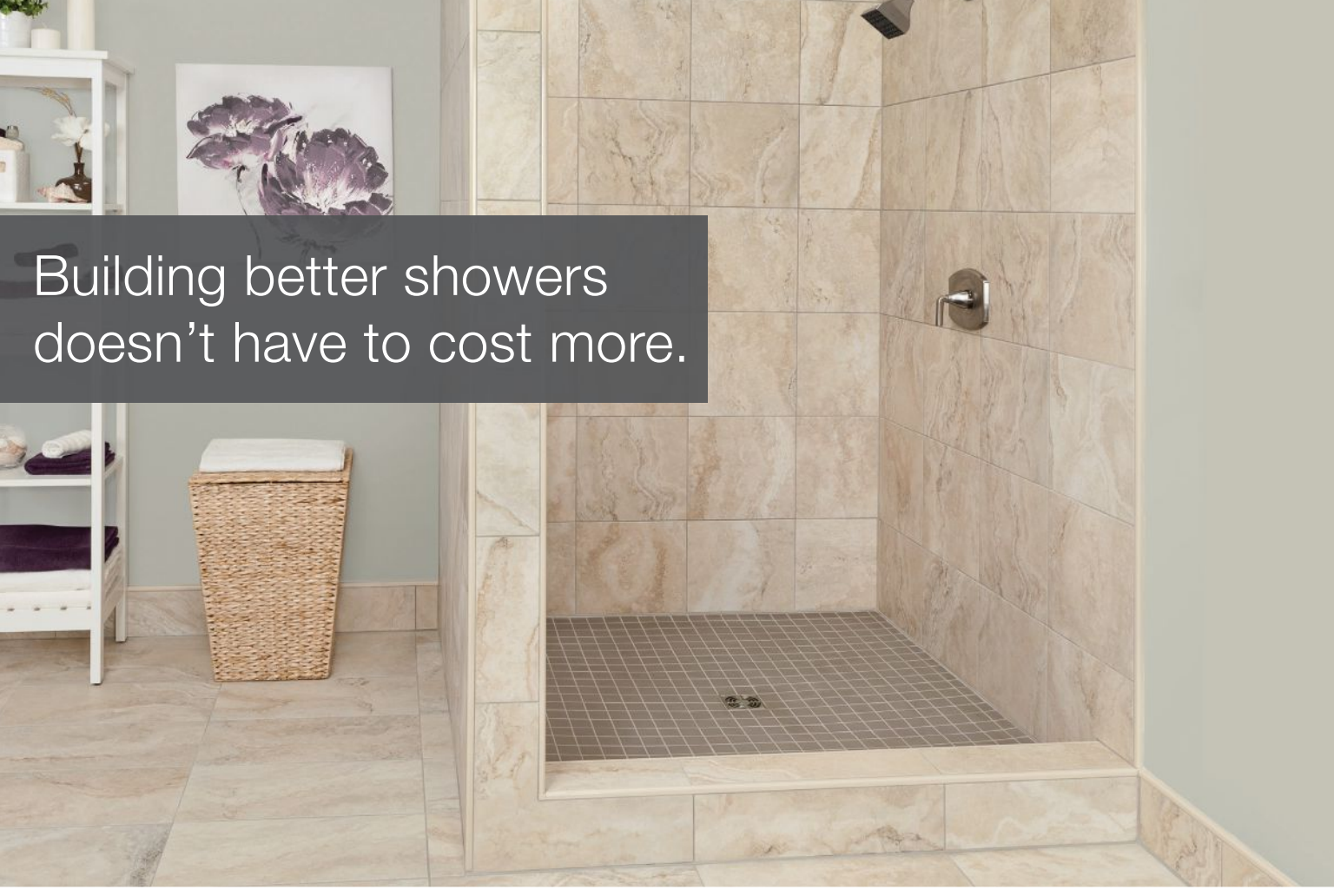
Fine finish work. We joke about some guys who put down their chain saws when they're done framing, and grab their recip saws to finish the trim. But jokes aside, a recip saw with a fine-toothed metal blade can sometimes make a smooth cut in a location where other tools can't reach.

Specialty tasks. As mentioned above, there are many different accessories available to adapt your recip saw to other jobs, such as scraping, scrollwork, grinding, or cutting exotic materials **(13)**. Usually, there are better tools for these jobs, but carrying a recip saw with these attachments on the truck can bail you out sometimes.

John Spier owns Spier Construction, a building and remodeling company on Block Island, R.I.

A long blade cuts the nails behind the shingles so the shingles can be removed **(11)**. Here, a special pruning blade turns a recip saw into a landscaping tool **(12)**. The flashing behind this rake trim needed to be replaced; a recip saw clips the nails that were holding the original flashing in place **(13)**.

For a more detailed discussion on reciprocating saws, go to **www.jlconline.com/training-the-trades/jack-of-all-saws**.



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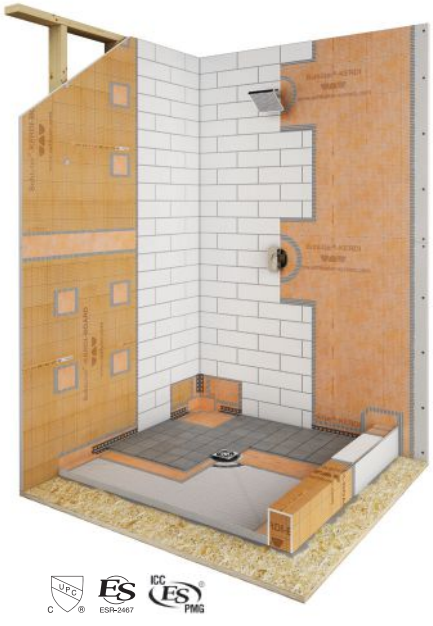

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*Builder Magazine sponsored Readex Study ranked Honda as "most preferred brand" for 12 consecutive years. Please read the owner's manual before operating your Honda Power Equipment and never use in a closed or partly enclosed area where you could be exposed to odorless, poisonous carbon monoxide. Connection of a generator to house power requires a transfer device to avoid possible injury to power company personnel. Consult a qualified electrician.

Q Some roofing-underlayment manufacturers and the building code seem to be at odds when it comes to installing drip edge with an ice-dam-leak protection membrane (the IRC term is "ice barrier"). Is there a way to satisfy both?

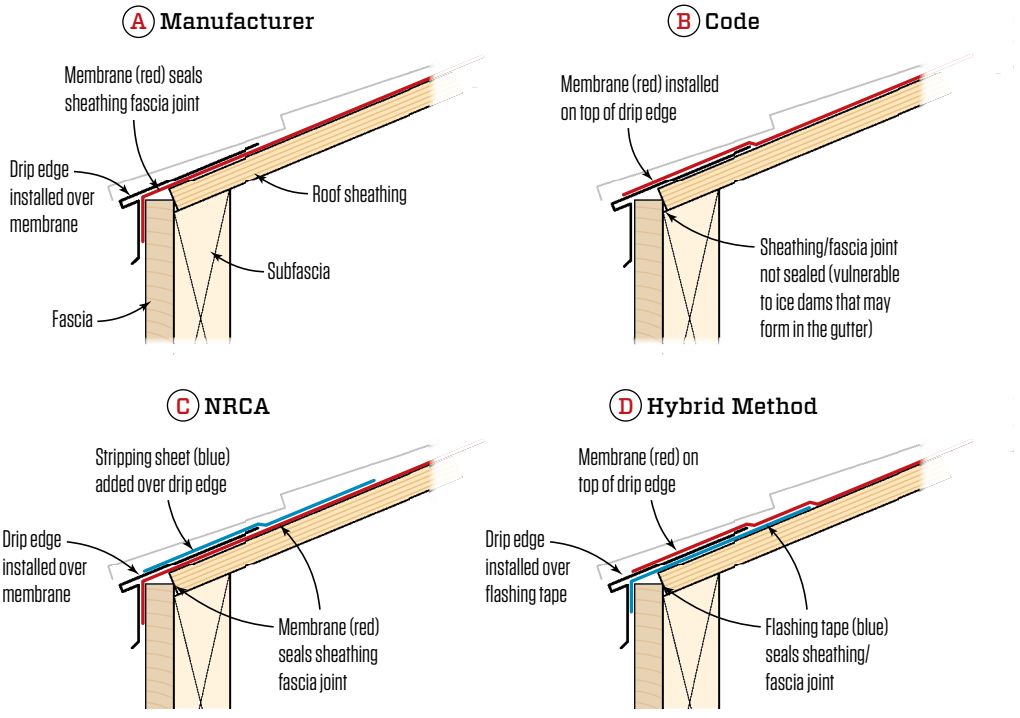
A Mike Guertin (instagram.com/mike_guertin), a builder and remodeler in East Greenwich, R.I., and a presenter at JLC Live, responds: You are correct that some manufacturers of roof ice-barrier membrane seem to be in disagreement with the International Residential Code (IRC) about the correct way to install drip edge with an ice-dam protection membrane. The IRC is clear on this subject: R905.2.8.5 Drip Edge says, "Underlayment shall be installed over the drip edge along eaves … ." Because the ice-barrier membrane in this situation is taking the place of the underlayment along the eaves edge, it should be installed over the drip edge according to the code.

But ice dams can form *in the gutter*, as well as on the roof. With the code-recommended installation of the ice barrier over the drip edge, water can back up at the eaves edge and get behind the vertical leg of the drip edge, where it can end up flowing into the joint between the fascia and the roof sheathing.

Once inside the eaves or soffit, the water may drain out harmlessly through a continuous soffit vent (best case). In the worst case, however, the water flows back towards the wall. Once water reaches the wall, it can get between the siding and the housewrap, between the housewrap and the sheathing, and inside the wall cavity itself, all of which are bad situations.

As you point out, some manufacturers of ice-barrier membranes (particularly plastic-surfaced types) recommend installing

Drip Edge and Ice Dam Protection Membrane



Different approaches to ice-barrier installation. Some ice-barrier manufacturers recommend applying their product under the drip edge to seal the sheathing–fascia joint **(A)**. The IRC calls for the membrane to be installed over the drip edge, leaving the joint vulnerable **(B)**. The NRCA puts the drip edge over the membrane with a stripping sheet added from the drip edge onto the ice barrier **(C)**. A hybrid method seals the joint with a strip under the drip edge, and the membrane installed on top **(D)**.

Illustration by Tim Healey

the ice-barrier membrane before the drip edge goes in. They suggest that the membrane lap down about an inch onto the face of the fascia and then up onto the roof sheathing. This seals the sheathing–fascia joint and blocks the water's pathway into the eaves and soffit. The drip edge is then installed on top of the ice barrier.

In my experience, most building inspectors understand the logic behind a manufacturer's recommendations once those recommendations have been explained to them. I would suggest showing the manufacturer's installation guide to the inspector and explaining why the recommendations make sense. Hopefully, the inspector will then approve the "drip edge over the ice barrier" installation method (which inspectors have the authority to do). If the inspector still doesn't approve the drip-edge-over-ice-barrier method, there are a couple of workarounds that will seal the fascia-to-roof-sheathing joint and comply with the code.

Method 1: Install the ice-barrier membrane according to the manufacturer's instructions with the drip edge installed on top of the membrane. Then install regular roofing underlayment (tar paper) over the top of the drip edge (and over the ice barrier) and continuing all the way up the roof. This approach will satisfy a code-conscious inspector as well as the manufacturer's recommendations.

Method 2: The National Roofing Contractors Association (NRCA)—a recognized authority on roofing installation—offers a different solution. Install the ice barrier first with the drip edge over the top, then apply a 4- to 6-inch-wide self-adhering "stripping ply" to bridge over the top of the drip edge and onto the ice barrier. The stripping-sheet method relies on the adhesive bond of the stripping ply to seal out water. This does run counter to the shingling method that we all use for shedding water properly.

Method 3: I recommend this hybrid method—just think of it as the NRCA stripping-ply method but in reverse. Before installing the drip edge, apply a 4- to 6-inch-wide "eaves" strip of membrane (many companies make narrow rolls of membrane for detailing around roof joints and penetrations that will work for this application, or you can cut strips from full-width ice-barrier membrane). Be sure that the eaves strip seals the joint between the roof sheathing and the fascia and that the strip is wide enough to extend a few inches above the roof leg of the drip edge. After applying the eaves strip, install the drip edge on top of it. Finally, apply the ice-barrier membrane over the eaves drip edge, running it up to the code-required height (see "Ice Barrier Roof Coverage," Feb/18). This hybrid approach seals the joint between the sheathing and the fascia, and it satisfies the code.

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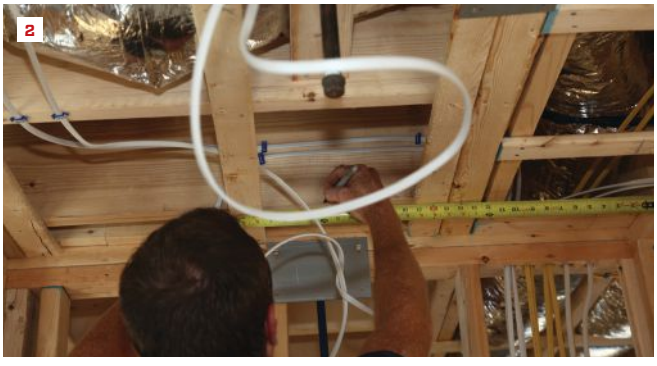


The first step when roughing in a ceiling can is marking out the location. For this shower light, the author first marked the centerline between the back wall and the showerhead **(1)**. Next, he marked the centerline of the width of the shower **(2)**. A slotted screwdriver removes the knockout for the switch leg **(3)**. After stripping back the outer jacket of the switch leg, the author feeds the cable into the box where a spring-loaded cable clamp secures it in place **(4)**.

Photos by Roe Osborn

Ceiling Can Rough-In

BY BEN GILES

In the January 2018 issue, I wrote "Rough-In Wiring," a feature about doing the preliminary work to install the electrical system in a home. Although that article covered the basics, there was not enough space for every single detail involved in the rough-in process. One thing I had to leave out was how to rough in a ceiling can.

Ceiling cans are the most ubiquitous permanent lighting fixtures in a house. These fixtures have a place for lighting in every room, from closets to kitchens. And with the wide variety of trim rings available to finish off the fixtures, they can serve myriad lighting duties, from ambient lighting to task and spot lighting.

THE RIGHT CAN FOR THE JOB

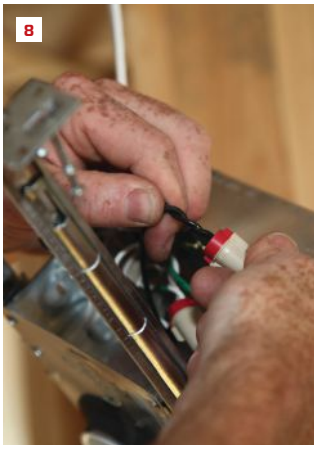
For every ceiling-can fixture I install, the first thing I need to determine is the type of can required for the location. The light for this project was being installed in a shower ceiling located directly below an unconditioned attic space. Because of the insulation that would be installed in the ceiling, I chose an IC (insulation contact) rated fixture.

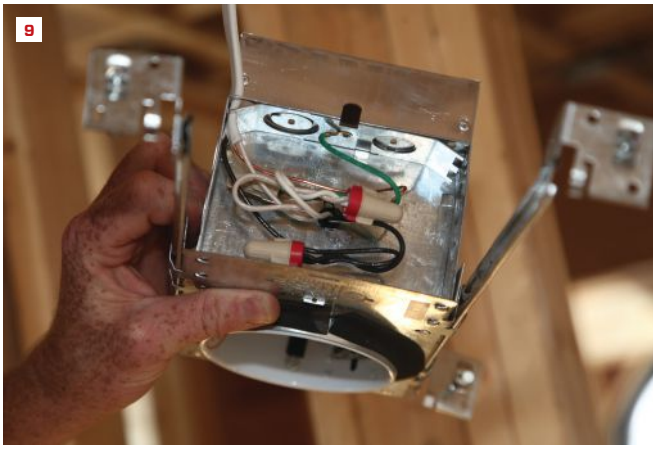
I also chose a fixture outfitted with a gasket that blocks the flow of warm, moist air from the shower into the attic. From a design standpoint, the owners had specified a small, 4-inch-diameter fixture, which would provide plenty of light for the shower.

From an installation perspective, I wanted a fixture that was quick and easy to install. I also wanted a fixture that was adjustable in all directions, vertically as well as horizontally, and that I could lock in place after positioning it.

MARK THE LOCATION

Installation always starts with laying out the placement of the light. Specifications called for the fixture to be centered in one direction between the back wall of the shower and the shower head, and centered in the other direction on the width of the shower. I measured and marked the location of the can in both directions. Many electricians opt to install the fixture first and then make all the electrical connections, but I find it easier to make the connections before installing the box.





The author twists the green ground from the fixture with the bare conductor of the switch leg **(5)**. Next, he strips about 1/2 inch of insulation from the white and black conductors of the switch leg **(6)**, leaving the braided fixture wires longer than the solid switch-leg conductors **(7)**. After twisting the conductors with wire nuts **(8)**, he pushes the bundles into the box **(9)**.

HOOK UP THE CONDUCTORS

The crew had left a single cable (called a switch leg) leading from the switch for connecting the can, so the wiring would be straightforward. I stripped back the outer jacket of the cable about 8 inches, exposing the conductors.

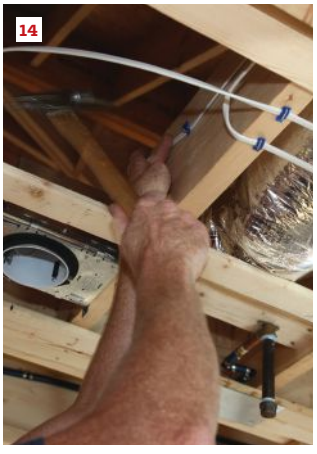
To prep the can, I used a slotted screwdriver to remove a single knockout from the corner of the metal electrical box that was mounted on the side of the fixture. On this particular fixture, the corner knockouts were equipped with spring-loaded cable clamps. I fed the cable into the box, letting the jacketed part of the cable extend about an inch past the spring clamp.

The fixture came equipped with three wires inside the metal box: a white, a black, and a green (ground). As with most fixtures such as this, the factory-installed conductors were braided wire. The fixture conductors were already stripped and twisted with about 3/4 inch of bare wire exposed.

With the switch leg fed inside the fixture's electrical box, the first connection I made was the ground. The ground for this fixture was riveted to the metal housing, so no additional grounding screw was necessary. I simply lined up the end of the green fixture wire with the bare conductor from the switch leg and twisted the two together with the appropriate-size wire nut.

Next, I stripped back the insulation on the black and white conductors of the switch leg, removing about 1/2 inch of insulation from each of the conductors. Because the braided wire is more flexible, it tends to wrap around the solid conductor when they are twisted together. So I made the exposed solid conductor slightly shorter than the braided conductor so that the two ended at roughly the same point when twisted together with a wire nut.

To join the white and black switch-leg conductors to their fixture counterparts, I held them together with the shoulders of the insulation from both conductors lined up. I twisted a wire nut onto the ends, letting the braided conductor twist around the solid conductor. When that was tight, I continued turning the wire nut a couple



To install the ceiling can, the author lines it up on one of his centerline marks **(10)**. Metal tabs on the hanger bars set the can at the proper height **(11)**. He drives nails to attach the hanger bars to the framing **(12)**, aligns the can to his other mark, and locks the can to the hanger bar with a screw **(13)**. Finally, he pulls the slack out of the switch leg and staples the cable to the joist **(14)**.

of more turns, so that the insulated parts of the conductors twisted together as well. When all three connections have been made, I push the bundles into the box and snap on the cover, and I'm ready to fasten the fixture in place.

INSTALLING THE FIXTURE

This fixture came with bar hangers that adjust for joist spans of 12 inches to 24 inches. I began by setting the fixture between the joists and aligning it side-to-side on the mark that I'd made earlier. Then I extended the hanger bars out to span the distance between the joists.

The bar hangers have attachment flanges at the ends with double-headed nails all set and ready to drive. The flanges have metal tabs that hang down to help gauge the proper height for the fixture. The ceilings in this house were strapped with 1x2 furring, so I let the tabs extend down 3/4 inch **(11)**, and I drove in the nails on the ends of the hanger bars facing away from me.

Next, I drove the nails at the other end. For this part of the installation, I am working off a ladder, so rather than getting down and shifting positions to nail in the other side, I've gotten pretty good at hammering backwards.

After driving all four nails, I slid the fixture along the bar hangers until it lined up with my other layout mark. Then I tightened the screw on the hanger bar to lock the fixture in place.

SECURE THE CABLE

As when running cable during rough-in, I try to minimize the stress on the conductors. To secure the cable after installation, I pulled the slack out of the supply side. Then I drove a staple near the top of the joist close to the position of the box. This left a nice, relaxed loop of cable between the staple and the electrical box on the side of the fixture.

Ben Giles owns South Shore Electrical Contractors, in Wakefield, R.I.

Working Safely and Comfortably at Heights

BY ELIOT LOTHROP

While restoring old timber-framed buildings, my crew and I regularly work up high—at times, upwards of 75 feet off the ground—on tasks such as stripping existing roofs, replacing roof framing, and installing new decking. Over the years, our techniques for work in this environment have evolved. My goal for this article is to give a quick overview of the equipment we currently use to work vertically and on roofs. Having grown wary of using "compliance-in-a-can" solutions for fall protection, we turned to using nontraditional equipment (gleaned from arborists and rock climbers) to work safely and comfortably at heights.

