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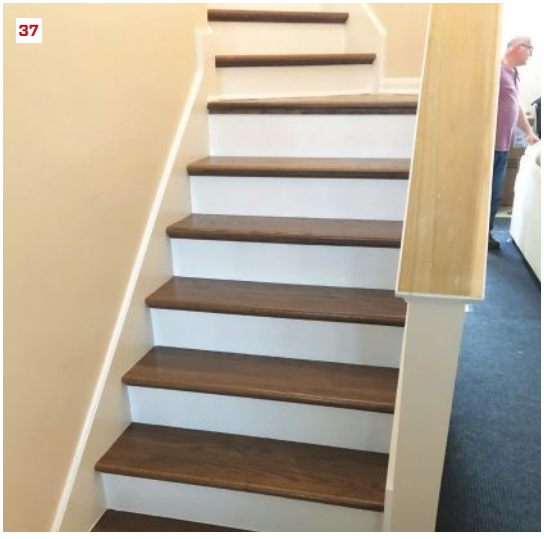

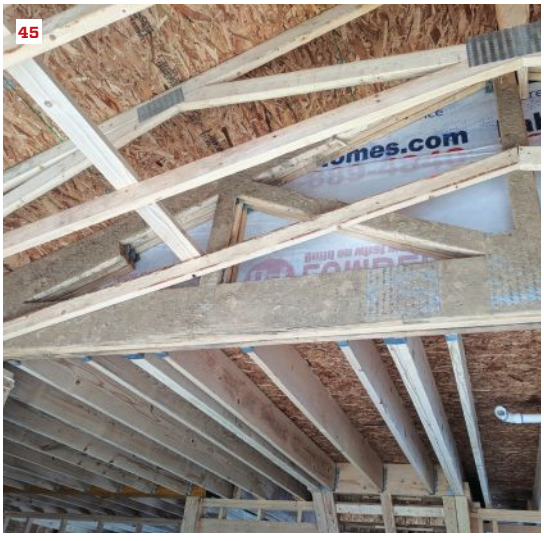

On the cover: Jason Hammer, owner of The Carpentry Pros, in New Palestine, Ind., test fits a tread on a stair remodel. He slides shims under the tread while checking level in two directions. See the story on page 37. Photo by Morris Ridenour.

FEATURES

DEPARTMENTS

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BY MIKE GUERTIN

Kickout Flashing: Required by Code, Yet Often Overlooked

I didn't even know what a kickout flashing was until the second half of my building career. After seeing and repairing a couple of rotted walls below eaves overhangs **(1)**, I realized that we needed a different approach to accepted flashing practices.

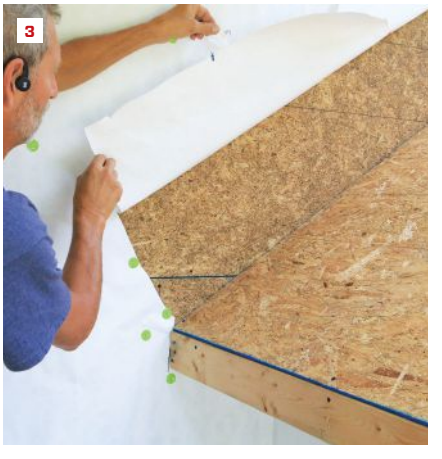
In the simplest terms, a kickout flashing is a special type of flashing installed as the first step-flashing at the edge of a roof where the eaves meets a wall, such as where the eaves of a garage roof meets the wall of a two-story home **(2)**. The wall leg of a kickout flashing extends out from the wall, protruding away from the siding, and directing runoff away from the wall.

Kickouts in the code. Kickout flashings have been required by the International Residential Code (IRC) since 2009, yet I've rarely seen them installed on new homes. Part of that might be the original awkward language that didn't even include the term "kickout flashing." In the 2012 IRC, Section R903.2.1, Locations, the language was changed to be clearer: "A flashing shall be installed to divert the water away from where the eave of a sloped roof intersects a vertical sidewall." Unfortunately, neither the IRC nor the code commentary on that section includes an illustration of the flashing.

Even though the code and good building principles call for us to install kickout flashing, it is often overlooked (or ignored) by builders, roofers, siding installers, and code inspectors. Perhaps that's because the requirement is fairly recent and the need for kickout flashing along with the method to install it properly isn't knowledge that has been passed down. Or maybe it's because the installation process involves different trades at different stages of construction, and no single person accepts responsibility for the detail. And then there are aesthetic concerns: Those turned-out flashing legs aren't very attractive, so contractors may opt not to install them.

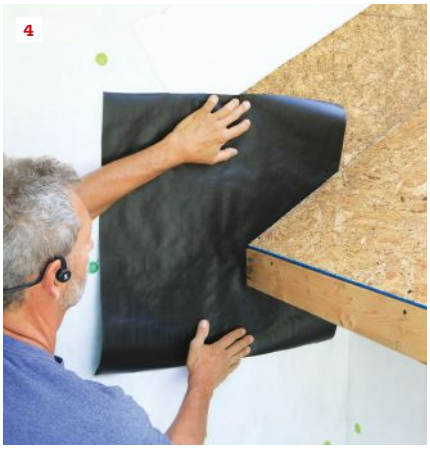
Good kickout flashing detailing is hard to execute—not because the process is difficult, but because it involves an intersection where multiple trades have a hand in the installation. To be effective, kickout flashing has to be layered with the framing, WRB, trim, roofing, and siding in a way that blocks water from getting into the wall assembly and redirects that water to where it can safely drain away. The sequence I follow is a little redundant and quite detailed in the application of water-shedding layers. My cautious approach is informed by the numerous repairs I've done—even some where kickout flashings had been installed, but water had still leaked behind the flashing and the WRB.

Start with the framing. I will describe the process with the WRB already installed, but I will also note where modifications



Photos by Mike Guertin

Kickout flashing has been required by code for more than 10 years, but the author still finds instances where it wasn't installed—with predictable results **(1)**. A properly installed kickout diverts roof runoff away from siding at the crucial eaves intersection **(2)**. The first step to installing the flashing is cutting and lifting a flap of WRB to access the sheathing at the roof-wall intersection **(3)**.



Subfascia or solid blocking provides backing for the flashing layers. A square of WRB (black was used in the photos for clarity) slides behind the eaves–wall intersection **(4)** and is stapled in place **(5)**. Flexible flashing tape bridges the intersecting surfaces **(6)**, while metal flashing protects the tape **(7)**. The finished fascia goes in next **(8)**. In cold climate areas, ice barrier laps over the fascia and up the wall **(9)**.

can be made for other circumstances; for instance, if the WRB is to be installed later or if the house has a sheathing-integrated WRB such as the Zip System.

Some of the waterproofing layers that precede the kickout flashing require solid backing along the fascia plane. If a subfascia has not been installed, fasten a block in the rafter or truss bay closest to the wall.

Start by cutting a 9-inch-wide (or wider) flap in the WRB, and fold it up the wall **(3)**. Next, slide a 2-foot-square piece of WRB sheet over the main WRB at the eaves edge. Ideally, I slip it a couple of inches behind the rafter or truss tail **(4)**, or just notch it to fit around the subfascia and roof. (If the main WRB isn't installed yet or sheathing-integrated WRB is used, apply the square piece of WRB to the sheathing surface.) Position the top of the piece about a foot above the eaves and cap-staple it to the wall, leaving the bottom of the sheet loose to integrate with the siding later **(5)**. (When installing the square WRB piece over sheathing-integrated WRB, seal the top edge to the sheathing with SAF or with fluid-applied flashing).

Seal the 3D corner. Next, using a piece of flexible SAF, I preflash the intersection of the subfascia, the square piece of WRB, and the roof sheathing **(6)**. The SAF is less prone to damage and leaking than the sheet of WRB beneath, and the tape seals the three-dimensional connection in case the kickout flashing is ever damaged.

The finished fascia board can be installed at this point, but for another layer of protection, I often install a metal corner flashing over the flexible SAF for good measure **(7)**. The metal anchors the tape in place and shields it from exposure and view if there is any gap between the siding and fascia. The fascia can butt up to the corner **(8)**.