ROCK CLIMBING–STYLE HARD HATS

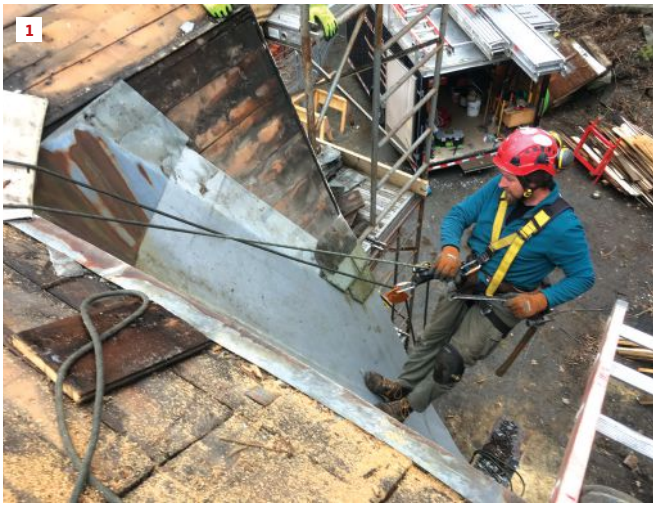
Starting with our hard hats, we switched to using helmets made by Petzl about 10 years ago. On our jobsites, we require that hard hats be worn at all times. Working at heights, we can't afford to use uncomfortable hard hats that constantly fall off. The Petzl hard hat is comfortable to wear and comes with a chinstrap that keeps it securely on your head. They've become indispensable to us and have earned their keep several times over, preventing severe head injuries.

My crew and I use the Vertex Vent, Type 1, Class C model, which is ANSI certified. The Type 1 designation refers to its impact resistance to the top of the head, while the Class C denotes that it's not insulated for electrical shock—Petzl does make a model rated for electrical shock (Class E). It has slots to insert clip-on earmuffs and holes on the sides for mounting a flip-down visor. There is also a slot on the front to insert a headlamp; we use Petzl's PIXA headlamps.

FULL-BODY HARNESSES

We used to use cheap full-body harnesses that were ill-fitting and uncomfortable. Another drawback was their lanyard attachment points were only on the back of the harnesses. These less-expensive harnesses were good only for fall-arrest protection and not for work positioning, which we found ourselves often trying to do.

To safely work on a roof slope or other location with poor footing where you might lean against your rope, the attachment point needs to be in front of you. Also, the harness's fit should be comfortable and padded against the legs. We prefer to use full-body harnesses by Petzl (though there are other construction-focused



A two-rope positioning system allows user to lean against his ropes and work with both hands free **(1)**. The Petzl hard hat comes with a chin strap **(2)** and is ANSI certified **(3)**. Higher-end full-body harnesses are more comfortable and safer. They also have padding against the legs and both front **(4)** and rear (dorsal) attachment points **(5)**.

Photos by Eliot Lothrop and Tim Healey

The photo above shows a roundup of the author's fall-arrest and work-positioning equipment: abrasion-resistant arborist rope (**a**); Protecta permanent ridge roof anchor with integral D-ring (**b**); DBI-Sala D-ring strap anchor (**c**); fall-arrest lanyard—Petzl ASAP mobile fall-arrester (**d**) clipped to a Petzl Absorbica energy-absorbing device (**e**); Petzl carabiners (**f**); Petzl RIG Compact self-braking descender for work-positioning (**g**); and Petzl Absorbica-I single lanyard with a compact, integrated energy absorber for clipping onto stationary points (**h**).

The author's crew are typically dropped off at their rope positions with their 65-foot Genie lift (its cage is seen here, peeking over the ridge) **(7)**. Pieces of old fire hose are used to protect the fall-arrest and work-positioning ropes from the edges of the metal roof **(8)**.

harnesses from companies like DBI Sala that are comfortable and may interface with tool pouches better).

I use Petzl's AVAO BOD fall-arrest, work-positioning, and suspension harness, which is CSA, ANSI, and NFPA certified. The AVAO harness has both a front and rear (dorsal) attachment point. It's designed to reduce pressure points during prolonged suspension and allows its user to hang from the dorsal attachment point for a longer time in case of a fall.

ROPES, ANCHORS, AND LANYARDS

For our lifelines, we use arborist ropes, which are abrasion resistant, strong, and lightweight. We typically anchor the ropes to the roof framing with the DBI-Sala D-ring strap anchors. OSHA requires that each anchor be able to support a weight of 5,000 pounds in case the anchor point is shock loaded. While the true capacity of the anchor might be hard to quantify, it needs to be substantial enough to really work and not just offer some false sense of security.

We employ a couple of different fall-arrest lanyard setups. For our rope work, we use Petzl's ASAP mobile fall-arresters. The ASAP moves smoothly, following you up and down the rope with little tending. But, if it senses a free fall or shock, it locks the rope (much like a car seatbelt). We clip the ASAP to a Petzl Absorbica energy-absorbing device, which we then clip on to the dorsal attachment point of our harness.

At stationary anchor points, such as clipping on to our Genie lift's cage when it's airborne, we use Petzl's Absorbica-I single lanyard with a compact, integrated energy absorber. This lanyard is longer than the one in the rope setup and allows for more freedom to move around while working. We clip it on to our front attachment point.

TWO-ROPE POSITIONING SYSTEM

We often employ a two-rope positioning system, which allows us to lean against our ropes and work with both hands free. In addition to the fall-arrest lifeline, we install a second, separate rope and anchor setup, along with a self-braking descender. We use Petzl's RIG Compact self-braking descenders, which allow you to ascend, descend, and lock yourself into a secure position. This piece of equipment was a game-changer for us.

If you are interested in using this gear, I recommend learning as much as possible before employing it in the field. Petzl has an excellent website with lots of informative videos to get you started. Always use the fall-arrest and work-positioning equipment as the manufacturer has intended—working at heights is no joke.

Eliot Lothrop operates Building Heritage, specializing in timber-frame restoration, in Huntington, Vt.

Safe Paint Removal

BY TOM O'BRIEN

I hate the RRP. There, I said it.

Count me among the thousands of remodelers who have griped about the difficulties of complying with the EPA's Renovation, Repair and Painting Rule since it was implemented in 2010.

I'm not just whining from a builder's point of view. When not swinging a hammer, I research and write on construction-related topics. I also live with my wife and son in a 1903 Queen Anne Victorian that we've been restoring since he was a baby, so the dangers of disturbing lead-based paint (LBP) are very real to me.

I've written many articles for *JLC* and other publications that explain the effects of lead poisoning on young children as well as on workers (see "Working Lead Safe," Jun/2016), and the requirements of the RRP Rule (see "Lead Safe Paint Removal," Mar/2011.) For research purposes, I've also sat through as many as 10 RRP classes over the years. And at the end of each one, I always felt like a survivor of a "Scared Straight" prison program.

Europe began outlawing LBP more than a century ago, but the U.S. didn't get around to it until 1978. In my opinion, it is a problem created and perpetuated by big industries (like galvanizing plants and coating manufacturers) and left for the little guy (building remodelers) to clean up or face the possibility of a $37,500 fine for each violation of the RRP protocol.

Nevertheless, the effects of lead poisoning are very real. I hope for the day when medical researchers achieve a breakthrough that enables the body to differentiate lead from nutrients such as calcium and magnesium. Until then, it's incumbent upon all of us who must disturb a painted surface in the course of our work to first do no harm.

Thankfully, technological solutions that enable us to strip paint without releasing dust or toxic fumes continue to improve. I was delighted to have the opportunity to try out a Speedheater Cobra, a new offering from the Swedish company that introduced low-temperature heat stripping to the U.S. more than a decade ago.

IR PAINT STRIPPING

Like its older brother, the Speedheater 1100 (see photo 1), the new Cobra uses infrared (IR) radiation to separate multiple layers of paint from the wood substrate. Compared with torches or heat guns, IR paint strippers operate at significantly lower temperatures (200°F to 400°F) that won't vaporize harmful chemicals such as

The original Speedheater 1100 is particularly well suited for stripping paint from flat surfaces **(1)**. The new, compact Speedheater Cobra **(2)** is designed for smaller surfaces. The heating element does not get as hot as a torch or heat gun, but caution still applies. Electrical tape on the power cord and melted portions of the metal shroud clearly show the need to be careful when setting the tool aside during use.

Photos by Tom O'Brien

The Cobra directs concentrated infrared radiation over a small surface area, making it an excellent tool for window work **(3)**. The compact heating element proves especially effective at softening glazing putty **(4)** to the point where it can be easily peeled away from the window frame **(5)**. (Note: while not required on this job, aluminum foil can be used to shield historic glass.)

lead, or pose a fire hazard—if used as directed.

I bought an 1100 way back in 2004, and it quickly became my go-to for stripping paint from broad surfaces, such as clapboards and baseboards. But the 1100 is bulky, and not quite as effective at softening layers of old paint that have taken refuge within inside corners and the crevices of moldings.

The Cobra is smaller and lighter than the 1100 and features a compact, shrouded heating element that focuses the radiation on its intended target almost like a laser beam.

I tested this tool on flat surfaces, various molding profiles, and a few windows I was restoring at the time, all of which were heavily paint-encrusted. It was remarkably effective, but not until after I mastered the learning curve.

The manufacturer's instructions clearly state that one to three seconds heating time is all that's needed to prepare a typical painted surface for scraping. And they warn that "excessive heating can potentially mar the wood, release toxic fumes, and start a fire."

What worked for me was to hold the Cobra in one hand (fingertips grasping near the neck, as if it were a pencil) and a sharp, pull-type scraper in the other. I'd hover the face of the heating element about an inch over the doomed paint until it began bubbling and smoking, then slide the heater to the next section of paint and scrape away the debris. With practice, I was able to keep the heater and scraper moving across the surface in a fluid motion.

When I reached the end of the line, I learned the hard way that it was crucial to have planned for a safe, fireproof, parking spot for the tool. One time I set it down too close to the 6-mil poly I was using for ground cover; another time I held it off to my side, heating element facing the ground, while I momentarily finished scraping a corner, and inadvertently melted the insulation on the power cord.

On flat surfaces, the Cobra proved adequate but slower than the 1100 (because of its much smaller heating element). It worked well for stripping paint from intricate, profiled surfaces, such as moldings, spindles, and balusters (as long as the scraper blade was a good match for the profile), but it excelled at restoring window sashes. The heating element was perfectly sized for stripping the frames, and it softened rock-hard glazing putty better than anything I've ever tried—I found that after two careful passes of heat over the surface, the putty came off as easily as if it were DAP right out of the can.

Tom O'Brien is a freelance writer and a restoration carpenter in New Milford, Conn.

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BY MELANIE HODGDON

Empowering Employees to Earn Without You

One of my clients was recently pulled off a job to deal with a serious family issue. It's a small company, and though he's the owner, he still puts on his toolbelt. In his absence, his one helper dutifully showed up for work—but was unable to accomplish anything. Because he showed up, he was paid, and because he didn't perform any billable work, the company made nothing those days. This situation can occur whether it's a small, two-person operation or a multimillion-dollar company with a dozen production workers. What's tragic is that it's avoidable.

This problem often occurs because a contractor exhibits one or more of the following characteristics:

Sole decision maker. Nothing happens without his direct involvement and authorization.

Most qualified carpenter. Anything requiring advanced skills must await his personal input.

Lacks detailed plans. The owner may think through all the decisions and find solutions, but he keeps them all in his head. Since employees aren't mind-readers, this requires the owner to communicate clearly.

Poor trainer. The crew is stuck with observing and trying to pick up skills as they go, or guessing what tomorrow's objectives will be. Sometimes they get it right, but they live in a gray world of uncertainty that drains confidence and motivation.

Control freak. The crew is standing around doing nothing while the business owner lays things out, figures out problems (often because of incomplete plans), and performs the "difficult stuff" rather than invest in training his crew so they can perform billable tasks at the same time.

No matter how friendly the owner may be with the crew, they still have to wait around for decisions, for instruction, for leadership. This creates resentment among crew members looking for challenges and a chance to advance, and complacency among those who are content to just hang around and get paid for it.

LETTING GO

The way to avoid all of this starts with recognizing these characteristics in yourself. Ask yourself: What if you are disabled or otherwise prevented from working? How would this impact your family and your employees? Your reputation? Next, look at what's preventing you from letting go. Are you so busy putting out fires that you don't feel you have the "leisure" to stop and train somebody to do what you're doing? While you're pondering the answers, think about this: What is the likelihood that you can expand your business if everything revolves around your personal involvement? If you don't want to be crawling around on rooftops in your 60s, exactly when do you plan on transitioning?

If you are honest with yourself and acknowledge that you don't have the patience or communication skills necessary to impart your skills to others, look to other resources. Can a local technical college provide courses for workers? What about professional organizations that offer training programs for everything from green building to lead carpenter certification? (A bonus: Having certified workers may differentiate you from potential competitors.)

What is the likelihood that you can expand your business if everything revolves around your personal involvement? If you don't want to be crawling around on rooftops in your 60s, exactly when do you plan on transitioning?

No matter what, you will need to let your crew work *on their own.* You, of course, need to supervise and check on them. But then get out of their way! They will make mistakes. Be there to support them. Mistakes happen. The important question will be what does the employee need to keep from making the mistake a second time?

Also keep in mind that although a worker may not accomplish a task in the exact way that you would have, it's still a viable solution. Be open to new approaches based on new technology and research that may have passed you by. This especially applies if your skills are 20 to 30 years old. None of this will be easy if you are truly a control nut. But if you want to grow a sustainable business and a stable, contented, qualified, and engaged workforce, you don't have much choice.

Melanie Hodgdon, president of Business Systems Management, based in Bristol, Maine, provides management consulting and coaching for contractors.

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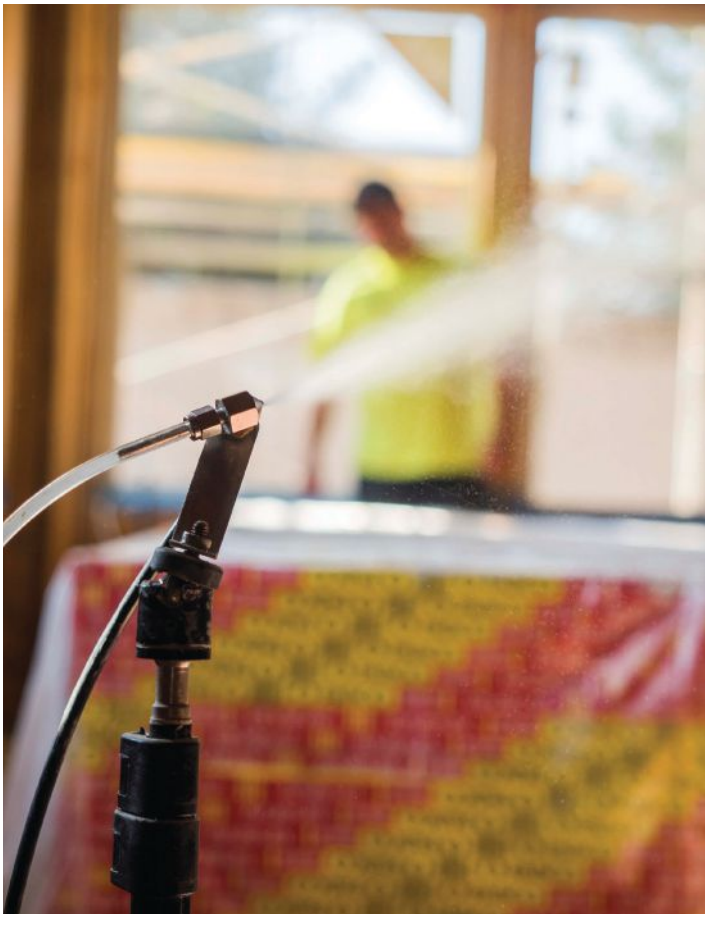
BY TED CUSHMAN

A Game Changer for Airtight Construction?

Nozzles inject AeroBarrier adhesive sealant into the air of a building under 100 pascals of pressure, along with humidity and heat. The caulking builds up and coagulates at air-leakage points, sealing small holes in minutes.



Photos courtesy AeroBarrier

It's rare for one innovation to transform a whole industry. But a new air-sealing technology called AeroBarrier may be poised to do exactly that for energy-efficient homebuilding in the United States.

In a time when production builders are struggling to make their houses airtight enough to meet the 3 or 5 ACH50 requirement in the latest energy codes, AeroBarrier, a simple system that blows a fog of caulk into the house while a blower door puts the building under pressure, has demonstrated the ability to bring a building from 15 air changes an hour down to less than one—in just a few hours and at a cost of around $1,000 per house.

For the most advanced builders, this puts the 0.6 ACH50 Passive House standard within easy reach. For mass-market production builders, it makes meeting (or beating) code a no-brainer. And for the remodeling industry, it means that even if an existing house is fully drywalled and finished, airtightness to rival the performance of well-built new homes is within reach, without the cost of demolition or reconstruction.

Automated air-sealing. The concept of aerosol air-sealing isn't new. Weatherizing contractors in the U.S. are already familiar with a duct-sealing technology called AeroSeal, marketed by the same company that developed AeroBarrier. AeroSeal works by injecting a fog of adhesive caulking into the duct system as you pressurize the ductwork using a Duct Blaster fan. As air pressure pushes the aerosolized sealant out through cracks and gaps in the ductwork, the goo coagulates at the leak points and seals the holes. AeroBarrier, introduced to market at the International Builders' Show in Orlando, Fla., in January of this year, applies the same one-shot air-sealing concept to an entire building.

Mandalay Homes, a production builder based in Prescott, Ariz., volunteered a year ago to be AeroBarrier's guinea pig, testing the system out on dozens of houses. According to Geoff Ferrell, chief technology officer for Mandalay, his crew has been able to reliably bring houses down to 0.3 ACH50, time after time.

JLC met with Ferrell at the Builders' Show in January and spoke with him again on the phone last month. As of February, Ferrell told us, Mandalay's in-house AeroBarrier application crew has 77 jobs under its belt.

While a blower door pressurizes the house, emitter nozzles pump a fog of acrylic sealant into the building air. Walls can be exposed sheathing (above left) or finished with drywall (above right); either way, the aerosolized sealant flows out through any air leaks and coagulates on small openings as it encounters a reduction in temperature and humidity.

"We've been actively spraying AeroBarrier in all our homes since July 26 [2017]," said Ferrell, "and the system has worked every time."

A fog of warm clog. "The beauty of AeroBarrier is how simple it is," said Ferrell. "Basically, it consists of three things. There's a blower door to pressurize the house; there's a computer-controlled pumping system that pumps the product into the home; and then there is a series of nozzles—typically between six and eight, depending on the size of the house—that aerosolize the product in the home. All of that is driven from a support trailer that has a generator for power, and a compressor for compressed air."

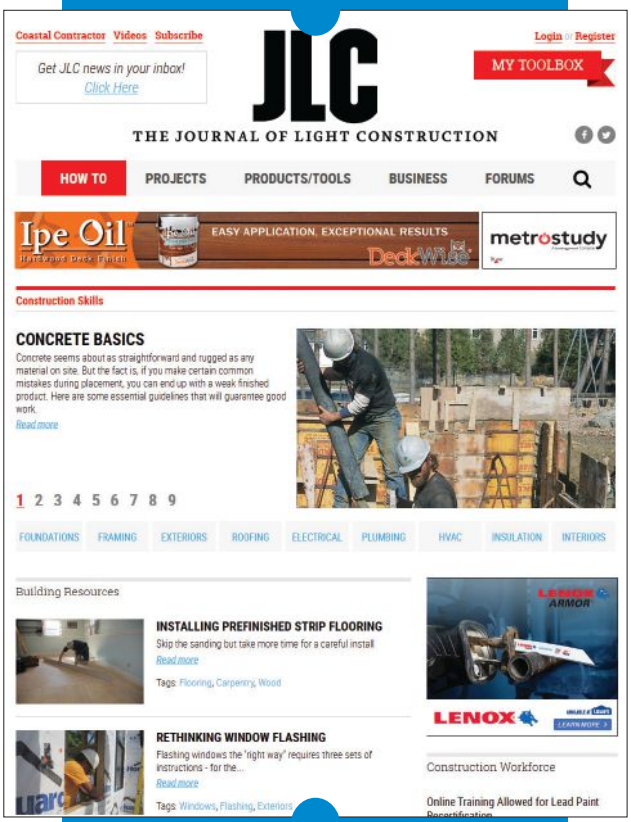
"When you pressurize the house to 100 pascals with the blower door, the house leaks," Ferrell explained. "Everywhere it's leaking, air is escaping. And once you aerosolize the AeroBarrier product into that shell, that product is leaking along with the air. The rig keeps the inside of the house warmer and more humid than it is outside, and when the fog hits that temperature and humidity differential, the product starts to gel, and it slowly builds up on itself.

"So if you have a crack between two 2x4s, or in a corner, you'll see the product build up on itself until it seals that leak, and it stops leaking—completely. At all those little spots you don't even know are leaking, that product is collecting and sealing it off." According to AeroBarrier, the process works on holes and gaps as wide as a half inch.

The sticky goo will clog any opening, Ferrell pointed out, so it's important to mask off any element you don't want sealed. "We've accidentally missed a bath fan or two," he said, "and you get in there afterwards and that whole thing is sealed shut."