For cold climates, run the ice-barrier membrane along the eaves edge so that it overlaps and seals the top of the fascia board and extends 6 to 8 inches up the sidewall **(9)**. In climates where an ice-barrier sheet isn't typically installed, I recommend applying a 4-foot-long by 12-inch or wider strip of self-adhering membrane between the wall and roof sheathing. The drip edge goes in next over the ice barrier along the eaves

After the ice-dam protection is installed, the drip edge goes in. Be sure to leave it 1/4 inch short of the wall **(10)**. Next, the kickout flashing—which is also the first piece of step flashing—is nailed in place **(11)**. The roofer can then install the shingles and the rest of the step flashing, continuing up the roof **(12)**.

Drop the flap of WRB back down over the step flashing along the roof-wall intersection **(13)**. Slit the WRB and slide an additional piece of WRB into the slit to protect the square (black) piece installed earlier **(14)**. Anchor the top and sides of this last piece of WRB, sealing it to the main WRB. Leave gaps in the tape at the bottom to allow any water to escape **(15)**.

edge. Be careful to leave a 1/4-inch gap at the end so that it doesn't exert any pressure on—and cut into—the upturned ice barrier or membrane strip **(10)**.

Flashing and roofing. At this point, the first piece of step flashing—the kickout flashing—can be installed. Premade kickout flashing is widely available or it can be fabricated from a large piece of step flashing. I prefer using manufactured plastic kickout flashing such as DryFlekt, which has a scupper formed to direct water into a gutter. Plus I can trim the turn-out leg to any length. Because the turn-out leg has to extend out beyond the siding, I choose a flashing color that is close to the color of the siding.

Be sure that the turn-out leg is deep enough to extend through any exterior insulation and rainscreen space and then go beyond the surface of the siding by a least 1/2 inch. I align the inside heel of the kickout flashing about 1/2 inch lower than the bottom of the drip edge and fasten the flashing to the roof and wall **(11)**. With the kickout flashing positioned, the roofing and regular step or continuous flashing can be installed along the sidewall **(12)**.

Buttoning up. Once the roofing is installed, the flap of WRB taped up earlier can drop down over the wall legs of the step and kickout flashings **(13)**. To counterflash the top of the square piece of WRB, another piece of WRB can be inserted into a slice in the

As the siding is installed, the bottom edge of the square WRB piece laps over the siding course just below the eaves **(16)**. When the next course goes in, the WRB is trimmed at the bottom of the course **(17)**. Slots or notches in the siding allow it to fit around the kickout flashing **(18)**. The layers behind the flashing should protect against any water that might get through.

main sheet of WRB covering the wall **(14)**. Trim the counterflashing piece of WRB around the kickout flashing and fully tape it along the top and sides. At the bottom, leave gaps in the tape so any water that might get to the inner layers of WRB can weep out **(15)**.

If you prefer counterflashing the kickout and step flashings with a strip of SAF or fluid-applied flashing, do that before lowering the WRB flap. This step is often done when flashing to a sheathing-integrated WRB system. If the main WRB is applied after the kickout flashing is installed, it can be applied over the top of the flashing and over the square piece of WRB, with the bottom edge of the square lapped over a sheet of WRB below.

Where the WRB is cut to fit around the top of the turn-out leg of the kickout flashing, there is always a risk of water leaking behind the flashing. And it's also possible for water rushing down the roof to hit the turn-out leg and to push upwards behind the counterflashing piece of WRB. This is where the square piece of WRB applied earlier does its duty, backing up the weak spot in the flashing system. In the event that any water does get behind the kickout flashing or in the joint where siding fits around the downhill side of the turn-out leg, that water is blocked from reaching the wall sheathing or main sheet of WRB by the square piece.

When a rainscreen space is used behind the cladding, the bottom edge of the square piece can be left on top of the primary WRB sheet, and any water blocked by the WRB piece can freely drain and dry in the vent space. When the siding is applied in direct contact with the WRB, the risk of damage to the siding is higher. To provide an exit for the water, I let the loose bottom edge of the square piece of WRB lap over the top of the siding course **(16)**, trimming it at the exposure line of the overlying course **(17)**. To prevent water from being trapped by the overlying course, I tap in a couple of toothpick-sized slivers of wood or plastic between the siding courses to leave a weep gap.

The cladding has to be cut or notched around the turn-out leg of the kickout **(18)**. Some installers balk at cutting a big notch in the siding, with worries about leaks. But I consider this to be a transition spot and there's no getting around having a small gap. I think of it like any other butt joint we install in a cladding system (at the corner boards, window trim, or joints between lengths of siding), which underscores the importance of the layers of WRB beneath the kickout flashing as well as providing an exit for any water.

The turn-out leg of a kickout flashing needs to extend only slightly proud of the siding surface to do its job. Manufactured models have extended legs to use with EIFS, exterior continuous insulation, and siding of varying thicknesses. The manufacturer's intention is for the installer to trim the leg to whatever length is desired. I typically leave the full leg intact or trim the leg diagonally from the scupper up to the top about 1/2 inch away from the siding. This reduces the leg projection but still leaves the scupper portion at the bottom to direct water into the gutter and away from the wall.

Mike Guertin is a builder and remodeler in East Greenwich, R.I., and leads training workshops at JLC Live and the Remodeling Show / Deck Expo. Follow him on Instagram @mike_guertin.

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

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With a porous stone like bluestone, the process of spalling (also called "thermalling" or "flaming") can be used to rough up smooth-cut surfaces. After thoroughly wetting the stone **(1)**, the mason applies heat with an acetylene torch **(2)**. The heat turns the water to steam. The rapid expansion of the water causes the outer layer of stone to pop off **(3)**. He repeats the wetting and heating process until the desired amount of spalling is achieved.

Q How do you give the cut edges of stone a cleft look?

A Peter Chappelow, who owns Half Moon Stone Works with his brother, Thomas, in western Vermont, responds: In the article "Stone Veneer on a Foundation" (Aug/19), my brother and I mentioned that the project designer opted for a bluestone cap for the top of the veneer after we had begun applying the veneer. Then, once we had installed the cap, a further decision was made to spall the cut ends of the cap to give it a rougher appearance, more like the face of the cap.

Usually considered a defect or problem in brick or concrete that needs to be repaired, spalling occurs when water enters the porous surface of the masonry and causes the outer layers to flake or pop off, leaving the rough interior surface of the masonry exposed. Freeze-thaw cycles can exacerbate spalling. In this case, we needed to force the spalling, and we didn't have the time that it takes Mother Nature to create natural spalling.

First, we soaked the areas to be spalled—in this case, the ends of the cap—with water. Bluestone is a very porous stone, so we held a wet rag over the cut end of the cap for a few minutes to let the water soak into the stone **(1)**.

While the stone was still wet, we blasted it with an acetylene torch **(2)**. Heat from a torch rapidly turns the water beneath the surface of the stone into steam, which makes the surface layer pop off. We repeated the wetting and heating technique as many times as necessary until we had achieved the amount of spalling for the desired rough look **(3)**.

Spalling (also called "thermalling" or "flaming") is a dangerous process because the flakes of stone can come off the surface with a lot of force. Safety glasses should be worn at all times—by the person with the torch and by anyone else helping or working nearby. And because we did the spalling after the cap was installed, we also needed to protect the adjacent trim surfaces. While one of us worked the torch, the other held a steel trowel against the trim to protect it from the heat, rewetting the end of the cap as needed.

For nonporous stone such as granite, a wide chisel can be used to flake off the outside layer of stone. This process—known as "pitching"—is more delicate and can be performed on a wider variety of stone.