Calibrated control. Applicators monitor the process using a laptop, said Ferrell. "You watch the blower door," he explained. "So you start at 4 or 5 ACH50, or whatever it is. And as the house leaks less and less, that blower door scales back the airflow to maintain 100 pascals of pressure. You see it on a graphic display in real time—the leakage rate going from 4 or 5 ACH50 down to two, down to one, down to a half, down to 0.3 or whatever—wherever

JLC



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we decide enough is enough [see chart, facing page]. And as you get lower and lower on that scale, your sealing slows down, because the air is leaking less. So it takes more time to seal up those last few tiny cracks."

Mandalay was building tight homes before the company began to spray AeroBarrier, said Ferrell. "We use open-cell spray foam for walls as well as for our sealed cathedralized attics," he explained. "Our company average for the previous two years, prior to AeroBarrier, was about 1.45 ACH50. And we were happy with that; but the problem was consistency. We would accidentally hit 0.8 ACH50 on some homes, but then we would accidentally have 2.0-plus ACH50 on some homes. AeroBarrier has helped us go from 1.5 ACH50 down to finish numbers of 0.5 or 0.6 ACH50 on our final test. That's almost 300% tighter. But it has also given us consistency. And we know as soon we are done applying AeroBarrier how tight that home is, because the computer has been graphing it the whole time."

Testing in, testing out. From experience, Ferrell said, his team knows what to expect as a pre-AeroBarrier blower-door test value. They use that knowledge as a pre-treatment screen for problems, he explained: "When we first turn the blower door on and get our initial leakage level, if it's a unexpectedly high number, we go in the house before we start spraying the product and look for obvious holes. So if somebody poked a hole for a wire, or we missed something on an outside wall around an outlet, you can hear the air whistling through it when you're at 100 pascals. So we plug those big leaks with some canned foam before we start the AeroBarrier process."

AeroBarrier seals everything, noted Ferrell—even the gaps around operating window lights. "No window is perfect," he said. "Especially a single-hung or double-hung window—they will leak a little bit of air where those sashes meet. And during the AeroBarrier process, those cracks get sealed. So when we are done sealing the house, we shut down the system, then we go through and make sure to operate every single window and door, to break those seals. And then we close all the windows and doors back up, turn the blower door back on, and retest the house. We want to know how much our houses leak with operable windows in them."

Interestingly, this step lets Ferrell know exactly how leaky his windows are. "So far," he said, "27.42 cfm per house is our average leakage attributable to windows."

Six or eight weeks after the AeroBarrier job, when Mandalay's HERS raters come in to audit the completed house, Ferrell can compare the final value with the record from the home's AeroBarrier printout. "If that number's much different," he said, "we know a change has happened, and it's easy to troubleshoot. Usually if I call the super and tell him we're seeing an unexpectedly high number, he'll remember—'Oh yeah, they stuccoed over an exterior outlet and we had to dig it out,' or whatever. So then we can go back and do a surgical strike on that leak."

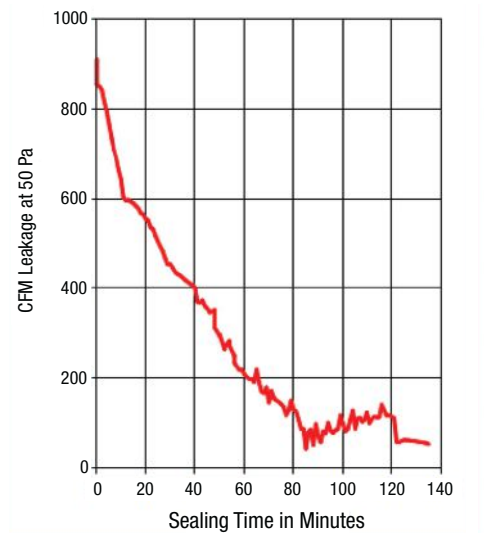
Townhouses and retrofits. *JLC* spoke by phone in February with AeroBarrier's manager of business development, Paul Springer, who was demonstrating AeroBarrier on site at a multifamily project for a production builder in Maryland. In this townhouse, Springer explained, drywall was already up—because that was the most practical way to button up the party walls between units. "Sealing those party walls is the hardest part for multifamily builders," said Springer.

Not every builder wants a squeaky-tight home; at this townhouse job, the airtightness goal was 3.0 ACH50. That way, Springer explained, the unit wouldn't be required to have mechanical ventilation. "Whatever it is that you need to hit, we know what it is in real time, so we just turn the system off," Springer said. "We guarantee it. And we give the builder a certificate of completion."

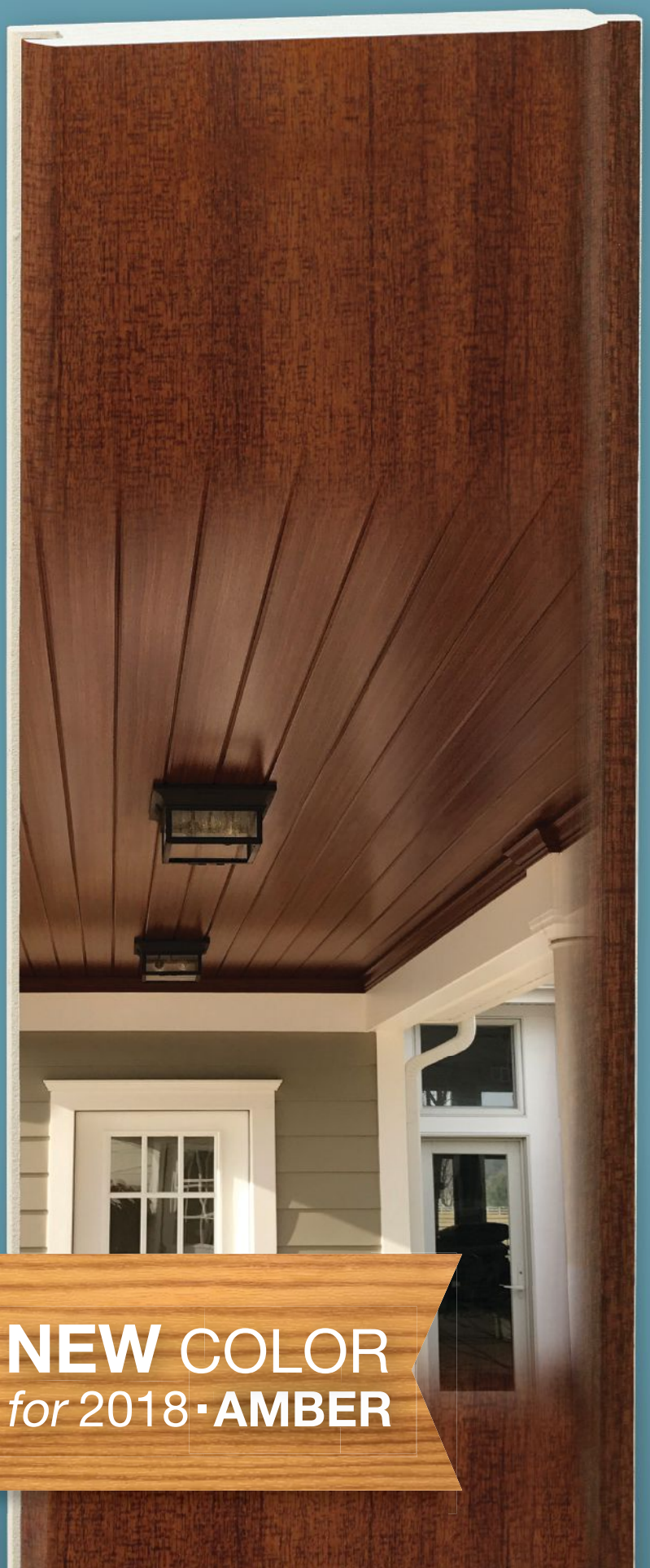
In retrofit situations, Springer said, the job can be sprayed at any point: The building could be completely gutted, completely insulated and finished, or anything in between. "As long as you can pressurize the space, we can seal it."

Following the January launch, Springer said, AeroBarrier is focusing on growing its market. "We are actively building out our network," he said. "People that want to do the work, we're talking to them. Builders that want to engage with it, we are talking to them. We are not turning anybody away."

Ted Cushman is a senior editor at JLC.



AeroBarrier's operating software lets technicians follow progress in real time as the home gets tighter, and also lets them stop the job as soon as the home reaches the builder's airtightness target. A printout (example above) documents the results.



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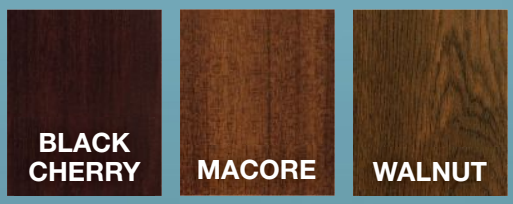

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Photos by Bryan Striegler

Paint-Grade Paneled Ceilings

Think in layers to create a striking overhead finish

BY GARY STRIEGLER

Detailed finish work on a ceiling is one of those elements that can set you far apart from other craftsmen, and it's one of the upgrades my clients most frequently request. Over the years, I've developed a design that I call a paneled ceiling, which is easier to install and more adaptable to the large, open spaces in today's homes than a traditional coffered ceiling.

Coffered ceilings typically consist of deep beams that divide the room into nine square sections with a partial beam running around the perimeter of the room. The tall sides of coffered ceiling beams can be made out of baseboard or flat finish material with panel molding added for detail. Sections of a coffered ceiling don't have to be the same size, but they are usually close to square, which means that the room—such as an office or a formal dining room—should also be close to square for the proportions to look right.

The paneled ceiling treatment that I describe in this article will work in almost any rectangular room. It still uses major beams that run across the shortest dimension of the room, but those beams are less than half as deep as the typical coffered ceiling beams. Secondary, or minor, beams running perpendicular to the major beams divide the ceiling into rectangular sections.

Preassembled panels then fit into this beam grid and all of the layered components join together with molding. The trick is having


1


2


3


4

After laying out the grid for the paneled ceiling on the floor, the crew transfers the layout to the ceiling and snaps chalk lines **(1)**. A 2x6 nailed to the ceiling supports the perimeter beam **(2)**. To attach the major beams, plywood nailers span between the joists **(3)**. Two rows of 2x4s have to notch around the nailers; here, a crew member lays out the notches **(4)**.

a plan for how the layers stack in place. No two projects are exactly the same, but I like to use a printed "inspiration picture" to keep everything straight. If you need more than a picture, it might be a good idea to mock up a small corner section to see how the layers stack up where all the components meet.

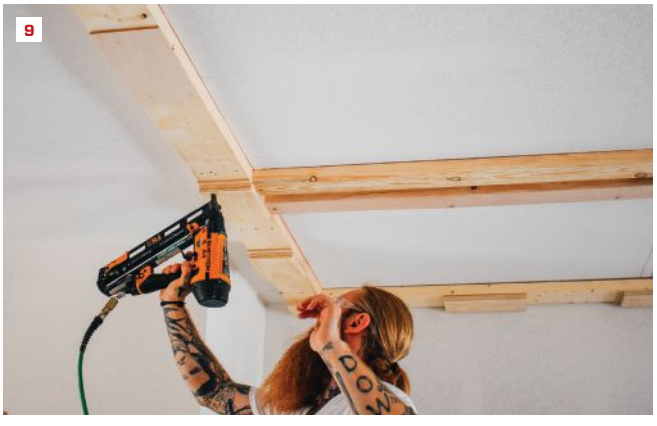
DO THE INITIAL LAYOUT ON THE FLOOR

For a project like this, the layout is a crucial first step. I try to start the layout on the floor so I can work out the measurements and layout for the whole ceiling without needing an extra person to hold the other end of the tape. Once I am satisfied with the locations of the major and minor beams, I have someone help me transfer the measurements to the ceiling and snap chalk lines for the layout **(1)**.

I always keep both red and blue chalk line on hand in case I need to tweak the layout, especially to accommodate items such as existing ceiling lights and HVAC duct vents. On this project, I could not get the layout to work with the locations of the can lights, which had been air-sealed in place with foam. So, reluctantly, we decided to abandon the cans and replace them with low-profile LED disc lights that could be attached to electrical boxes cut into the beams.

BUILDING THE MAJOR BEAMS

We decided to make the beams along the perimeter of the room 5½ inches wide, so we nailed 2x6s to the ceiling as the attachment layer **(2)**. The major beams running across the middle of the room were 9 inches wide; for their attachment, we used two lengths of 2x4s with a 2-inch gap between them. But the major beams ran parallel to the ceiling joists, so we had to come up with



Multiple 3/4-inch-deep cuts on a miter saw create the notch **(5)**, and a chisel removes the waste **(6)**. After glue is applied to the face of the notched 2x4s **(7)**, they are tacked to the plywood nailers **(8)**. The crew drives screws in to complete the installation. Lengths of 1/4-inch and 3/4-inch plywood stack below the beam framing to create the proper depth **(9)**.

a way to attach the 2x4s to the ceiling. As a solution, we installed 3/4-inch plywood nailers that spanned between the joists **(3)**.

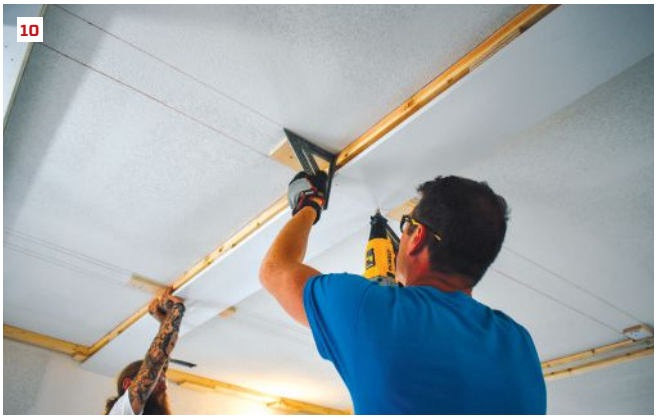
Then we needed to notch the 2x4s to fit around the plywood nailers, so we held the 2x4s in place and marked out roughly where they crossed the nailers **(4)**. At the workbench, we set the depth of the miter saw blade to 3/4 inch and made several passes through the framing lumber between our marks **(5)**. We removed the scrap wood and cleaned up the notch with a chisel **(6)**. To mount the 2x4s on the ceiling, we first spread glue on the faces of the framing **(7)**, and then tacked them to the nailers **(8)**. We drove 2-inch screws at each joint to tie the assembly together.

For the final trim details to end up with the proper reveals, we had to create the correct vertical drop for the beams. The bottom surface of the beams would be 3/4-inch-thick material, and we determined that the major beams and perimeter beams would need to be padded down a total of an inch. So we added layers of 1/4-inch and 3/4-inch plywood blocking every couple of feet along all the framing for the perimeter beams and the major beams **(9)**.

With the framing and padding in place, we added a layer of 3/4-inch-thick primed pine ripped to a width of 9 inches for the bottom surface of each major beam. As we nailed the pine in place, we were careful to keep it lined up with the blocking above **(10)**. For the perimeter beams, we used the same material, fitting the pieces between the major beams.

LOCATING LIGHTS

As mentioned before, we had to relocate the light positions. The 2-inch space between the 2x4s supporting the major beams was perfect for running electrical cable. So that each fixture would fall precisely at the intersection of the major and minor beams,



Primed pine 3/4 inch thick makes up the bottom surface of the major beams. The bottom of the beam must align with the framing above **(10)**. To locate lights in the beams, the author first takes a precise measurement from the wall **(11)**. The hole for the electrical box is cut with a large hole saw **(12)**. The crew then installs the board with the wire lead through the hole **(13)**.

we first measured out the distance from the wall to the center of the fixture **(11)**. Next, using a 4-inch hole saw, I carefully drilled the hole in the pine board for the pancake electrical box **(12)**. (Our electrician assured us that pancake boxes would be adequate for the low-profile LED fixtures). We then fastened the board in place with the supply wire led through the drilled hole **(13)**.

BUILDING THE PANELS

The next step was building the ceiling panels. My design called for the frames for each panel section to be 3 1/2 inches wide and made from 3/4-inch pine. I planned to space the panels 2 inches from the major beams and from the wall beams, so we marked the layout from the major beams and perimeter beams with a 2-inch block **(14)**. The minor "beams" would also be 3/4-inch pine, but would be 5 1/2 inches wide; they would bridge between the panel sections and lap over them by 1/2 inch. That meant that we needed to leave a 4 1/2-inch space between the panel sections, which was the spacing of the lines we'd snapped on the ceiling earlier.

After taking careful measurements, we started building the frame-and-panel sections. We made single-panel sections for the ends of the room and double-panel sections for the middle of the room. We cut all the parts for the frames using a miter saw with a very accurate stop system for fast, repetitive cuts that made the frames identical. I ripped the frame pieces from wider boards and I ran them on edge through a planer to ensure that they were all exactly the same width **(15)**.

For speed and strength, I used pocket-screw joinery to assemble the frames **(16)**, and then glued and stapled 1/4-inch plywood to the back of each frame for the panel faces. We trimmed the inside edges of each panel with a Kuiken Brothers panel-molding





A 2-inch-wide block sets position for the edge of the panels **(14)**. A planer makes the panel-frame pieces exactly the same width **(15)**. The author pocket-screws the frame together **(16)**. After gluing and stapling 1/4-inch plywood to the frames, he installs panel molding around the frame **(17)**. Crew members hold the sections in place while nailing them to the ceiling **(18)**.

profile (KB 242). Because the frames were identical, I cut the panel molding to fit inside each frame using the same stop system on the miter saw, and then glued and nailed the pieces in place with headless pins **(17)**.

SETTING THE PANELS

At this point, we had the major beams completed to the bottom surface along with the perimeter beams that ran parallel to the major beams. The design called for a run of single-width panels between the perimeter beam and the first major beam, so we filled in that run of single panels starting at one end of the room and installing them on our layout lines.

Working overhead, a second crew member was a huge help holding the panels against the ceiling while I aligned and fastened them. This was especially true with the double-width panels that were heavier and more unwieldy. Positioning the panels in both directions was also tricky, but wherever possible, I used a spacer to keep the panel positioned in one direction while I lined up the panel in the other direction and nailed it through the ceiling drywall and into the joists **(18)**.

THE IN-BETWEEN LAYER

Next, we had to add the layer of finish that stepped down from the frame of the installed panels to the bottoms of the major beam. As with the previous layers, this intermediate layer was made of 3/4-inch pine. Along the major beams, this layer was a strip of pine 2 1/2 inches wide. When butted against the framing for the major beams, the strip overlapped the panel frame by 1/2 inch.

Before we could install this strip, we needed to install blocking for nailers in the space between the panels and the major beams.

Nailing blocks fill in between the panels and the major-beam framing **(19)**. A 2 1/2-inch strip nails in along the major beams to create the intermediate layer **(20)**. Pieces of pine 5 1/2 inches wide span between the panel sections for the minor beams **(21)**. A crew member drives nails in the corner to keep the minor beams aligned with the 2 1/2-inch strips **(22)**.

We ripped 1-inch material for the nailers that was equal to the total thickness of the panels: 3/4 inch for the pine frame plus the 1/4-inch plywood stapled on back. We installed the nailers every couple of feet, gluing and tacking them in place **(19)**.

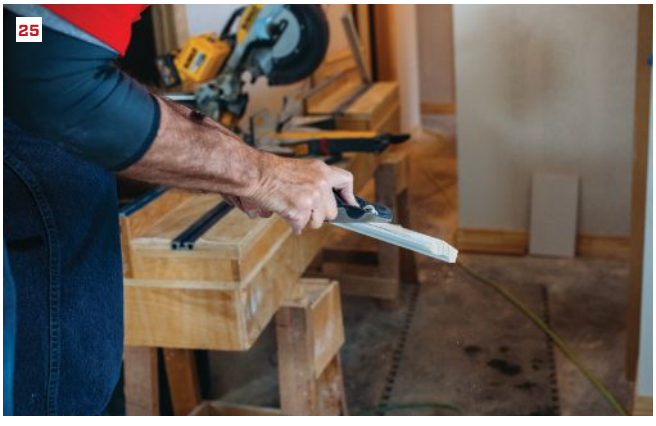
After the nailers were in place, we put in our 2 1/2-inch-wide strips of pine parallel to the major beams and lapping onto the panel frames **(20)**. Because we could not get material long enough for entire runs of the 3/4-inch stock, we used 45-degree scarf joints to add the extra length. We located each scarf joint at a nailer, carefully gluing and nailing in the filler pieces.

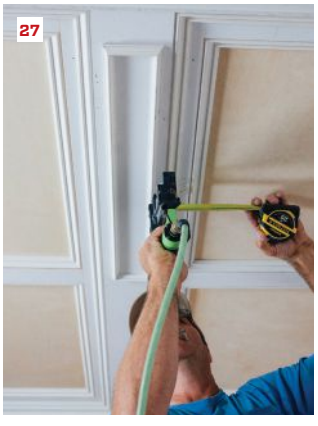
To complete the intermediate layer, we added the 5 1/2-inch-wide minor-beam pieces that fit between these strips **(21)**. These pieces also lapped 1/2 inch onto the panel frames. To make the minor-beam pieces perfectly in plane with the 2 1/2-inch strips, we flushed them at each corner and drove pins to hold them even **(22)**. At the end walls, where there were no minor beams, we simply ran additional 2 1/2-inch strips between the strips along the major beams.

ADD THE TRIM

With a project like this, I am always anxious to see what a finished section will look like. It probably isn't the most productive way to work, but I feel like a kid on Christmas morning, so I had the crew jump ahead and install the moldings to finish the first sections we had installed.