Photos by Tim Healey

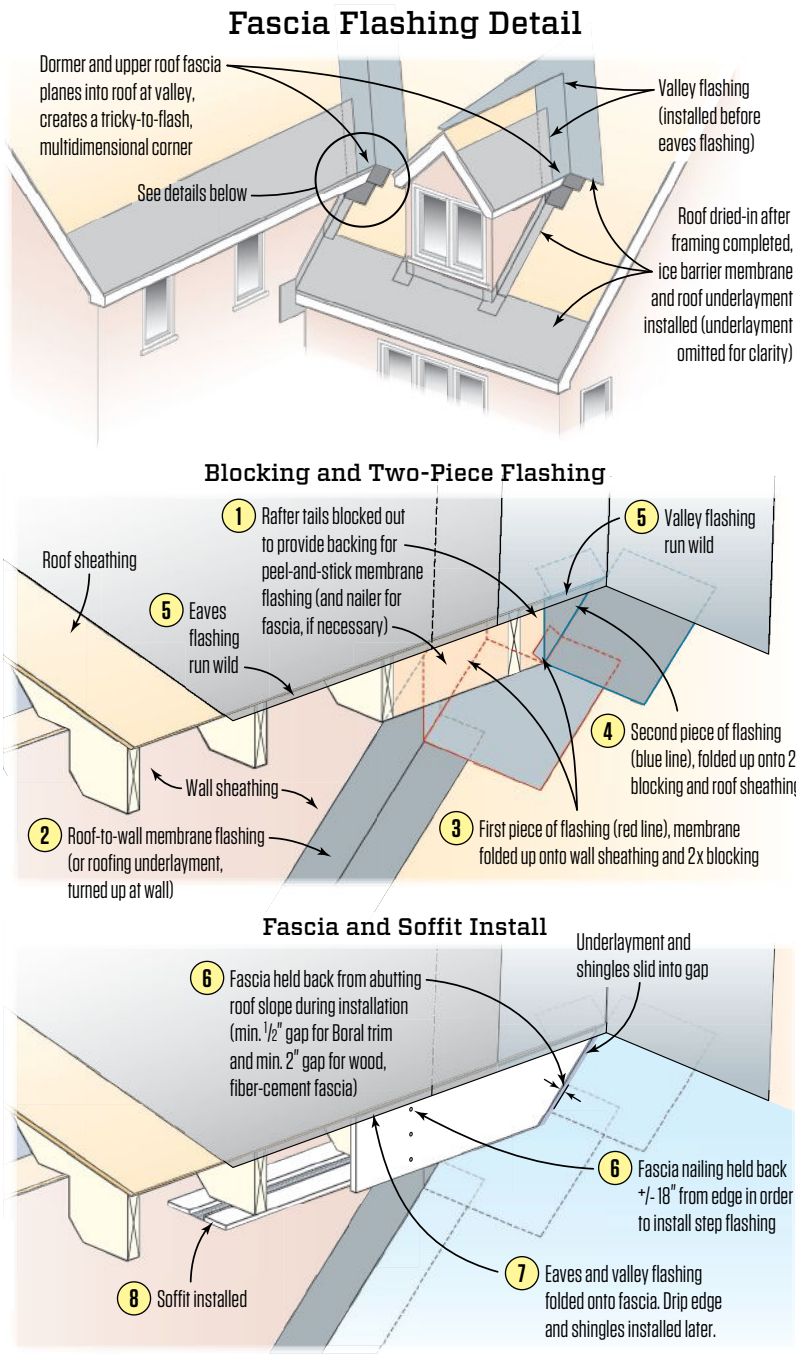
Q I've noticed that wood fascia trim at the juncture between dormer eaves and the main roof is often subject to premature decay. Is there a good way to protect this joint from water damage and rot?

A Doug Horgan, vice president for best practices at BOWA, responds: This is a complex area, and implementing a workable detail is tricky when the roofers and carpenters are different crews. One way to make this area better is to use solid blocking at the rafter tails (assuming there's an overhang) and apply ice-and-water membrane over the blocking. That at least protects the framing.

Protecting the fascia board itself is another story, however. One way to install the fascia is to have the board touching the roofing material, or nearly so. This looks neat and clean, but it makes it impossible to paint the end of the board, where the end-grain cut will soak up water very effectively. So our company has started generally holding wood products off the roof by a fairly substantial margin. The Western Red Cedar Lumber Association (WRCLA) follows the fiber-cement and stucco industries in recommending a 2-inch clearance from roofs for siding and trim. This is our normal standard, and it allows the end to be painted down the road.

Not all clients and architects are OK with this look, though. So we often borrow a detail from the excellent Hardie best practices manual and fill in the 2-inch space with bent flashing—or, more frequently, with a piece of synthetic trim such as PVC or Boral, as they have no clearance requirements.

Having said all that, we've had so many issues with wood trim of all types that we most often use synthetic trim materials these days. In that case, clearance and rot are not issues anymore. Even so, if I'm applying synthetic trim, I still prefer installing solid blocking at the eaves first. This provides a nice framed box for all the roofing and flashing to terminate to and allows a full ice-dam wrap of a vulnerable area.



To protect this vulnerable juncture from water intrusion and rot, install solid blocking at the eaves to provide a substrate for peel-and-stick flashing, then install the flashing shingle-fashion to protect against water, ice, and snow. When installing trim, provide sufficient clearance as shown, or use a moisture-tolerant material such as PVC or Boral.

Illustration: Tim Healey

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Building a Library Ladder

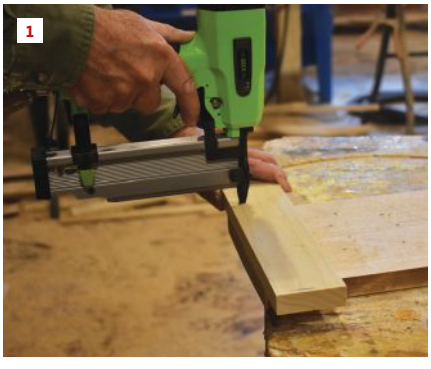
BY GARY STRIEGLER

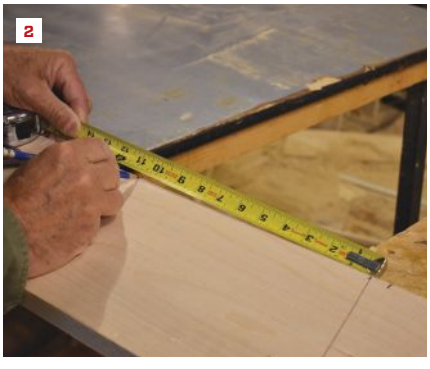
For years I avoided building ladders because unlike the code guidelines for stairs, those for a safe ladder were always a bit fuzzy to me. Then a few years ago, I found out that Custom Service Hardware (CSH) offered kits that eliminated the guesswork of building a library ladder. CSH sells kits with prebuilt ladders as well as kits with just hardware, and when a client requested a library ladder to access built-in bookshelves that we'd built in a bedroom, I jumped at the challenge. I also saved them a little money by building the ladder myself, out of maple that matched their hardwood floor.

Ordering the kit. We'd talked about a library ladder when we were building the shelves, so I made stiles and rails that were large enough to attach the mounting brackets for the ladder track to. Before placing the order, my clients selected the style and finish of the hardware, and they opted for bottom wheels that lock when you put weight on the ladder. They also selected the "captive roller" system, with two sets of rollers that fit around a cylindrical track to hold the top of the ladder. (Other options include top rollers that let you move the ladder between two tracks, and roller and track systems that allow the ladder to travel around a corner).

I called CSH with my client's selections and the overall height of the built-in cabinets, and the company helped me determine the exact kit to order. I gave CSH the wall-to-wall measurement for the length of the rail (because the room was more than 8 feet wide, we would have to use two track sections with a splice kit), along with the bracket style. Within a week, the kit arrived at my shop.

Making the rails and treads. CSH offers an online guide with the dimensions and angles for making your own ladder. Building the side rails began with selecting the flattest material I could find. Because of the work involved in milling the side rails, I decided to make a spare set of rails for a future ladder. Following the





Photos by Gary Striegler

The author tacks two side rails together for milling **(1)**. He spaces the treads **(2)** and draws layout lines with a rafter square **(3)**. A stepped jig guides a router to cut the dadoes **(4)**. He makes a cut at the top of each rail **(5)** and then rounds over the edges **(6)**.