We used two runs of molding to complete each paneled section. Working down from the ceiling, the first run of molding sat below the paneled frames and butted against the edges of the 2 1/2-inch strips in one direction and against the minor beams in the other direction. For this run of molding, we used the same panel molding profile that we'd used on the panels **(23)**.





Panel molding transitions from the framed panels to the minor beam **(23)**, while a bed molding transitions between the minor-beam and major-beam layers **(24)**. To ensure that the reveal at the bottom of the bed molding stays consistent, the author scribes and planes problem areas **(25)** before nailing them into place **(26)**. Panel molding dresses up the bottoms of the minor beams **(27)**.

The second molding layer was actually a bed molding profile (KB 319) that nailed to the edge of the major beams at the bottom and butted against the face of the 2 1/2-inch strips at the top **(24)**. With the material thickness and blocking, there was a 1 1/2-inch difference in height between the two layers. To create a 1/8-inch reveal at the bottom of the bed molding, I chose a profile with a height of 1 3/8 inches.

This height worked fine for most of the ceiling except in one area where the ceiling height dropped slightly, making the reveal disappear. Because that bottom reveal is critical to the visual success of the molding, I scribe-fit the molding in this area, planing enough off the top of the bed molding to maintain an even reveal **(25)**. The difference at the top of the bed molding was barely noticeable, and I was then able to nail in the molding in place with none but the sharpest eyes able to pick up on the tweak that I'd made **(26)**.

I've occasionally been accused of gilding the lily, and the paneled ceiling would have been fine with the bottom surfaces of the beams left unadorned. But I opted to dress up the minor beams with surface-applied panel molding (KB 654). We cut and built the rectangular assemblies on the workbench, gluing and pinning the joints. We had to cut only two lengths of panel molding, so we mass-produced the pieces for these assemblies using the stop system on the miter saw. Next time I do a paneled-ceiling project like this, I may try attaching the panel molding to each minor beam section before it is nailed into place. This time around, we just measured carefully to make sure everything lined up before we nailed anything in **(27)**.

Gary Striegler owns Craftsman Builders, in Fayetteville, Ark., and teaches workshops at the Marc Adams School of Woodworking. His website is craftsmanbuildersnwa.com.

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Working With SmartSide

Making the switch from fiber-cement to an engineered-wood siding

BY TIM UHLER

Photos by Tim Uhler and Kyle Davis

The first article I wrote for *JLC* was about installing fiber-cement siding (see "Installing Fiber-Cement Siding," Dec/03). We started using fiber cement in the late 1990s, after LP's InnerSeal, the siding we had previously used, became the focus of a class-action lawsuit. At the time, fiber cement was really the only alternative to LP's product, other than wood siding, which was more expensive and requires considerable maintenance on homes in the Pacific Northwest where we build.

We installed fiber cement on our homes until 2009, when we switched to LP SmartSide. There were many reasons we switched, but a primary one concerned the warranty. When we first started using fiber cement, the warranty was 50 years, but by 2009 that warranty had been downgraded to only 30 years. SmartSide offers a pro-rated 50-year warranty. While many will argue about the actual value of a "pro-rated" warranty, the strength of a warranty is mostly in what it says to our customers at the time of sale. We have never actually had to act on a warranty claim. What does matter is the customer's perception of how a manufacturer stands behind a product.

There were a number of other reasons for switching away from

Sealing cuts. All cuts, rips, and end cuts need to be sealed. If the siding boards are acclimated, the author hits the edges with spray-on primer, such as Zinsser Bulls Eye 1-2-3 Plus **(1)**. If the wood needs to acclimate, or if the weather is wet, the author will install the siding first and caulk the gaps later **(2)**. LP's instructions call for an ASTM-C90 minimum Class 25 sealant; the author uses OSI's Quad Max **(3)**.

fiber cement. The weight, shorter lengths, difficulty cutting the material, and the relative fragility of the material all led us to try LP SmartSide. Some performance issues also gave us pause. We were repairing fiber-cement siding frequently on houses we had built in golf-course communities because of damage from golf balls. In addition, we'd noticed that fiber cement seems to become brittle on the wall and is very easy (too easy it seems) to remove. I recently had to remove siding from one wall to fix a leak and no matter how careful I was, the siding broke and crumbled as I removed it.

By far the biggest drawback of all is what it takes to manage the dust from cutting fiber cement. As I wrote in 2008, we used both aftermarket vacuum attachments and circular saws with built-in attachments (see "Cutting the Dust From Fiber Cement," Sep/08). We also used the Ridgid R3400 saw, which was designed specifically for cutting fiber cement, and it worked well for us for years before it was discontinued. In practice, all these solutions for cutting fiber cement were burdensome. Shears probably work best (no dust), but you can cut only one piece of siding at a time, which is slow. Now that OSHA's silica rules, which apply to the installation of fiber-cement materials (see *Toolbox*, page 65), have gone into effect, we are unlikely to go back to using fiber cement anytime soon.

The only benefit of fiber-cement siding that LP SmartSide cannot match is how it performs in fires. This could be a concern for builders in rural settings far from emergency services or in areas where the risk of wildfire is high. For us, however, neither of those conditions apply.

WHAT IS SMARTSIDE?

Before we decided to use this product, I did a lot of research to find out what made SmartSide different from InnerSeal, which

Devil's in the details. SmartSide can move and squeeze out caulk at butt joints. To avoid this, seal the butt joints with H-Moldings **(4)**. These are still noticeable, but vastly better looking and more durable than ridge lines of caulk **(5)**. At corners, the author prefers "spider catcher" downboards, which protect the siding ends **(6)**. Kickout flashings are a must; a 2-by on the roof is used to butt siding pieces to create a 1 1/2-inch gap at the roofline **(7)**.

had failed and resulted in lawsuits. I should note that in drier climates, InnerSeal did not have problems, and in fact, I just inspected a building in my region that was sided with InnerSeal in 1994, and it is in very good shape.

InnerSeal was a first-generation manufactured-wood siding product—more of a waferboard material than anything else. SmartSide is much more engineered; it's not simply commodity OSB with a surface finish, either. SmartSide starts as fast-growing aspen logs that are turned into wood strands that are then coated with a mixture of resin (to bind the strands together), wax (to resist moisture), and zinc borate (to resist fungus growth that can lead to rot).

The strands are much smaller than in commodity OSB, so there is a proportionally higher resin content. These strands are placed in layers, with the top and bottom layers oriented for strength in the long direction. The thick mat of coated strands is covered with an overlay of resin-saturated paper, and the entire composition is pressed together at intense pressure (on the order of 2,200 psi) and temperature (425°F). The result is a wide, flat panel that is then ripped into either lap siding or trim boards.

Product line. In addition to lap siding, we regularly use the vented and unvented soffit material that comes in 16-foot lengths and 12-inch, 16-inch, and 24-inch widths. We have also used the 4x8, 4x9, and 4x10 sheets for board-and-batten applications and for soffits.

We recently tried the "fiber line" of trim for windows and corner boards, as well as Perfection Shingles. The shingles install quickly, as they come in panels 8 inches tall by 4 feet long. The "fiber" product has the same warranty as the strand product, but we have been paying more careful attention to priming the "fiber" product.

Ribbon boards serve as a visual element that helps define gable ends. Here, the author packs out a trim board with OSB ripped narrower than SmartSide Trim boards so the bottom edge of the ribbon overlaps and protects the siding board below it **(8)**. The top of the ribbon needs a Z-flashing **(9)**, which must be integrated with the Zip System WRB, using Zip Tape. Like all adhesive flashings, this needs to be rolled to ensure a tight, lasting bond **(10)**.

PRODUCT QUESTIONS

We did have some initial concerns with SmartSide. First and foremost, was this product going to have issues like InnerSeal did? Second, what would our customers think? And third, how would the installation costs compare with those of fiber cement?

After extensive research, I have yet to find an inherent problem with SmartSide. It seems to have a solid track record as reported by others since it came to market in 1997. Like all products, if it is not installed according to the instructions, problems will occur. We have been careful to follow all manufacturer instructions and have had no problems over the course of the nine years we have been using it.

As far as our customers or real-estate agents are concerned, we haven't had any problems. We explain the reasons for the switch, the warranty, and our experience repairing it. The instructions for installing fiber cement have also changed quite a bit since we started using it. I know one sider who keeps every set of instructions and their dates in case of warranty claims. We have had two customers since 2009 insist we use fiber cement, so we went ahead and installed it for them.

INSTALLATION

Our installation costs have gone down because this product installs more quickly and is easier to handle than fiber cement. But like all products, the devil's in the details. LP has done a good job of making its installation instructions "readable" using illustrations. It also has useful installation videos on its YouTube channel.

All cut ends or rips need to be painted with 100% acrylic latex paint or sealed with caulk. If the siding is acclimated, we seal as we go, typically hitting ripped edges with a spray primer. Instructions call for an "ASTM-C920 minimum Class 25" sealant; we use OSI's

Helpful jigs. The author depends on two jigs made PacTool. The Gable Slide easily adjusts to the rake angle of the gable end **(11)**. Here he's using it to find the angle for the last piece of the ribbon board **(12)**, but that same angle will be used for all the siding that fills in the gable end, as well. The Gecko Gauge, to the right of the author in the photo **(13)**, holds a long run, making it easy for one person to install long lengths of siding.

Quad Max. While it does take time to seal cuts, it isn't a problem once you're set up for it.

I was taught to keep a 1-inch clearance between any siding and step flashing along the roofline. While this is allowed with SmartSide, we have found it easier to use 2-by material to keep the siding 1½ inches off the roofline. We define the angle using PacTool's Gable Scribe and gang-cut six pieces (one bundle) at a time for the rake cut. We can the seal the cut ends of the entire bundle at once.

Our roofers always install large kickout flashings, which are somewhat annoying to side around. But the kickouts are important for directing water into the gutter and away from the wall.

A 3/16-inch gap must be maintained at all butt joints. Where we have found this to be critical is where lengths of lap siding butt together. This material ships with a very low moisture content and will move on the wall. I like to order the siding to be delivered when we start framing a job. That way it can acclimate for the three to six weeks we are framing. The siding moves much less on the wall when we order it early.

For butt joints, Diamond Kote H-Moldings can be inserted into the butt joint in lieu of sealant. Some people don't like the look of these, but a caulked joint isn't exactly a thing of beauty either. An 8-foot stick costs us $10.50 and we can get 13 pieces from it, so each piece costs about 80 cents before tax and shipping.

Over Z-flashings on window heads and ribbon boards, LP requires a 3/8-inch gap. We use a scrap piece of siding to keep the gap consistent. With SmartSide Trim, a 3/16-inch gap is required between the trim and window, as well, but boards can be butted tight to another piece of trim.

Tricks. We use Huber's Zip System exclusively, so we know exactly where our framing is behind the sheathing; the nailing is not

covered up by a housewrap. We snap top lines along the wall for any siding more than 10 feet long. This allows us to keep the siding straight, but one issue we've noticed with the 3/8-inch SmartSide is that it can have a "crown" to it. Sometimes this is 1 inch or so. We install 16-foot pieces by nailing one end, then the middle, then the other end, and then nailing off the field. This allows us to pull up or down at the other end, which straightens the board. I haven't noticed this crown on the 7/16-inch series.

Another technique we use is to install "spider catchers," our nickname for corner boards installed over the siding at outside corners. This method has some important advantages. For one, it protects the siding from the weather. It also reduces the time spent installing sealant. Good-quality sealants aren't cheap, and they are not a place to try to save money. Spend the money on the sealant and save by reducing the number of places you have to apply it. The fewer places sealant is required also means less maintenance for the homeowner.

With a PacTool Gecko Gauge, this siding is easy for one person to install. It doesn't curl back at the installer as he puts it on the wall.

For outlets and hose bibs, we have used Diamond Kote's premade blocks. These are nice and install quickly, but they are expensive (about $50 each for the larger size), so the budget doesn't always allow for them. Then we have to fashion up mounting blocks from scraps of SmartSide Trim boards, which we can do inexpensively.

Because SmartSide instructions call for sealing the cut ends, whenever we have a long rip, say at roof-to-wall metal flashing, we'll stop the full-height piece at the edge of the roof, then cut our rip and flip it over so it is factory-edge down. This looks nicer than a long rip because of the eased edge. Even if a rip is cut with a track saw and is perfectly straight, it doesn't look as good.

WHAT WE LIKE

The 16-foot lengths are a major time saver and with fewer butt joints, the installed product is more pleasing aesthetically. Frequently, we have walls on the front of the house that are longer than 12 feet and less than 16 feet, and in these cases, it works well to gang-cut full-length pieces.

This material is stiffer than fiber cement, so we don't have to be as gentle with it. We've installed pieces around a window or door that required a 1-inch rip, and these narrow pieces installed without blowing apart or breaking as we walked them from the cut station to the wall. Of course, you can't score with a utility knife and snap pieces off like you can with fiber cement. However, we see that as an indication of the performance advantages of SmartSide.

Because this material weighs less than fiber cement, we can easily carry bundles of nine lengths on our shoulders (two people). We have to work a lot in the rain and this material doesn't become fragile when wet. Fiber cement is more easily scratched, especially when it's wet, and in general, must be handled more delicately. We've never replaced a piece of SmartSide from golf-ball damage.

WHAT WE DON'T LIKE

The only issue we've had is with dimensional movement if we have to install the material in winter before the house has fully dried out. In those conditions, the material tends to move to the extent that all the caulking gets squeezed out at the butt joints. We have dealt with this in two ways. For one, we wait to caulk those joints until late in the spring. The other approach is to use H-Moldings and let the material move. We are careful to allow for a 1/4-inch gap if we use H-Moldings.

Painting the cut ends is a small inconvenience, but now that we are used to doing it, that doesn't slow us down.

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

Nailing. Without a housewrap to hide the nailing on studs, Huber's Zip system makes it easy to nail siding into studs. Over window and door heads, the author uses a scrap piece of siding to keep an even 3/8-inch gap between the siding and Z-flashing **(14)**. **Penetrations.** Diamond Kote mounting blocks make quick work of providing a weathertight penetration for exterior outlets. These have a built-in flange that is nailed into place **(15)** and then integrated with the Zip System WRB **(16)**. The only disadvantage of these premade blocks is that they are expensive.

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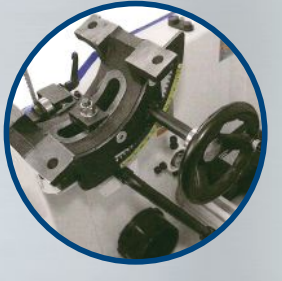

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Welcome to the New PDB

In case you didn't get our memo last fall: *Professional Deck Builder* magazine has indeed found a home as a special insert within the pages of *JLC*, starting with this issue. Look for us in the May, July, and September issues too. For *JLC* subscribers who aren't familiar with *PDB*, here's our backstory.

It starts in 2001, when deck builder Mike Owens launched a small trade magazine—called *Professional Deck Builder*—out of his home in Texas. Likely deciding after putting out a handful of issues that building decks was a lot more fun than publishing a magazine, Mike then sold *PDB* to Terry and Diann Dempsey, in 2002. At the time, their company—Dempsey Management Services, based in Snellville, Ga.—ran several different trade associations, but the Dempseys shifted their focus exclusively to the rapidly growing deck industry. Over the next few years, they—along with key employee Maura Jacob, who served in a number of different roles, including editor—worked on growing *PDB*'s size and circulation. In addition, they started DeckExpo, the industry's first major trade show, which made its debut in Atlanta in 2003, and they were instrumental in forming NADRA, the North American Deck & Railing Association.

PDB was already well established as the voice of the deck, dock, and railing industry when Hanley Wood acquired it and DeckExpo (and Maura) from the Dempseys in 2006. I was an editor at *JLC* at the time and pleased to learn that Andy Engel would become the editor of the company's new deck publication. Both of us had cut our teeth in the editing trade at *Fine Homebuilding* magazine, and I knew that *PDB* would be in capable hands.

Under Andy's watch, *PDB* flexed its editorial muscles, rolled out a website, introduced an e-newsletter, and waded into social media. After he left *PDB* in 2013 to return to *FHB*, I took over *PDB*'s helm and tried to maintain the editorial progress that Andy started.

This issue marks a bit of a course correction—the end of *PDB*'s long run as an independent magazine, and the beginning of an even closer association with our sister publication, *JLC*. For those who prefer the look and feel of the printed page, this is where you'll find *PDB*'s familiar content, including columns such as "Readers' Tips," "Structure," and "Day's End," as well as our regular feature-length articles.

But recognizing that our readers want and need different means of accessing our information, *PDB* continues to expand our digital platform, deckmagazine.com. Say, for example, you've just read Gus Dering's article on building a cedar pergola (see page 29) and you're curious about the CNC machine that he used to cut the parts. You can pull up the article on your desktop or smartphone and watch a video of the machine in action. Or say you're on a job and need help figuring out how large to make the footings for a deck you're building. No problem ... just use your smartphone to pull up our home page and go to our "Design and Construction" section, where you can find dozens of articles about footings. No matter where you are or what device you are using, *PDB* is—and will continue to be—available 24/7.

In fact, everything we've published in the printed pages of *PDB* since 2006 is on our website, which continues to grow in viewership and engagement. In 2017, website page views grew by more than 40% compared with 2016. There's also a lot of content online that we don't have room for in the printed magazine, and we continue to add to that regularly.

As we continue our digital evolution, you can keep up with the latest trends in the deck, dock, and railing industry by bookmarking our home page—which we frequently update—and by subscribing to one or both of our two e-newsletters. If you have questions, comments, or a story idea, reach out to us via our Forum pages, in the "Comments" sections that follow all of our articles, on our Facebook page or other social media channels, or simply by emailing us at prodeck@hanleywood.com to let us know how we can serve you best. ❖

Andrew Wormer
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Welcome Kits for Decks

by James Baldwin

At my company, we take pride in our workmanship, but we also pay close attention to the entire customer experience, from first contact to after the build is complete. This involves keeping the jobsite clean and orderly, interacting positively with the homeowner, following up after completion, and asking for and receiving social media reviews.

Those customer service measures are pretty standard, but we've added another wrinkle that seems to be less common, at least among deck builders. Shortly after wrapping up a job, we send our clients a "welcome kit." In it, we include a cooler, a customized koozie and pen with our company's logo and contact info, and a USB drive with all the photos and videos from the job. We use a drone to shoot some of the video, and we also set up a GoPro camera on every job to produce a before-and-after time-lapse video (in addition to putting this video on the USB drive, we email a YouTube link to our clients so that they can share it with their friends). The kit also includes a binder that we've assembled with photos that summarize the job, showing the build process and highlighting some of the things clients don't usually see.

Giving these kits to our clients is an effective way to get referrals and to set ourselves apart from other deck builders. Need proof? Well, I got married recently, and my new wife was becoming a little peeved with how long it was taking the photographer to deliver the wedding photos. But then the photographer showed up at our door with the official photos, along with a USB drive containing all the photos that she took as well as a nice video that she had put together of our wedding day. Once my wife saw the presentation, all was forgiven and then some. That example of customer service convinced me that this stuff works! ❖

James Baldwin owns SelectDecks, in Morgantown, W.Va.

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 May 2018 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.

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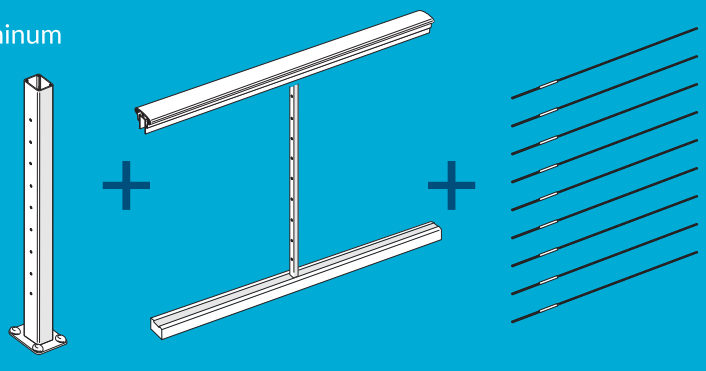

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‘Optional’ Deck Railings and the Code

Q I’m building a deck that’s less than 30 inches above grade, so a guardrail isn’t required by our local building code. However, the owner on this project wants the deck to have a railing for aesthetic reasons. If a guardrail isn’t required by code and I install a railing anyway, does the railing still have to comply with all the elements of the code (minimum height, live load, infill spacing, and so on), or can I just install a decorative railing that looks good but that may or may not meet code requirements?

A Chuck Bajnai, chief residential plan reviewer in Chesterfield County, Va., responds: Guards (also called guardrails or guard systems) are required to prevent someone from falling off an open-sided, elevated surface, such as the walking surface of a deck. When the walking surface is more than 30 inches high, measured vertically from a point 36 inches from the edge of the deck, a guard is required by code, to prevent serious injury. (The reason for the 36-inch extension is to prevent folks from piling up mulch at the edge of a deck to avoid installing a guard.)

Whenever your local building code doesn’t require something, anything above nil is acceptable, because your AHJ has authority only for compliance over matters that are contained within the code. Since there are no requirements in the IRC for guards adjacent to open-sided walkways with less than 30 inches to grade, anything is permissible—with a couple of caveats.

If you’re installing a proprietary, manufactured guardrail system, the code requires that the manufacturer’s installation instructions be followed for liability issues. If a guard system fails, resulting in an injury, and the guard manufacturer’s instructions say to use 1/2-inch-diameter bolts while you’ve used 3/8-inch-diameter lag screws, a judge would not likely rule in your favor should there be a lawsuit.

Also, keep in mind that not every state or jurisdiction adopts the code as published by ICC. For example, Virginia replaces Chapter 1 of the IRC and rewrites it in its entirety, so it’s possible that some states have different requirements for railings. When in doubt, it’s best to check with your local code official. The building official should recommend that the homeowners do “the right thing” and follow best practices in the industry, but probably cannot enforce it.

What About Uplift?

Q In the first section of the deck portion of Chapter 5 in the 2009 to 2015 versions of the IRC, it says: “For decks with cantilevered framing members, connection to exterior walls or other framing members shall be designed and constructed to resist uplift resulting from the full live load specified in Table R301.5 acting on the cantilevered portion of the deck” (R507.1 2015 IRC). If the live load is 40 psf (the listing for decks in Table R301.5), will joist hangers mounted to the ledger provide adequate uplift resistance? Is there any circumstance for which a deck builder would need to use special hardware to account for uplift?

A Andrew Wormer, editor of *PDB*, responds: There are a couple of ways to approach this question. If you are following the prescriptive path spelled out in the IRC or in the American Wood Council’s DCA-6 (“The Prescriptive Residential Deck Construction Guide”), you don’t have to worry; joist hangers have plenty of built-in capacity for the uplift forces created by a live load on a properly framed deck. Use the span tables in either the IRC or DCA-6 to size the joists and cantilevers, install blocking and connectors or fasteners (that is, hurricane clips or toenails) at the joist-to-beam location as required, and attach the joists to the ledger with approved joist hangers—and you’ve met the uplift requirement in R507.1.

If you veer off the prescriptive path, you’ll want to consult an engineer. I contacted David Finkenbinder, who is an engineer at Simpson Strong-Tie, for his thoughts about this question. When I asked him how one might go about calculating uplift, he responded by sending me some indecipherable (at least by me) engineering equations but also promised to do some math based on the longest possible joist and cantilever spans and with the live load only present on the joist cantilever. Even with 2x12 SYP

joists 24 inches on-center spanning 13 feet 6 inches, with an additional 3-foot-4-inch cantilever, he found the maximum resulting uplift to be less than 40 pounds. This is well within the uplift capacity listed for common joist hangers.

You can easily find uplift values for Simpson Strong-Tie and USP hangers in the companies' published technical literature. For reference, Simpson's LUS210Z double-shear joist hanger provides for 1,165 pounds of uplift, which is plenty even after the required wet-service reduction has been factored in. Standard joist hangers such as SST's LU210 (850 pounds) or USP's JL28 (855 pounds) also have plenty of uplift capacity.

According to Finkenbinder, the main reason why the uplift calculations find such a small reaction is due to the IRC limiting the cantilever span to one-quarter of the adjacent joist span. He warns, however, that if you are designing a deck outside of the IRC limits and this ratio starts to exceed ¼, the amount of uplift generated increases substantially. As the back span decreases in length, joist hangers alone may become insufficient and additional reinforcement may be required. Live loads that are significantly larger than the standard 40 psf (per the IRC) can also generate more uplift.

Cantilevered deck joists act like levers, creating uplift where they are attached to the ledger when loads are applied to the cantilevered portion of the deck.

PHOTO: CLIFF WHITMER

Finkenbinder also notes that the deck provisions in the IRC are a work in progress and are nowhere near as comprehensive or complex as other sections of the code (such as Chapter 6-Wall Construction and Chapter 8-Roof-Ceiling Construction). For example, for decks, the IRC does not take into account high winds or other special loading conditions. ❖

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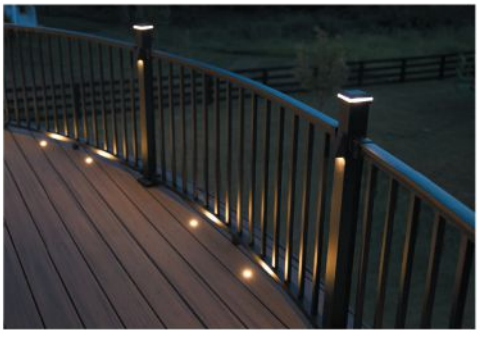

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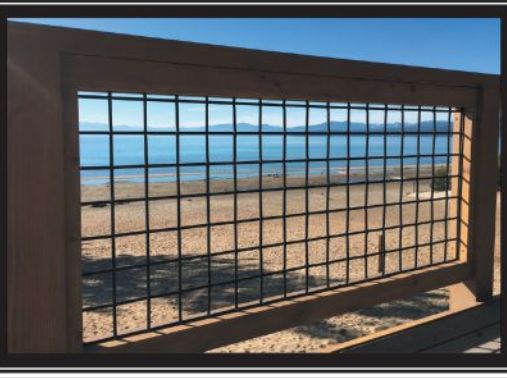

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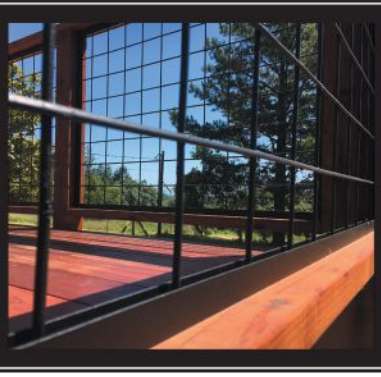

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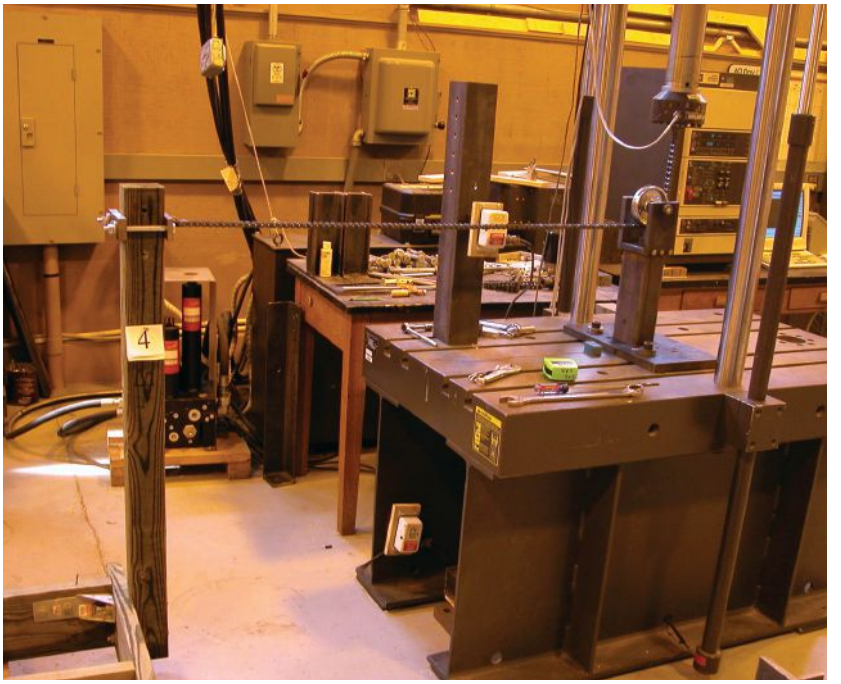
A Guideline Toward Safer Deck Railings

by Frank Woeste and Joseph Loferski



Virginia Tech researchers attached a chain to a guard post 37.5 inches (code requirement plus 1.5 inches) above the joists, over to a pulley, and up to a load cell. Raising the test machine load head produced a horizontal force on the post.

For years, the IRC has required that deck top railings be strong enough to resist 200-lb. concentrated loads applied at any point and in any direction along the top of the top rail. The purpose of the 200-lb. load requirement is to prevent someone from falling from an elevated deck. Despite efforts to introduce prescriptive guard-post connection details into the code that would meet the 200-lb. outward load requirement (see "Looking Ahead to the 2018 IRC," Sept/16), the 2015 (or 2018) IRC doesn't offer guidance for builders or inspectors on how to connect the guard post to the deck structure to meet the IRC requirement.

But there's another potential avenue for getting guard-post design details into the hands of builders and building officials: by creating an ICC Guideline. Though not a code or standard, and therefore not mandatory, an ICC Guideline could be used to provide a pathway to details that could eventually be adopted by the IRC. In the meantime, the guideline development process could open the door for input by all stakeholders, especially deck contractors and practicing engineers, and result in a useful benchmark for the design and construction of guards until it is codified.

What We Know About Guard Post Connections

When someone falls through a deck guard and is either hurt or killed, the failure point is typically the connection of the guard post to the deck structure. While the outward force of a 200-lb. person simply leaning against a residential deck rail is relatively small, if that person trips, the dynamic load on the top rail can easily reach 200 lb. or more. And as our testing at Virginia Tech has shown (see "Tested Guardrail Post Connections for Residential Decks," *Structure Magazine,* July 2007, and "Strong Rail-Post Connections for Wooden Decks," *JLC*, February 2005), guard posts and their connection to the deck (or balcony) structure are most highly stressed when loads are applied at the top of the post and in an outward direction.

Without guidance from the code community, many deck contractors "guess" as to what detail constitutes a safe guard-post connection, typically followed by a plan reviewer or building inspector making an approval decision without guidance beyond what they may have seen used in the past. Because of the lack of prescriptive detail in the IRC, some building inspectors use the "push test" to evaluate a guard, where they apply a small load—maybe 15 lb.—and observe how much the guard deflects. But this test is a measure of stiffness, not strength; a dangerous, nailed-on guard post could appear stiff when loaded by a small outward load, yet with a slightly larger load, the post connection to the deck band could suddenly fail, resulting in total collapse of the guard section.

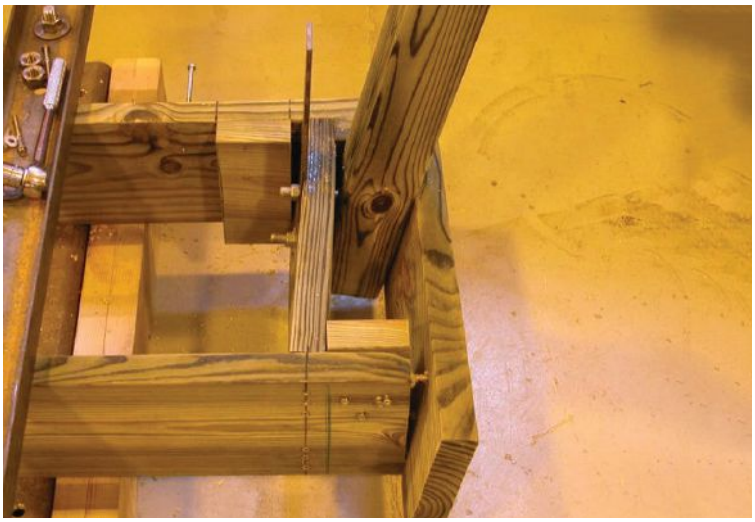
For comparison, think about pulling out a nail with a claw hammer or crowbar. On the first attempt, the nail may not even budge, but a second and more forceful attempt can produce nearly total withdrawal of the nail. Pushing on a

constructed guard post is analogous to the first attempt at removing the nail with a claw hammer; tripping and falling against the post is analogous to the second, more forceful attempt.

Our team at Virginia Tech University tested stress-rated 4x4 guard-post connections from 2004 through 2008. Our lab test specimens were "perfectly fabricated" using new No. 2 southern pine lumber for the framing, and 4x4 guard posts. Over the five-year research period, the tests were witnessed by hundreds of continuing-education-course participants, about a quarter of them code officials, inspectors, or plan reviewers. What we found is that common guard-post connections typically would fail at loads between 20% and 75% of the target test load of 500 lb.

Why 500 lb., instead of the IRC-designated 200 lb.? The purpose of a test safety factor is to account for a number of variables, including the fact that actual deck guard-post connections are never "perfectly fabricated" in the field. Other variables include the near weakest post in the tested grade and species, the near lowest density of the joist that holds the bolts or screws, and uncertainty about the maximum load the post connection will experience in service. Based on our judgment, we selected a test load safety factor of 2.5, which was also the minimum test safety factor in previous editions of the model building codes.

After many unsuccessful test configurations, we figured out a way to build a guard-post connection that could resist the 500-lb. test load at the top of the post. The solution was to use load-rated connectors rather than a "fasteners only" approach. The "connector solution" for attaching a guard post to decks has been widely published in contractor magazines and engineering journals. In fact, the American Wood Council's popular DCA-6 includes a detail for connecting a 4x4 post to a deck that is based on our published research on guard-post-connection testing. To our knowledge, at least three manufacturers now market metal hardware specifically designed to be used for connecting guard posts to decks. However, despite these efforts, none of these solutions are in the IRC code.



This post detail—which relies on blocking, ½-inch bolts, and screws—failed the load test. In fact, the only post details that passed the authors' testing were ones made with load-rated metal connectors. Without the connector approach, the deck band "peels off" at load levels between 20% and 75% of the test requirement.

The Value of an ICC Guideline

Plan reviewers and inspectors are left without guidance—beyond DCA-6—on any proposed alternative details that would have sufficient strength to safely resist the code-mandated 200-lb. concentrated load requirement. Some contractors argue—without any testing evidence—that there are other 4x4 guard-post connection details that are safe. But without evidence, and because of the gap in the current IRC on how to prescriptively construct a guard-post attachment to a deck, the code community faces the nearly impossible task of ensuring that deck-guard constructions they approve will in fact safely resist the code-specified design load in service.

Until a proposal to the IRC for prescriptive guard-post details is finally approved and adopted, an ICC Guideline could be valuable in an attempt to protect life and prevent fall injuries and fatalities from decks and balconies. Plan reviewers need a concise document that addresses the complicated issue of guard-post attachment to decks. The value of the proposed guideline is vast—all residential plan reviewers can benefit from a published ICC Guideline by using it in deck or balcony plan checking and inspection until this life-safety issue is addressed by the IRC, hopefully within the next decade. ❖

Frank Woeste is professor emeritus at Virginia Tech University and a wood construction consultant. Joseph Loferski is Professor of Sustainable Biomaterials at Virginia Tech University.

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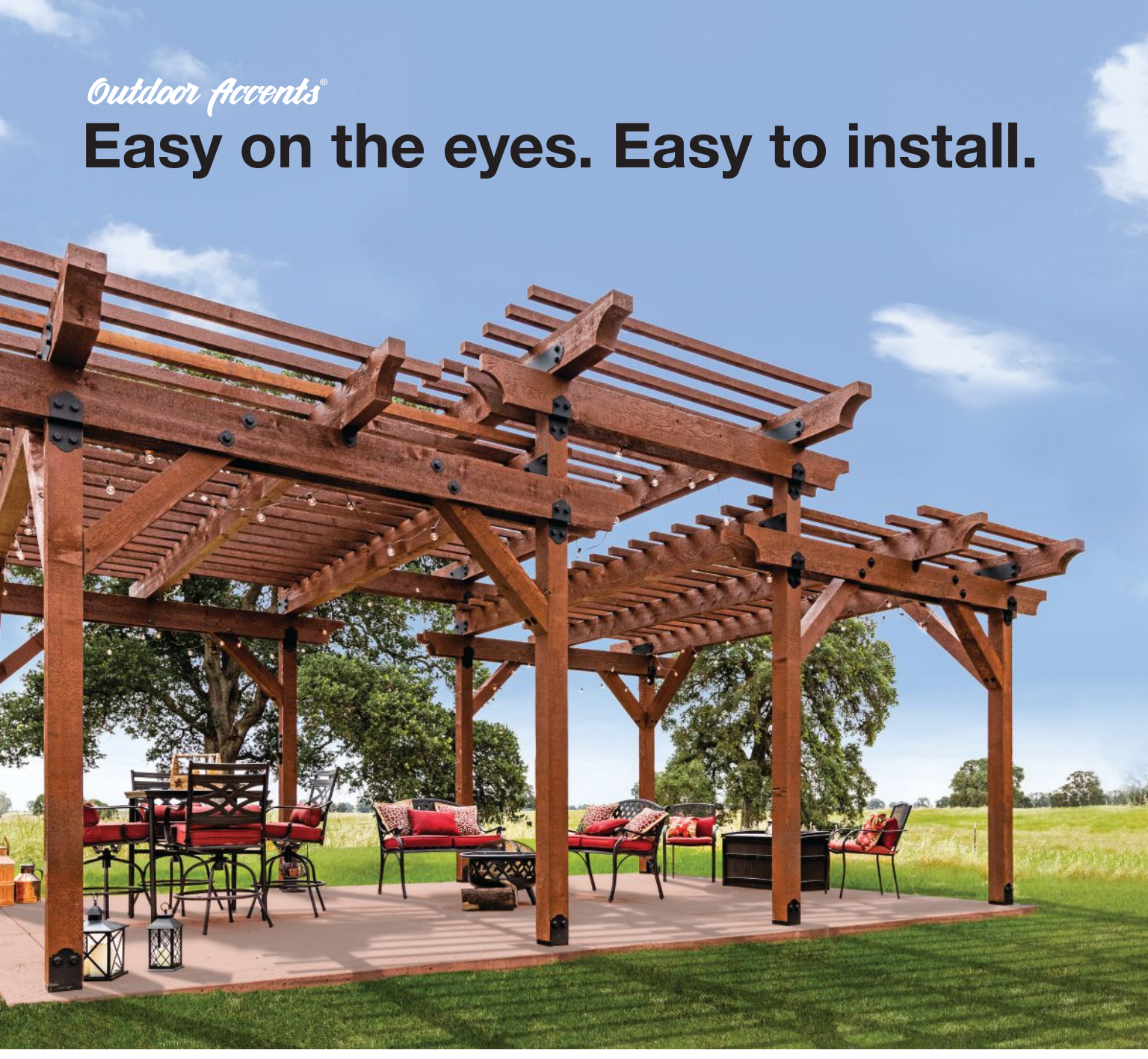


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Installing a Swim Spa

All it took was a 90-ton crane, 44 yards of concrete, and six bags of ice

by Jerry Bannister

PHOTOS BY KEN SMITH/NAVIGATE PHOTOGRAPHY

Even as our deck projects continue to grow in size and complexity, we find that we're always learning something new on every job. Recently, for example, we discovered how useful ice—yes, frozen water—can be for installing a large swim spa. Let me explain.

The spa was a late addition to what was already a fairly complex project—the makeover of a hillside deck into a multilevel structure that would have more than 1,500 square feet of outdoor living space. Our clients liked the idea of a small pool-style spa and asked us to research the advantages and disadvantages of site-built vs. prefabricated self-contained units.

After looking at factors such as cost, features, and energy consumption, my clients chose a Hydropool AquaTrainer 17fX, which was supplied by Aqua Quip, a Seattle-area company that specializes in hot tubs and spas. Measuring almost 8 feet wide by 18 feet long, the fiberglass unit has swim and hydrotherapy jets, built-in pumps and heaters, and LED lighting. The size and weight of the unit—a little less than 3,000 pounds empty and more than 21,000 pounds when full—required careful planning, especially considering its hillside location.

Concrete Work

The deck design—by The Leren Co., of Mill Creek, Wash.—is anchored by a pair of massive concrete retaining walls. One of the walls stabilizes and encloses part of the hillside site where the spa is located. The other wall also provides a foundation for a multilevel deck structure that is connected to the spa area. Because of the sloped site and the project's location in a Class D (high risk) seismic area, we consulted with a geotechnical engineer to assess the stability of the soil and review the foundation plan prior to excavation.

The retaining wall that partly supports the deck framing surrounding the spa is also part of a large earth planter that forms the outer edge of the lower deck. To support this retaining wall–planter assembly, we formed and poured a 14-inch-thick by 6-foot-wide by 34-foot-8-inch-long steel-reinforced concrete footing, along with another similar-sized but more irregularly shaped footing for the multilevel portion of the project.

To meet local requirements, the bottoms of the footings had to bear on either undisturbed soil or properly compacted structural fill that was below the minimum frost depth, or 18 inches below finished grade.

We also formed and poured narrower footings for the remaining 8-inch-thick stem walls and for the multiple piers that would support the deck structure. Then we formed the walls and set round tube forms for the piers, reinforcing the piers with #4 rebar cages that are tied to the footings.

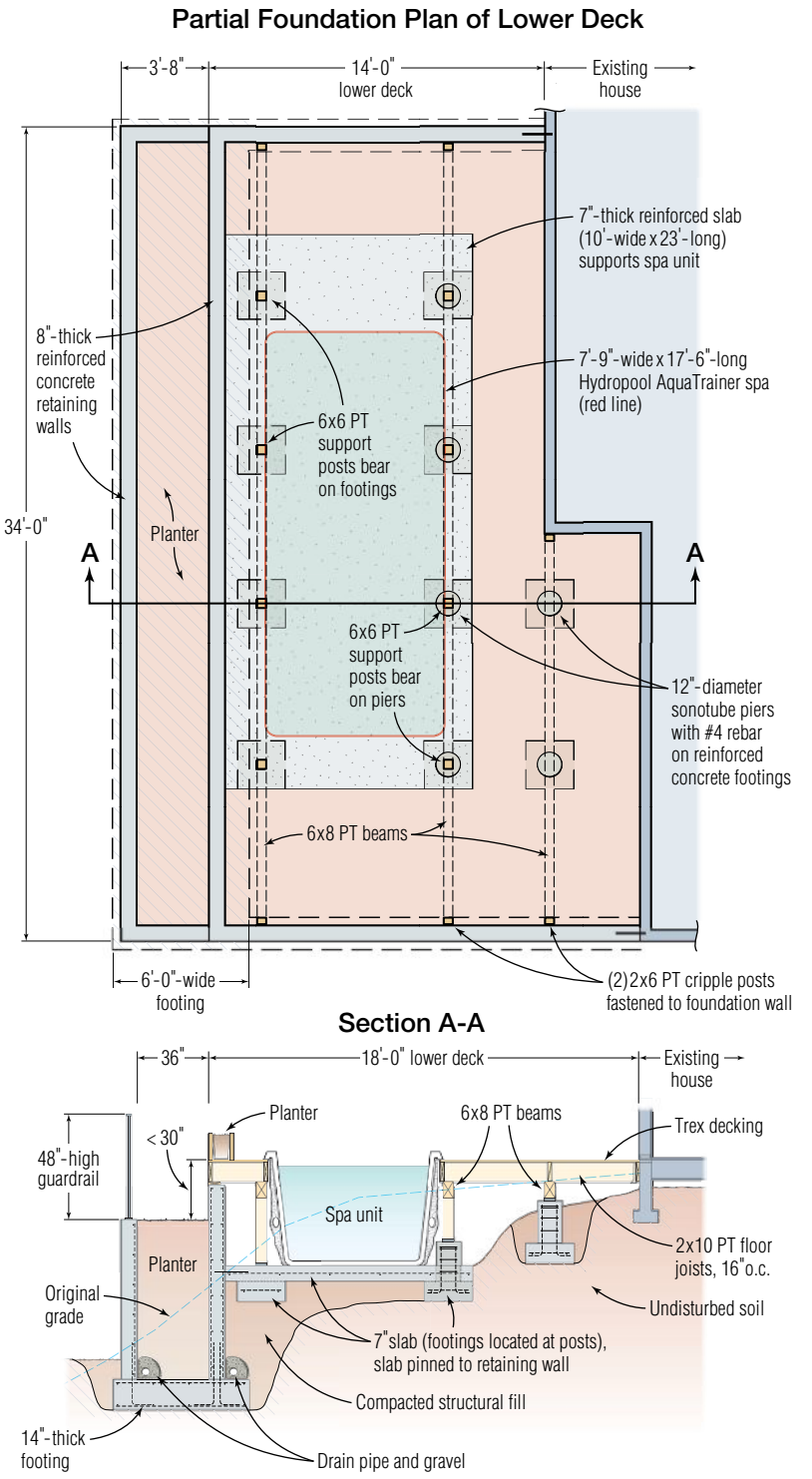
After stripping the forms off the retaining walls, we set to work forming the 7-inch-thick reinforced concrete slab that supports the spa. Where the eight posts supporting the deck framing that surrounds the spa would bear on the slab, we excavated an additional 16 inches below the slab for their footings. Both the slab and the footings are reinforced with #4 rebar, which we also used to pin the slab to the retaining wall.

During the project, we pumped nearly 44 yards of concrete to form the footings, retaining walls, slabs, and piers necessary to support the deck framing on the sloped site.

Deck Details

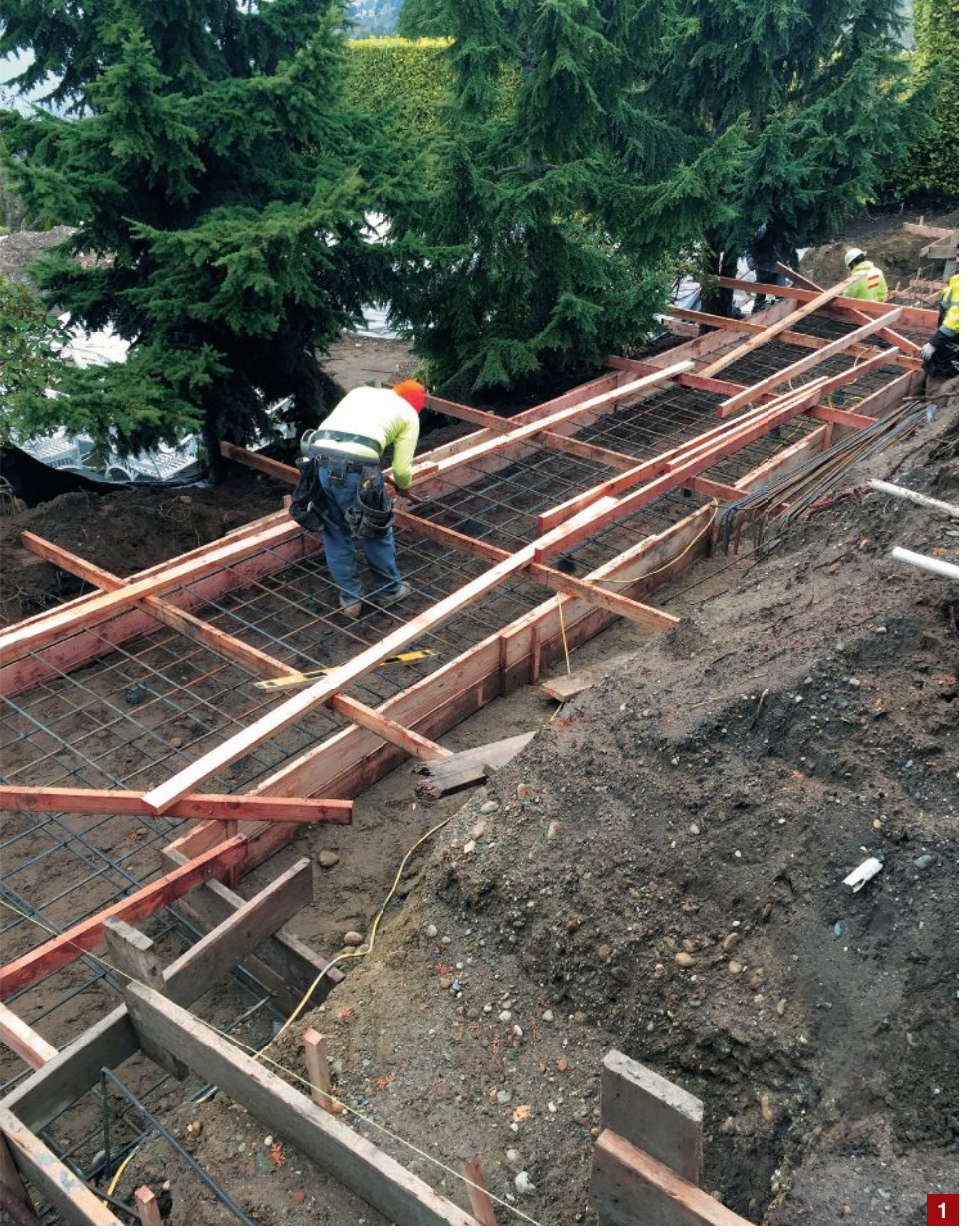
Once the concrete cured, we installed the deck framing, starting with 6x6 PT support posts. Because the spa is supported by the slab rather than the framing, we could use standard details suitable for 40-lb.-per-square-foot live loads, but we still had to take seismic requirements into account. For example, the tall posts and 2-by infill framing supporting the multilevel portion of the deck are sheathed with ½-inch PT plywood to act as shear walls.

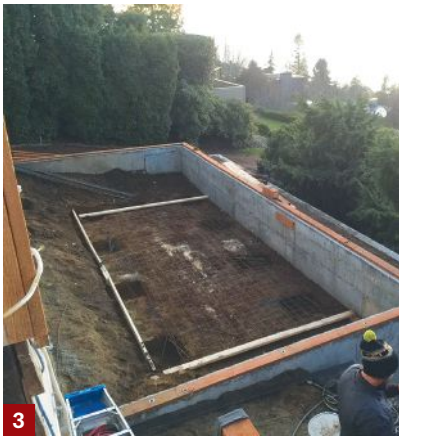
While waiting for delivery of the spa, we completed the multilevel deck and as much of the spa deck as we could. Both areas feature Trex Tiki Torch decking in the field and Lava Rock for the picture frame, borders, and stair returns.



A complex foundation with multiple footings, retaining walls, and piers was needed to stabilize the hillside site and support the spa deck framing. The spa itself rests on a 7-inch-thick reinforced concrete slab.

ILLUSTRATION: TIM HEALEY





A steel-reinforced spread footing supports the inner and outer walls of the earth planter–retaining wall assembly, which was required to stabilize the sloped site (1). Here, forms for the retaining walls are ready for concrete (2). A reinforced slab was needed to support the large spa, which weighs more than 21,000 pounds when full (3). Crew members fill the piers with concrete from a pumper truck, prior to pouring the spa slab (4).

To provide for dry, secure storage, we enclosed the area underneath the upper level and installed a Trex RainEscapes under-deck drainage system. Access to the area is through a wide pair of doors just off the small landing, which is shaded by a small pergola.

To maximize the views of beautiful Puget Sound, we installed a Fortress vertical cable railing system on the multi-level portion of the deck, as well as on the stairs connecting the upper deck to the lower pool deck.

Setting the Spa

Because of the size of the unit and the difficult hillside location, we contracted with a crane company to set the spa. A 90-ton crane was needed to pluck the spa off the flat-bed delivery truck, hoist it up over the roof of the house, and gently lower it more than 60 feet down into position. Making this even trickier, there was less than one inch of clearance between the sides of the spa and the framing.

Here's where the ice trick came into play. Normally, when you set a 3,000-pound spa onto a slab with tight framing surrounding it, you use blocking to support the unit while you're pulling out the crane straps. But we've found that this method sometimes results in damage, so on this project we supported the spa with six bags of ice—one on each of the corners and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Since the spa bears on the slab rather than on the framing, the deck was built with standard PT lumber and deck details suitable for 40-psf live loads (5). A 90-ton crane was used to lift the spa over the house and lower it into position on the slab (6). The completed project includes multiple living areas; in addition, the upper deck was fitted with an under-deck drainage system to provide dry storage for covers, cushions, and deck furniture (7). Views of Puget Sound are unimpeded by the security fence, thanks to the planter design (8).

one at the midpoint on each of the long sides of the spa—located so that the ice was out of the way of the lifting straps. The technique was recommended to us by the trucking company that delivered the spa, and we were able to easily remove the lifting straps once the spa was in position and supported by the ice. As the ice melted, the unit slowly settled into place with minimal adjustments needed.

With the spa installed and the plumbing and electrical connections made, we completed the lower deck. To meet Washington state code, which requires at least a 48-inch-high guard fence around swim structures, the pool deck for the spa is completely enclosed with an aluminum railing fabricated by American Structures and Design. Each gate into the spa area is lockable and has a safety alarm.

Because of the design of the earth planter, which creates a 36-inch-wide level area that is less than 30 inches below the front edge of the deck, we were able to drop the elevation of the guard fence without reducing its effective overall height. This provides our clients uninterrupted views out over the Sound while they enjoy their hillside spa. ❖

Jerry Bannister is manager and owner of BHD Construction LLC and Bannister Homes & Decks, in Bothell, Wash.. His companies specialize in both residential and commercial deck and outdoor living projects in the greater Seattle area.

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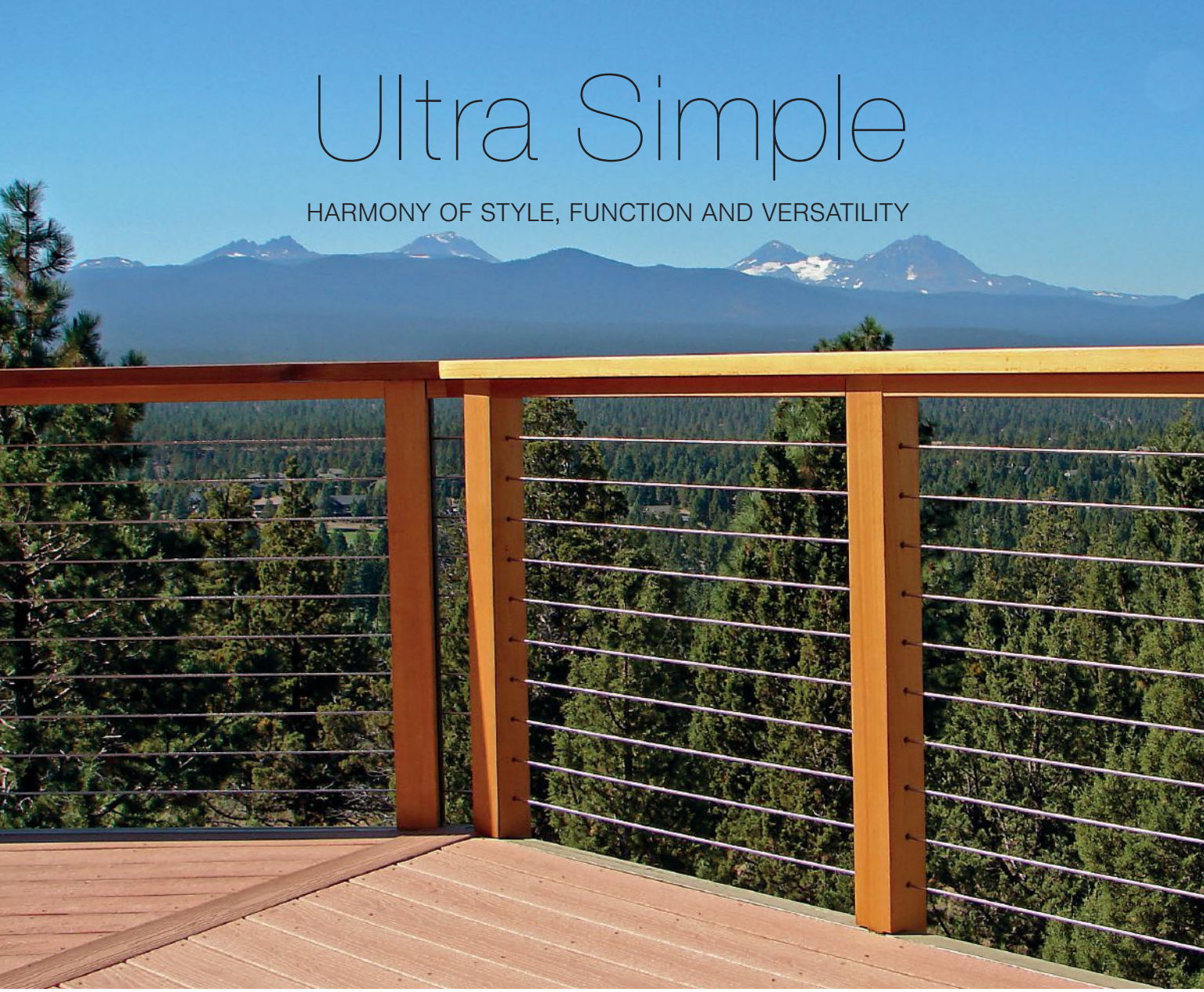

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Prefabricating a Pergola

Tapered dovetailed mortise-and-tenon joints connect the beams to the columns, eliminating the need for metal connectors

by Gus Dering

I started my career as a carpenter's helper in 1981, and soon after became a general contractor. Then some years later, I opened a cabinet-making business, which I operated for 15 years before retiring last year. So when I built a cedar pergola a few years ago, I still owned a fully-equipped cabinet shop. That allowed me to cut all the curved components on a CNC machine. These cuts could probably be made just as easily with a handheld bandsaw, but I didn't own one of those at the time; besides, using the CNC machine was fun.

PHOTOS BY GUS DERING

Building a Kit

My plan was to prefabricate the parts in my shop, but first I coordinated the layout and installation of the column bases with the landscape contractor. Because I wanted to route electrical conduit up through the posts, the conduit from the house needed to exit finished grade as close to the posts as possible (unfortunately, we missed our target, and as a result, ended up needing a heavier base detail to cover the conduit). Once the column bases were set and the elevations located with a laser level, I finalized my cut list—including post lengths—and got to work in my shop.

I started by programming the beam, rafter, and slat end details into the CNC. Since these were essentially mirror images of each other, I could cut two parts at a time, using clamps to hold them together **(1)**. The parts rested on a spoils board, which has a series of holes drilled through it that allow direct suction to be applied to the assembly to hold it in place (plugging some of the holes with rubber grommets applies maximum holding power to the parts). The spoils board also allows the CNC bit to exit the cut without any tear-out.

To keep the cuts as clean as possible, I programmed the CNC machine to make multiple passes, taking off no more than about $\frac{1}{2}$ inch at a time. For most of the cutting, I used a long compression bit that has $\frac{11}{16}$ inch of upshear, while the remainder of the bit is downshear. The beauty of a compression bit is that the final pass lifts the wood fibers on the bottom face and pushes down on the upper face, leaving no splintering on either face. Even though the

long bit has the depth of cut to do the lion's share of the work, I made my first pass with a shorter, ½-inch downshear bit. Otherwise, if I had used the longer bit exclusively, the first pass would have used the upshear portion of the bit and splintered the face of the workpiece.

In an effort to keep the bit as cool as possible, I stopped the machine manually after each pass and blew the chips out of the kerf with compressed air (though I'm not sure whether this made a difference).

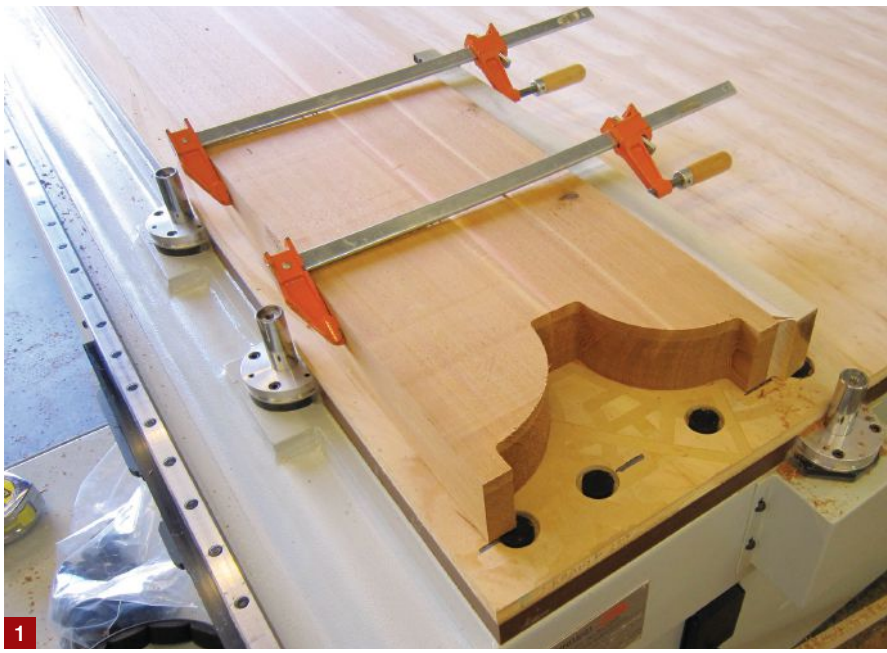
There is much more involved with using a CNC machine than I can go into here, and it wasn't an essential tool. But the knee braces—which I cut one piece at a time—are an example of a perfect use of the machine. Not only did the machine's accuracy make it possible to cut identical curves, but more important, it allowed me to precisely cut the 45-degree angles on the 4x8 material.

Hollow Columns

To create the channels for the electrical conduit in the columns, I split the columns in two, dadoed half the channel in each piece **(2)**, and then glued the columns back together. Because the rough-cut 6x6 red-cedar stock measured almost a full 6 inches, I had enough extra material to send each post through a planer to clean it up before I made the pair of cuts on my table saw to split the post. To help conceal the glue joints, I oriented the posts so that the cuts were made in the faces with the most vertical grain. Afterward, I sent the post halves through the planer again to nibble off the saw marks and accurately dimension them.

Dadoing on a table saw is straightforward, but I needed the conduit to exit the post just above the column bases to avoid conflict with the lag screws that would secure the posts to their bases. For this, I marked the outlines with a quick plywood template and free-handed the cuts with a router.

I glued the posts back together with polyurethane glue, using plenty of clamps **(3)**. After I sent the posts through a planer a final time to dress them down to the 5½ inches I needed for a proper fit in the column bases, the glue joints had virtually disappeared.



The author used his CNC machine to cut the parts, including the rafter tails (1). To accommodate electrical conduit, the author split each post and dadoed a channel in either half. Conduit exits the post above the base via a short channel, cut with a router (2). Then he glued the posts back together (3).

Tapered Dovetails

Instead of connecting the perimeter beams to the posts using metal hardware, I decided to fit them with tapered, dovetailed mortise-and-tenon joints. In addition to providing strength, this method left the conduit chase intact through to the top of the post and let me create the illusion that the beams passed through the columns.

I sized the tenons to be as large as possible, to give the base of the joints ample

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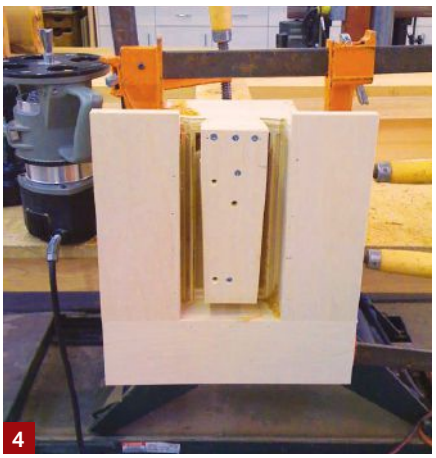
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A plywood pattern screwed to the ends of the perimeter beams was used to cut the tenons; the U-shaped jig clamped to the beam supported the router base while making the cuts (4). A similar jig was used to cut the matching mortises in the columns (5). Each perimeter beam has a matching rafter tail (6), making it appear that the beams are continuous through the columns (7).

bearing while offering that locking feature that the taper and the dovetail provide. Then, to cut the mortises, I made a plywood pattern jig, which served as a guide for the router and as a work table for the router to ride on while cutting each mortise. A pair of legs screwed to the bottom of the jig helped center it over the posts and also gave me a place to fasten my clamps.

To fine-tune the fit, I used the template to cut a sample mortise in a scrap post end, then experimented a bit to find the right size for the counter template to cut the tenons on the ends of the beams. This is a simple plywood pattern that I could screw to the end of the beam, along with a U-shaped piece of plywood that I also clamped in place to support the router base **(4)**. After a few tries, I had two templates that worked well together.

By that point, I had cut all the posts to length and numbered them for position. I cut all the mortises in them first **(5)**, then I cut the tenons in the beams, which were also cut to final size and numbered **(6)**. Because I was using a dovetail bit with a 1¼-inch depth of cut and because the tenons had to be cut in a single pass, a powerful, 3½-hp router was essential to the operation.

Each beam end had a specific mortise it needed to fit into, so as I cut each tenon, I tested for accuracy, making final adjustments as necessary with a file to remove a little bit of material here or there to get the right fit.

One of the last shop tasks was to make the counter bores and through-holes in the knee braces for their lag screws and washers, using my drill press. When sizing the lag screws, I had to take into account the electrical conduit running up the center of each post. I wanted the lags to be long enough to make a solid connection, but not so long that they would penetrate the electrical conduit.

Once the heavy work was completed, I cleaned up the parts with a heavy-duty random orbital sander. I marked the rafter locations on top of the beams,

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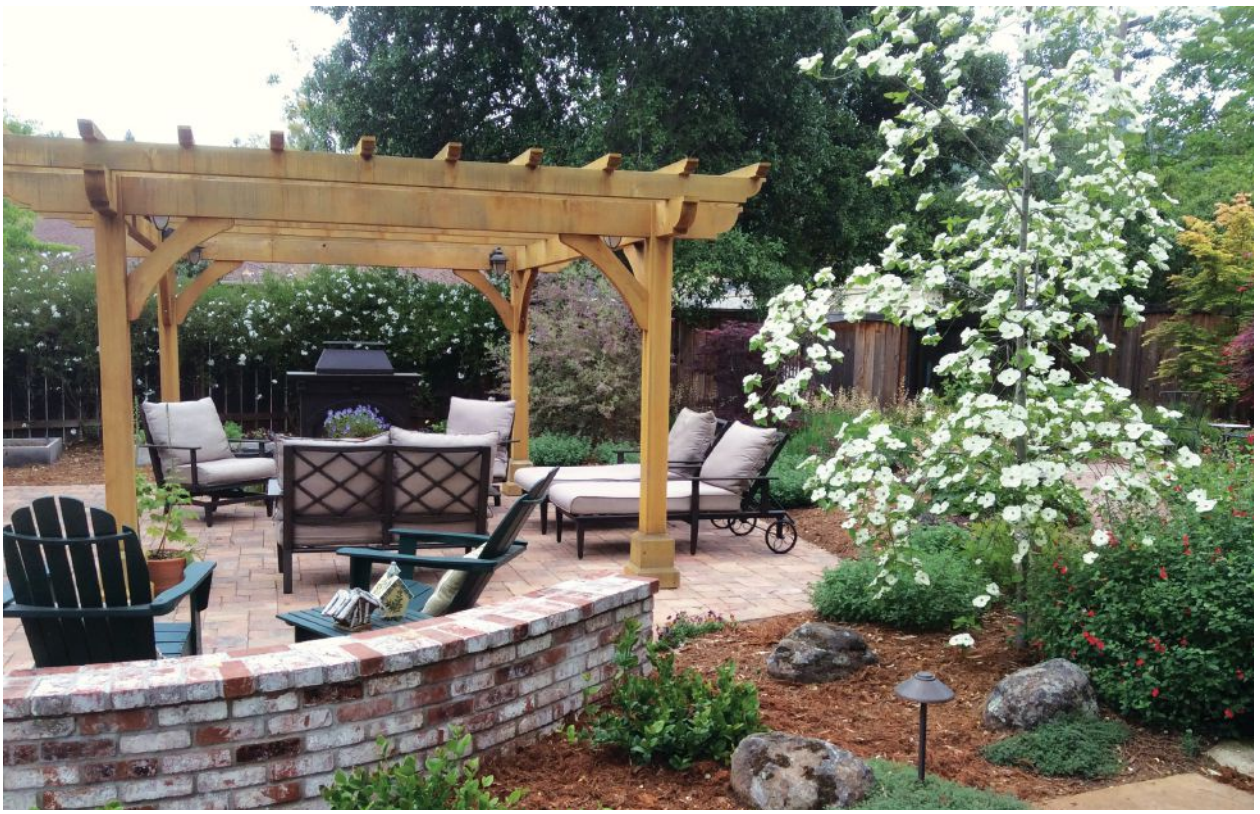

With all of the pergola parts prefabricated in the shop, the actual installation went quickly.

marked the slat locations on top of the rafters, and drilled pilot holes for the fasteners. Finally, I was ready to load everything up onto my trailer and bring it over to my house for installation, which, after all the prep work in the shop, was pretty straightforward.

Installation

I didn't want to screw braces to the posts when positioning them, so instead I used clamps to hold them plumb until they were locked in place by the beams. I used a liberal amount of polyurethane glue at each post-to-beam connection, having planned for glue expansion by leaving about 1/16 inch of clearance between the end of the beams and the bottom of the mortise when I cut the joints. I was a little more conservative within the dovetail tenons, holding the glue at least 1/2 inch or so away from the shoulder, as I knew excess glue oozing from these joints would be nearly impossible to clean off later without leaving some evidence. Strap ties temporarily screwed across the tops of each assembly held everything together until the glue cured.

The CNC machine wasn't essential, but its accuracy made it possible to cut identical curves and precise 45-degree angles on the 4x8 material.

I fastened the rafters to the beams with TimberLok structural wood screws, then screwed the 3x3 slats to the rafters with 6-inch HDG lag screws. Finally, before removing the braces, I installed the knee braces using 1/2-inch-diameter galvanized lag screws **(7)**.

With the conduit pre-installed in each corner post, it was relatively easy to wire the pergola for lighting. We also added a custom-sized shade cover, which we bought from Greenhouse Megastore. To ensure that the cover fit properly, I installed the grommets myself using a kit purchased at a local hardware store. For a total materials cost of about $3,000, including $2,500 for the western red cedar, this was one of the best investments toward a comfortable retirement that I could have made. ❖

Gus Dering is a former building contractor and cabinet-shop owner living in Eagle Bridge, N.Y.

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Smart Baluster Spacing Tool

by Cliff Whitmer

We build a lot of railings on site. Over the years, we've experimented with different methods to make the picket spacing—including between the first and last pickets and the rail posts—consistent along the entire length of the railing. Every method we tried had its drawbacks, though, and we continued to search for something better.

We found it on our smartphones. As more of the crew came to work with these little computers in their pockets, we put them to work to calculate picket spacing. Eventually, I created a few spreadsheets that could run on our phones to help automate the calculations.

That worked so well we started using our phones to lay out joists too. Most of our crew—including me—come from a background in framing houses, in which many components depend on joists, studs, and other structural members being a known distance (typically 12 inches, 16 inches, or 24 inches) on-center. So we used to frame our decks the same way, pulling our tapes starting at one end and marking the layout (16, 32, 48, 64, and so on) until we reached the other end. As a result, there could be a 2-inch or other awkward-size space between the last two joists.

However, as we realized that other deck components don't rely on specific layouts, we started laying out joists evenly spaced. This was a new way of thinking, but it provided some real benefits.

It looks better. Your client will notice consistent spacing both from below (especially if the deck is elevated) and from above (because of the even spacing of the deck fasteners).

It can save money. Oftentimes, consistent spacing can eliminate an extra joist—along with the fasteners and labor needed to install it. Not only will you be able to eliminate a narrow joist bay, but you will also have an easier time installing rail-post bolts and joist hangers.

It can smooth out the decking surface. The width of nominal 2-by framing lumber can vary as much as $\frac{1}{2}$ inch, and the difference is more noticeable when the joists are close together than when they're farther apart. This is especially true with composite decking.

We now use this layout method for rail posts, wall posts, and rafters, as well. We've even started using it for spacing fasteners on highly visible parts, such as rail caps. We find it saves time overall by eliminating guesswork.

While the consistent-spacing method works great, our phone-based spreadsheets were a little clunky and difficult for new hires to learn. I couldn't find an app that worked well for what we wanted to do, so I wrote one.

Our app, the Whitmer Decks Field Tools, contains two parts—called *Even Spacer* and *Picket Spacer*—that help us determine consistent spacing. I also threw in a few other handy calculators, including one that helps determine the number of risers to use in a flight of stairs, a common-rafter calculator, and a right-triangle calculator.

My goal was to create an app that's quick and easy to use and that provides answers to common deck-framing questions with just a few clicks. For example, to speed entry, you can input minimum spacing or set a default value for the minimum. The app automatically limits picket spacing so that openings are less than 4 inches, as required by code. The app can also calculate the spacing for sloped-stair railing pickets. And to help speed things along, the app is able to store default values for many of your most-commonly used measurements. The Whitmer Decks Field Tools app is available as a free download for Android devices on the Google Play Store. ❖

Cliff Whitmer owns Whitmer Decks, located in Fairfax County, Va.


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3


4

A prefabricated wood-fired barrel sauna (1) is just one of the many features of a large outdoor-living project that came to be known as "The Behemoth." One of the focal points of the project, which spreads out for more than 150 feet along the back of the house (2), is the hot-tub area (3). Another is a sunken lounge that has a gas fire pit (4). Trex Vintage Lantern and Havana Gold decking establish a color scheme that unifies all the different areas of the deck.

The Behemoth

by Calvin Cerilli

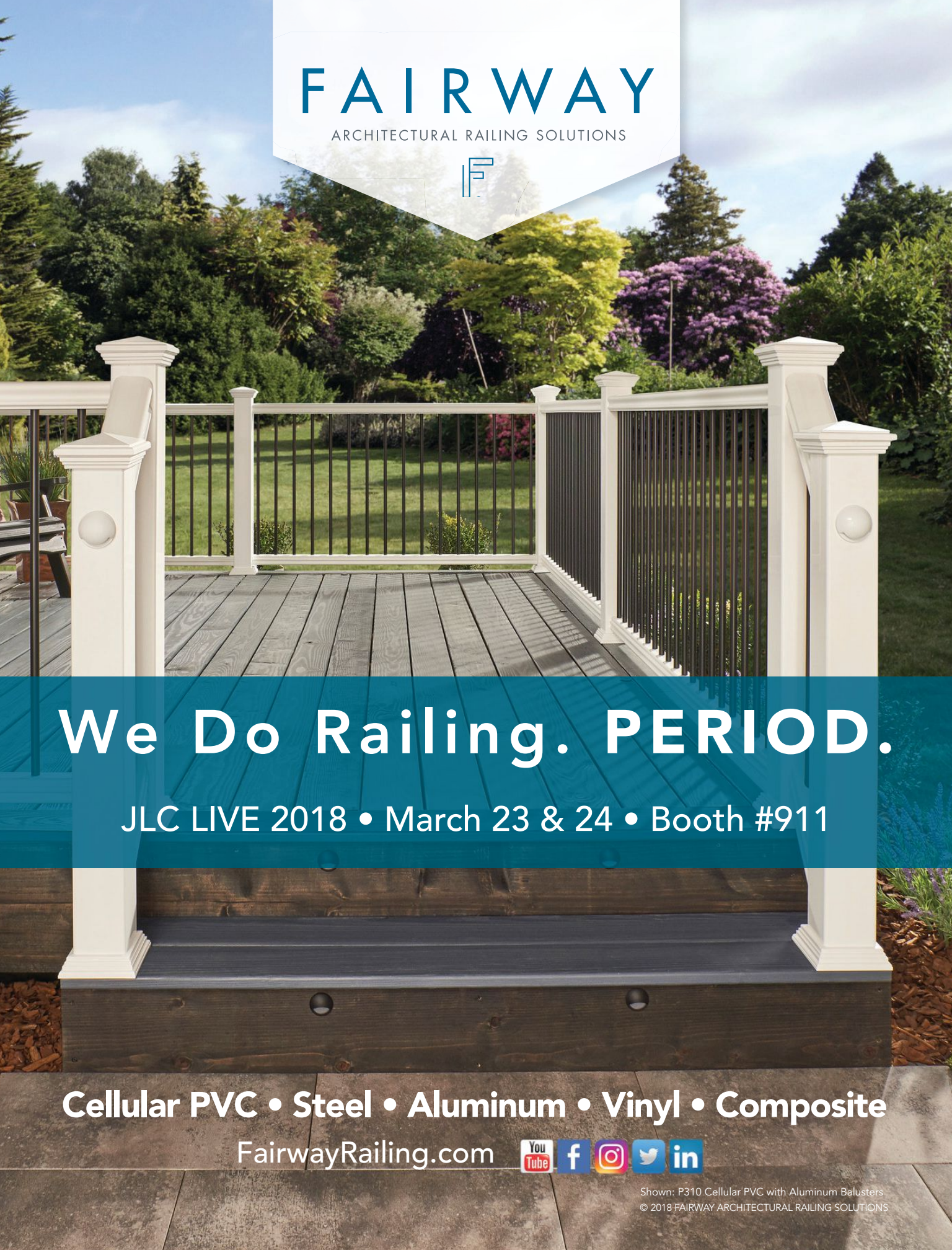
Even though our company, Blue Chip Decks, was only in its second year of business at the time, last year we bid against several more-established companies for a huge deck project that we came to call "The Behemoth." The decision came down to a "design-off," and after making a number of revisions to our detailed 3D renderings, we were selected to build the project.

One of the main challenges when designing the deck—which spans more than 150 feet—was to create unique living areas, while accommodating transitions and entry points onto the deck. At roughly its mid-point, the deck is tied together with a transitional area, identified by its intertwining herring-bone-pattern Trex decking. Flanking this is a sunken lounge area that has a fire feature and is shaded by a chocolate-stained cedar pergola. On the other side is a hot tub, which is framed by a custom bar and matching planters and benches and covered by an Arcadia louvered roof system.

We capped the project with a Dundalk red-cedar barrel sauna, accessed from a separate deck attached to the home's indoor pool house. Heated by a wood-fired furnace, the prefab sauna was easy to assemble and didn't require any major electrical or water hookups. It has a large fire box that holds plenty of wood, and water can be poured on the sauna rocks to create an awesome steam room. Perhaps best of all, when the fire is burning, the yard is filled with the amazing smell of fresh cedar. ❖

Calvin Cerilli cofounded Blue Chip Decks with Trevor Lunsted in 2015. The company is based in Winnipeg, Manitoba, Canada.

PHOTOS: CALVIN CERILLI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BY TED CUSHMAN

A Crawlspace Moisture Mystery

There was a packed house at January's International Builders' Show (IBS) in Orlando, Fla., for a three-hour master class on building science titled, "How Do I Avoid This? Conquering Home Performance Errors Before and After Construction." Five speakers took turns at the podium digging into complex issues of moisture and energy in modern homes: nationally known building scientist Joseph Lstiburek; DOW Building Solutions expert Brian Lieburn; Vermont-based consultant Peter Yost; Austin, Texas, builder Matt Risinger (Risinger Homes); and Greenville, S.C., builder Todd Usher (Addison Homes).

Peter Yost (who described himself as "the Northern guy") opened the session by reciting this basic principle: "Things get wet, and heat dries them out. Energy-efficiency measures reduce heat loss. So energy and moisture have to be managed with equal intensity."

With that opening summary, Yost neatly tied the rest of the lessons together. All of it was interesting. But for builders in the warm, humid Southeast, the most directly relevant portion may have been Todd Usher's story of the moisture problems his company encountered and overcame after they switched to building sealed (or "encapsulated") crawlspaces about a decade ago.

Raised floors over crawlspace foundations are typical in Usher's market, as they are in much of the Southeast and mid-Atlantic and also in

At right, a view of an Addison Homes "encapsulated" crawlspace, showing the company's current standard features: a 20-mil poly ground cover; 1.5-inch foil-faced insulation on the walls; and an "inspection strip" at the top of the block walls to allow termite inspections. The masonry-wall top is coated with waterproofing to prevent vapor intrusion.

During construction, the waterproofing crew applies a temporary ground cover **(2)** and applies waterproofing to the wall top and the tops of the interior masonry piers **(2, 3)**. The waterproofing provides a capillary break that keeps moisture from escaping out of the foundation into the underfloor air.

parts of the Midwest. Traditionally, those foundations have been vented to the outdoors, with insulation installed as needed in the floor joist systems between the crawlspace and the occupied space above.

It's a time-honored practice. But common as they are, those traditional crawlspaces are a well-known source of moisture problems. They also waste energy. So starting with the 2003 and 2006 versions of the International Building Code (IBC) and the International Residential Code (IRC), local building officials have allowed unvented, conditioned crawlspaces, which bring the underfloor space, and any equipment or ductwork located there, within the climate-controlled envelope of the home (see "Building a Sealed Crawlspace," Oct/03, and "Fixing a Wet Crawlspace," Aug/04).

Seeing the opportunity to save energy while also managing moisture more effectively, Todd Usher, like many other builders, went ahead and made the switch. "The last vented crawlspace that Addison Homes built was nine years ago," Usher told the audience of builders at IBS. "Everything since then has been encapsulated and conditioned. Essentially, we're building a mini-basement. We install insulation on the interior of the crawlspace walls, and a 20-mil vapor barrier along the floor of the crawlspace and up the walls behind the insulation."

The change did save energy. But when it comes to moisture, as Usher learned, sealing up the crawlspace is no simple solution.

Damp surprises. "We aren't allowed to have power in the house until drywall is hung," Usher noted, "so we can't turn on the HVAC and start pulling moisture out of the house until it's almost finished." That's long after the crawlspace is capped by the floor system, trapping any ground moisture into the air beneath the house. "With one of our first sealed crawls, after we framed in the floor, we noticed there was a shower happening underneath the house," said Usher. "We had to go in and remediate some mildew."

Lesson learned: After that mishap, the company's routine has been to install a temporary sacrificial ground cover to keep moisture out before decking over the crawlspace, and to leave temporary vents to the outside open (see photo 4, facing page) to air out the space until the power is on, the HVAC is working, and the space can be conditioned. Once the air conditioner is operating, they seal up the vents and install a clean, permanent ground cover in the space.

"For this temporary purpose, we don't have to worry about the code-required number of vents," said Usher. "We just put in as many as we want. And ever since we started doing that, we haven't had that problem with moisture during construction."

A humidity mystery. But Addison Homes did encounter an ongoing moisture problem in one of its earliest homes built over a sealed crawlspace—after the mechanical system was operating and the home was occupied, Usher said. And that experience also taught the builders an interesting lesson.

The walls of the crawlspace shown above have been insulated and waterproofed, and a temporary ground cover is in place. Temporary foundation wall vents are left open until the house is drywalled, power is turned on, and the HVAC system is operational so that the space can be conditioned.

"This was an older customer who wanted a zero-step entry," said Usher. "They wanted easy access, not only from the garage and the front door, but also through the back of the house. So we backfilled this whole foundation right up to just below the framing."

"It was a beautiful sealed crawlspace," said Usher, "but we started getting problems. We had high relative humidity in the crawlspace, and that was keeping relative humidity in the house high. Then we started seeing buckling in the wood floors. But when we called our flooring contractor, he said, 'Oh, you did one of those sealed crawls. It's not our problem. It's your problem.'"

"We don't install a stand-alone humidifier in our crawlspaces," Usher went on. "We condition the space with the mechanical system. But when we had this issue, we went ahead and put a dehumidifier in the crawlspace to see if we could dry it out. And the dehumidifier ran constantly, but the humidity really didn't come down—it stayed at about 70%, and the house stayed at about 60%. And when you walked into the house, you could feel that it just wasn't comfortable."

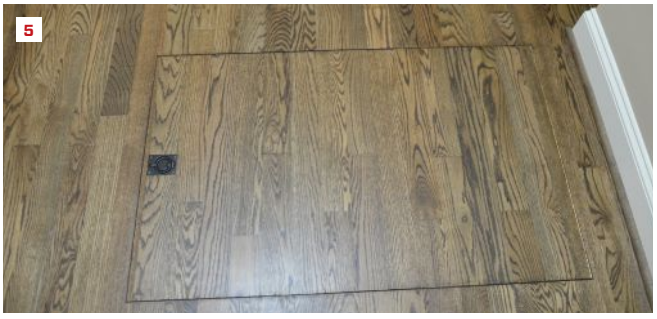
Detective work. At that point in his story, Usher stopped to ask the audience to guess what the problem might be. "Missing a transfer grille for airflow?" suggested one. Good thought, said Usher; this house in fact didn't have a designated return air path, although it did have conditioned air delivered into the space.

"Duct leakage too high?" guessed another audience member. Well, noted Usher, all the ducts were in the crawlspace, so duct leakage wouldn't be likely to pull in outdoor air.

"Capillary action?" suggested a third audience member. "The vapor barrier only goes partway up the wall, and the footings are still in the dirt. So water is going to migrate."

Bingo. At the time this house was built, said Usher, Addison Homes was building to the specifications of the EarthCraft green building certification program (earthcraft.org), promulgated by the Southface Energy Institute in Atlanta, Ga. (southface.org). That program called for a capillary break in the foundation. "It wasn't mandatory, but it was a way to score points," said Usher. "So we had put a capillary break on top of the foundation wall. We just had our crawlspace-sealing folks leave some of that extra membrane after they installed the wall membrane, and we would drape it over the block wall before we framed the house."

"Our termite inspection company wants us to leave a 4-inch termite inspection gap at the top of the wall," said Usher. So the piece of poly installed as a capillary break under the framed sill was left hanging loose, so that it could be lifted up for inspection. Moisture wicking up from the red clay soil, through the footings, and up to the top of the masonry wall was collecting on the underside of the poly and dripping back down into the crawlspace. "None of it was getting into the framing material," said Usher. "None of it was making the wood wet. But the foundation was drawing that



To safeguard the crawlspace's character as conditioned indoor space, Addison Homes provides access from inside the house with a floor hatch **(5)** and a small set of stairs **(6)**, rather than providing a door to the outside. Exterior waterproofing and drainage **(7)** help defend the space against ground moisture.

moisture up from the footer into the crawlspace, and making the humidity in the crawlspace high."

"So what do we do now?" said Usher. "We looked at putting a capillary break on top of the footing, but there were logistical challenges: How do you put it down? What happens if it rains and there's mud on the footing? For a while, we had the masons put a capillary break between the courses of block, at about the height of the backfill. But they didn't like that—they complained that the block wasn't going to stay together. So then we came up with a simple approach: When the waterproofers spray the outside of the wall, we have them spray the top of the wall too, and one course down on the inside [see photos 2 and 3, page 54]. Our crawlspace-sealing crew brings their poly up to that waterproofing line. We do the same thing on the piers. And we have had no more problems since."

Access hatch. Usher doesn't provide any door from the crawlspace to the outdoors. "If you put the access door on the outside," Usher explained, "people tend to do dumb things, like stick the lawnmower under there, or the gas cans, or the paint cans. And it's tough to seal a door for the exterior foundation wall."

So instead, Addison Homes installs a hatch with a small set of stairs to allow access to the crawlspace from the occupied first floor (see photos 5 and 6, above). "Now folks can really value the space," said Usher. "It's clean and dry, and they can store things down there."

"Our trade contractors love our sealed crawlspaces," Usher noted. "But we had to train people to take off their shoes before they go into the crawl. If you don't take your shoes off, you are going to be cleaning the mud off the ground cover."

One builder in the audience asked, "But couldn't you argue that an unvented crawl has been around for maybe 20 years, while vented crawlspaces have been around for hundreds of years, and a lot of them have functioned just fine? Is it really that vented crawls are bad, or is it that bad vented crawls are bad?" Usher responded: "I'm going to let Joe Lstiburek talk about the history of venting crawls."

Said Lstiburek: "Well, if you didn't insulate the crawlspace at all, and you didn't build with engineered wood (which is an insult to both engineers and wood), you'd be fine. You could build with real dimensional lumber and plywood; and if you had no insulation in it, and a plastic ground cover? Yay. Back to the Civil War. Not a problem."

"But it's just like Peter Yost said earlier," Lstiburek continued. "When you change the energy balance, everything changes. In the old days, we had an enormous energy exchange. So when things got wet, they dried out. But we changed the energy balance."

The moral of the story, said Lstiburek: "You can't get your money for nothing and your chicks for free—that's the second law of thermodynamics set to music."

Ted Cushman is a senior editor at JLC.

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hanleywood

BY KATHLEEN BROWN

1. Composite Porch Flooring

Deckorators' new composite porch flooring is made with "Eovations technology," which the company says creates a fiber-like core that is impervious to moisture. The 3 1/8-inch-by-7/8-inch boards are available with square-edged or tongue-and-groove profiles, and in three paint-like colors: chicory, macadamia, and kettle (gray). The T&G boards come in 10-, 12-, and 16-foot lengths; the square-edged boards are available in 12-foot lengths only. Prices range from $3.25 to $3.50 per lineal foot. deckorators.com

2. Sleek, Stylish Shower Drains

Schluter Systems has introduced three grate designs that integrate with its Kerdi 4-inch-square point drains and its Kerdi linear drains (in lengths from 20 inches to 48 inches). The grates for all three designs—"Curved" (shown), "Pure," and the nature-inspired "Floral"—have no screw holes and fit into a thin, discreet frame. Grates and frames for both the Kerdi drain style and the Kerdi line style are made with brushed stainless steel and are adjustable to work with common tile thicknesses. Pricing varies by distributor. schluter.com

3. An Interchangeable Sink Design

Elkay's Stainless Steel Farmhouse sink with Interchangeable Apron Front gives kitchen designers the ability to change the kitchen design in minutes. The interchangeable aprons are available in several colors and materials, including stainless steel and white fireclay. On select models, a low center divider makes it easier to wash large items, like baking sheets and roasting pans, over both bowls. Sinks range from $750 to $1,150, and aprons range from $250 to $450. elkay.com

4. A Tough Screen System

Screen Tight's heavy-duty MeshGuard porch screening system is engineered to withstand up to 50 pounds per square foot of pressure, the company says. The vinyl extrusions used with the company's MeshGuard polyester screening are reinforced with galvanized steel strips that act as elongated washers to prevent the extrusions from pulling away from the framing under load. The pre-punched strips come in 8-foot lengths. The MeshGuard system sells for about $6 per square foot. screentight.com

5. A Thin Sound Abatement System

While many sound-abatement products rely on solid or absorbing materials, Acoustiblok does neither. The thin, flexible 1/8-inch-thick polymer sheets are stapled or screwed to studs before drywall. The product transforms acoustical energy into inaudible "internal friction energy," the firm says, and allows easy access to the wall interior for plumbing and wiring maintenance. The recyclable material comes in rolls of 30-foot, 60-foot, and 350-foot lengths. Pricing varies according to types of sound and level of noise reduction desired. acoustiblok.com

6. Hurricane-Resistant Glass Doors

Sierra Pacific Windows has expanded its line of FeelSafe hurricane-ready products with the new FeelSafe Bi-Fold Door, intended for large, expansive openings. The company says the door's laminated glass is shatter-resistant and engineered to withstand hurricane-force winds up to 180 mph. When fully open, the folding door panels stack perpendicular to the wall to optimize space and views. Pricing varies by opening size and selected options. sierrapacificwindows.com

7. A Snap-In LED Downlight

Kichler's Horizon fixture is an LED-lit alternative to traditional recessed can fixtures. This light sits nearly flush, extending only 1/2 inch from the ceiling or mounted surface. It is designed to snap into either a 4-inch-octagon or a 4-inch-square (2 1/8-inch minimum depth) ceiling junction box, offering fast installation and placement flexibility. The light is made from die-cast aluminum with a powder-coat white finish. It is Energy Star rated and wet-rated. Pricing starts at $30. kichler.com

8. Ultra-Thin Showerheads

California Faucets added a line of Ultra-Thin Showerheads to its offering of contemporary bath fixtures. The collection includes square and round styles in 6-, 8-, 10-, and 12-inch sizes, measuring 5/16 inch thick—one of the thinnest styles on the market today, according to the manufacturer. The Ultra-Thin Showerheads offer a clean, minimalist design and rain-like spray performance. The solid brass showerheads are available in more than 30 finishes. A round 6-inch showerhead in polished chrome starts at $175. calfaucets.com

9. A Drill-Powered Deck Board Clamp

Dextor Power Hand is a deck-board clamp that can be powered by a cordless drill/driver equipped with a clutch and an 11mm hex bolt bit. Depending on the width of the hardwood decking boards being installed, the Power Hand can clamp three or four boards at a time and is capable of providing more than 400 pounds of pulling or pushing force to straighten the decking, according to the company. Suggested price for the Dextor Power Hand is $170. dextorworks.com

10. Expanded Railing Line

Fairway Architectural Railing Solutions' new cellular PVC rails are reinforced with an aluminum insert and available in 6-, 8-, and 10-foot lengths, meeting IRC and IBC code standards, the company says. Matching posts come in both 36-inch and 42-inch heights. The railing system is compatible with square PVC and round aluminum balusters that fit in the pre-punched bottom and top rails without screws, as well as with glass slats and horizontal cable. The system is available only in white, Fairway says, but can be finished in other paint colors. MSRP is $36.16 per foot. fairwayrailing.com

11. Laminate Flooring With a Wood Look

Mohawk's new Revwood Plus flooring is a 100% waterproof laminate flooring with a wood look. The durable flooring is stain-, scratch-, and dent-resistant, pet- and kid-friendly, and waterproof, according to Mohawk. The flooring also features a pet warranty. Spills, accidents, and tracked-in stain-makers are kept on the surface for quick, easy cleanup thanks to a glueless locking system, which also allows easy installation of the floating planks. Pricing ranges from $4 to $4.50 per square foot plus installation. mohawkflooring.com

12. Gas Fireplace Without a Glass Front

Heat & Glo's Phoenix combines the ambiance of a traditional wood fireplace with the convenience of gas. The Phoenix terminates horizontally to offer a greater view of the fire and to provide installation and design flexibility. Artwork or a TV can be safely hung 12 inches above the fireplace without a mantel, the company says. The Heat & Glo Phoenix includes an optional built-in Bluetooth speaker as well as a quiet ventilation system that the company says creates airflow while minimizing sound. Pricing starts at $6,500. heatnglo.com

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BY CHRIS ERMIDES

Working Safely With Silica Dust

You've likely heard by now that OSHA updated its rule on acceptable exposure limits to silica dust. If your response to this news is to groan, slap your forehead, and lament "another regulation," you're not alone. The update went into effect this past September and was most recently challenged in federal appeals court; the challenge was rejected essentially because the court found OSHA's standards to be economically and technically feasible to carry out.

Putting aside the term "rule" and "OSHA" for a moment, consider what silica dust is and why it is dangerous. Silica is the dust form of silicon (Si), which is the second most common element on Earth (oxygen being first and aluminum being third). According to OSHA, "Inhaling very small ("respirable") crystalline silica particles causes multiple diseases, including silicosis, an incurable lung disease that can lead to disability and death. Respirable crystalline silica also causes lung cancer, chronic obstructive pulmonary disease (COPD), and kidney disease."

OSHA first recognized the hazard by implementing a rule in 1971 based on data that was gathered in 1960 and earlier. Since 1971, OSHA has discovered that the limits it set weren't adequately protecting workers, and it also acknowledged that its path to compliance wasn't easy to follow. According to silica-safe.org, a site run by the Center for Construction Research and Training, silica can be found in the following materials: asphalt, brick, cement, concrete, drywall, grout, mortar, stone, sand, and tile.

The new rule drops the acceptable exposure over an eight-hour day from 250 micrograms per cubic meter of air to 50 micrograms. How big is that? It equates to about 1/20 of a grain of table salt. Think about the last time you drilled a hole in concrete, cut fiber cement, or feathered the edge of tile with your grinder. Within seconds, you produced way more than that amount of dust. Not all of it went into your lungs, obviously, but over the course of an eight-hour work day, or over the course of several days, it adds up.

The issue is much more prevalent in certain commercial industries that deal with concrete and rock all day every day, but if you do any work at all with the materials listed above, you are at risk of exposure. In an effort to help with compliance for smaller companies and independent contractors, OSHA has created the Small Entity Compliance Guide (publication OSHA3902; osha.gov). It outlines in great detail how to comply with the rule. Here are some of the highlights.

HOW TO COMPLY

OSHA offers several ways to comply, including following a prescriptive path in "Table 1" of the rule (see OSHA 3902). The path provided there is the simplest and most manageable for smaller companies that don't work with materials that produce respirable silica in ample amounts. Table 1 lists the 18 most commonly performed tasks that produce respirable silica, including cutting

Respirators are not enough. OSHA offers two compliance paths: "Table 1" from the rule, and "Objective Data" based on testing performed by respective tool manufacturers. Respirators aren't often needed within either compliance path, while dust-control methods almost always are.

When a respirator is required, Table 1 indicates whether it needs to be rated APF 10 or, in some cases, APF 25. Some dust-control methods, like the grinder shroud and dust extractor shown here, might still require the use of a respirator depending upon the duration of the task. Grinder shrouds, like this one from Metabo, are becoming readily available from most power-tool manufacturers.

Photos courtesy of the manufacturers

and drilling concrete as well as working with fiber-cement products (siding and tile backerboard). Within the table, OSHA breaks down exposure limits to time frames: less than or equal to four hours, and more than four hours.

Table 1 is not the only compliance path. Users can also use Objective Data provided by tool manufacturers. Most manufacturers of concrete working tools have excellent guides on their websites concerning compliance. While this may be perceived by some as a marketing ploy, it's not; the resources spell out how each of their respective products fulfills the OSHA regulation and indicates whether compliance is via Table 1 or Objective Data.

MOST SAWS REQUIRE WATER

Table 1 spells out several cutting tasks that require everything from handheld cutoff saws to riding saws. To be compliant, no matter what diameter blade you're using, and no matter if you're cutting indoors or outdoors, the rule requires that the saw be equipped with an integrated water-delivery system that feeds water continuously to the blade. An important note here is that the delivery system must be specifically designed commercially for the type of tool you're using. So, you can't make jobsite modifications to tools or use methods like spraying the blade—or the concrete, block, brick, or whatever material you're cutting—with water and be considered in compliance (or even protected).

As you well know, commercially available saws are typically equipped with a hose connection. Skilsaw sells a saw called the Medusaw (now available as a walk-behind saw as well) that is a redesigned Skilsaw 77 equipped for cutting concrete and masonry. The problem here, as with any saw that has onboard hose hookup, is that it requires a water source.

There are systems available for when a water source isn't readily present. Several manufacturers have a pressurized tank system for this purpose. Hilti has an add-on pump kit that can draw water from a large bucket. This works for a couple of the Hilti saws in situations when you don't have running water.

GRINDERS NEED WATER OR DUST SHROUDS

Mortar removal is spelled out in its own step within Table 1—wherein you're allowed to use a grinder equipped with a commercially available water-delivery system or with a commercially available shroud and dust-collection system. Most manufacturers that make grinders now have these shrouds and dust-collection systems available. You can purchase the shroud separately as a retrofit for many grinders—both cordless and corded. You can purchase it as part of a kit with a grinder, as well. For other tasks, like surfacing concrete or cutting tile, you can use either a water or a dust-collection approach. However, there are other parameters for both approaches, so be sure to read Table 1 carefully.

In either scenario, the dust-collection system must provide at least 25 cfm of air flow per inch of wheel diameter, have a filter that is 99% efficient or greater, and use either a cyclonic pre-separator or a filter-cleaning mechanism. Cyclonic pre-separators are becoming more widely available—though typically only worth an investment

Cutting options vary. The most straightforward path to compliance when you're cutting concrete or masonry is to use a wet cut-off saw. The Hilti DSH-700 (top) has an add-on water pump feature that complies where running water is not available. Cutting fiber-cement products like siding and backerboard should be done outdoors in a way that does not create dust. If a saw is used, it must be equipped with a dust shroud, like the one on the Makita (second from top). A popular misconception is that the dust extractor in this scenario must be equipped with a HEPA filter; it does not. But the extractor must be equipped with a filter that is 99% efficient or greater. Skilsaw's Medusaw (above) complies with Table 1 when used with its water-delivery system. But the saw also complies via the Objective Data component of the rule if used with a dust extractor according to Skilsaw's recommendations.

Drilling options. Several other tool manufacturers offer inexpensive shrouds designed to contain silica dust. When you're drilling overhead, this shroud from Milwaukee (top) can be emptied and reused, or the tool can be hooked up to a dust extractor. Most tool manufacturers offer Table-1-compliant, onboard attachments, like this DeWalt shroud (second from top), which is designed to contain dust, as well as pull dust away from the hole. Other shrouds, like the Bosch (above right), hook up directly to a dust extractor. These shrouds suction to the work surface, contain the dust, and pull it away at the same time. Hollow-core drill bits (not shown) are also available that connect directly to the dust extractor and remove dust as the hole is drilled. HEPA-equipped dust extractors, like this new model from Hitachi (above left), are available in various sizes and cfm ratings to comply with Table 1.

if you're doing significant amounts of this work. Metabo, for example, has one coming out in April that is HEPA rated and costs $2,500. If you do only some mortar removal, cutting, or surface grinding with a grinder, or use a grinder to cut tile or fiber cement, a dust extractor with filter cleaning might be the most economical approach. Depending upon features, size, and other specs, you can purchase a dust extractor for anywhere from several hundred to a couple of thousand dollars. If the dust extractor doesn't have automatic filter cleaning, look for one that has an onboard gauge that indicates when the system is getting full and needs to be cleaned.

If you work with the wet method, keep in mind that the Table-1 prescriptive path requires that you clean up the slurry, as well. Dried slurry turns into dust, which then requires a HEPA filter to adequately handle. The OSHA3902 publication has some good guidance on containing and managing slurry, particularly in freezing temperatures.

DRILLING REQUIRES DUST CONTROL OR COLLECTION

With the exception of core drilling, which requires an integrated water-delivery system, all drilling tasks into concrete, masonry, and other materials that produce silica dust require a dust-collection system that complies with Table 1. Some manufacturers have products that aren't specifically Table-1 compliant, but provide the Objective Data required to prove they keep the exposure limit below OSHA's limits. One example is Milwaukee's SDS Plus Dust Trap, which captures dust while drilling holes up to 7/8 inch in diameter by 4 inches deep. When attached to a dust extractor, the Dust Trap becomes Table-1 compliant, but on its own it fulfills the Objective Data component of the rule. A shroud like this is by far your least expensive option if you don't often drill holes in concrete or mortar; it sells for about $20.

Another less expensive option, if you already own a HEPA-rated extractor and don't want to invest in an entire setup, is a hollow-core bit. These are available from many tool manufacturers in a wide range of sizes and sell in the $80 range, depending on size and brand. When using this type of bit, you need a HEPA-rated filter in the dust extractor that is Table-1 compliant.

Dust shrouds that encircle the bit near the work surface are available from all of the manufacturers. These shrouds keep the dust from becoming airborne and connect to a dust extractor that's equipped with a HEPA-rated filter. The shrouds adhere via suction directly to the surface being drilled once the dust extractor is turned on.

If you drill a lot of holes and have bought into a battery platform, or if you already own a cordless rotary hammer, there are commercially available shrouds that attach directly to the tool. These shrouds are like having an onboard dust extractor and include a filter. They are powered by the tool's battery. Some manufacturer's products are Table-1 compliant, while others comply with the OSHA rule by providing Objective Data about that specific setup.

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*Advertising appears in regional editions

BY TIM HEALEY

To increase production speed, Levitt and Sons used slab-on-grade construction. At the height of its productivity, the company erected one house every 16 minutes—which became part of its sales pitch. By 1951, 17,447 homes had been constructed. No under-slab insulation or vapor barriers were installed, and the copper piping used for the hydronic radiant heat corroded fairly quickly (leaks often went unnoticed, soaking into the ground). Many homeowners abandoned their heating system within 15 to 20 years.

Levittown's 'Cellarless' Homes

On May 27, 1947, a town board meeting was held in Hempstead, New York, on Long Island. First up on the agenda was a request to repeal section 809 in Article 8 of the local building code, which required that all homes be built with basements. Debate on whether to allow the building of "cellarless" homes lasted a little more than 20 minutes. The code amendment was approved, most of the attendees exited the small meeting room, and the town board carried on with Hempstead's affairs.

What seemed to be a simple amendment changed the face of building in America. It allowed the first 2,000 homes (of an eventual 17,441 total) to be built in the town later named "Levittown."

HOMES WITHOUT CELLARS AND WITH 'RADIATION' HEATING

Berni Fisher, a beat writer for *Newsday* (the local paper of record) painted a more colorful picture of the meeting. In his story on May 28, 1947, Fisher wrote, "New hope lights the faces of those (some desperate for homes) who heard Hempstead Town Board change the zoning laws to permit building of homes without cellars and with radiation heating. Interested spectators crowded into the room where the hearing was held, and overflowed into the hall and down the stairs." Fisher added, "Scores of veterans and families were among the record throng of 800 who attended the public hearing."

Fisher went on to report that developer William Levitt, of Levitt and Sons, told the board that "he sought an amendment for the sake of speed." Fisher quoted Levitt as saying, "Building cellars would not affect the cost of this project, but under the present building conditions it would take three to four years to complete this number of houses." Levitt wanted to finish 2,000 homes within a year. His attorney, Ira Goldman, pointed out that "noted architects and engineers have approved this type of basementless construction," in an apparent nod to Frank Lloyd Wright's passion for using radiant slabs.

Fisher reported that in response to presiding supervisor A. Holly Patterson's probing on whether this type of building would sacrifice the desirability and quality of the homes, Levitt said, "This is the best construction we have done in 20 years." Levitt had honed his production skills building slab-based housing during the war.

WE WANT THE HOUSES!

The attendees began to sound off: "Cellar or no cellar doesn't mean anything to me or anyone else here. We want the houses!" and "No cellar beats one room in an attic where you freeze to death for $45 a month." Next, according to Fisher, Patterson assured everyone that the board intended to cooperate with builders in Nassau County, N.Y., and insisted that the board was "primarily interested in seeing that the townspeople get fine livable homes." Patterson then declared a motion to repeal section 809, and so it passed.

Tim Healey is a senior editor at JLC.

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