The author drills holes for the rollers **(7)** and a pilot hole for the top rung **(8)**. He drills a slot for the top rung **(9)** and uses a jig for the tread attachment screws **(10)**.

After predrilling for the screws, the author attaches one rail to the treads and the top rung **(11)**. He then flips the assembly over and attaches the other rail **(12)**.

CSH guidelines, I made the finished rails 3 1/2 inches wide and 13/16 inch thick. I ripped the rails 3/16 inch oversize and straightened one edge on a jointer. To true the other edge, I ran the stock through a planer on edge.

The guidelines recommended fitting the ladder treads into shallow dadoes cut into the rails at a 12-degree angle. Before cutting the dadoes, I tacked a scrap of 1-by stock to join the ends of each pair of side rails while I laid them out and routed them **(1)**. I gave the treads 10 5/8 inches of rise between steps **(2)** and drew layout lines with a rafter square set at 12 degrees **(3)**. I made a stepped jig to guide the router for the dado cuts, with the step width being the distance from the edge of the 3/4-inch-diameter dado bit to the edge of the router base. I clamped the jig to the rails with the edge positioned on the layout line, and then let the router base travel along the edge of the step on the jig **(4)**.

On the bottom of each rail, I cut a 12-degree angle aligned with the dadoes for the bottom rise. With a track saw, I cut the top angles on each rail at 78 degrees—the complementary angle to the tread angle **(5)**.

To soften the sharp edges on the rails, I ran a 1/4-inch round-over bit along every edge **(6)**. I test-fit the upper rollers that mount along the 78-degree cut, then marked and drilled the mounting-hole locations **(7)**.

By comparison, the treads were easy to make. The finished treads were 4 inches wide, and I used the same milling process for the treads as I did with the rails. Because I used a 3/4-inch-diameter router bit to cut the dadoes on the rails, I planed the boards to exactly 3/4 inch thick and rounded over all the edges. Then I set up a stop on the miter saw and cut the treads to 14 5/8 inches, which gave me a ladder 16 inches wide. At 4 inches deep, the treads were slightly deeper than the rails, so I clipped each corner slightly at a 45-degree angle.

Building the ladder. Every library ladder has a turned rung between the tops of the rails where the rollers mount. I could have gotten one from CSH, but for this ladder, I turned a simple dowel on a lathe in the same maple as rest of the ladder. I cut the dowel to an overall length of 15 3/8 inches, and made 1/2-inch-long by 3/4-inch-diameter sections at each end to fit into round slots in the rails.

To install the dowel, I first clamped two opposing sides together, lined up the ends, and drilled a tiny pilot hole through both sides **(8)**. I centered the pilot hole between the holes I'd drilled earlier for the rollers, and using a 3/4-inch Forstner bit, drilled a 9/16-inch-deep hole on the inside of each rail, using the pilot hole to start the bit **(9)**.

Because the treads would be held in place with exposed screws, I wanted uniform spacing for the screw heads. I made a drill

The author attaches the roller hardware to the tops of the ladder rails **(13)**. After drilling holes, he installs the spreader rods, which are held at each end with cap nuts **(14)**. The bottom roller hardware is the last part to attach to the ladder **(15)**.

The cylindrical track came in sections that were cut to fit the built-in shelves. Brackets slide into the track on the first side and attach to the shelves. The ladder then slides onto the track. After inserting the splice hardware into the track **(16)**, the second section attaches to the first, installed in similar fashion. The finished ladder is handsome and useful for accessing the bookshelves **(17)**.

guide out of 3/4-inch stock that fit into the dadoes to drill screw holes for each tread **(10)**.

To ensure that everything would go together smoothly, I test fit the treads, shaving a little off the ends with a block plane to slide them easily into the dadoes. To assemble the ladder, I slipped the treads into one rail, predrilled holes in the treads, and drove in a pair of the 1 3/4-inch washer-head screws that came as part of the kit **(11)**.

When I'd attached the treads and the top rung to one rail, I flipped the ladder over and attached the opposite rail **(12)**. After attaching the treads to both rails, I attached the top rollers **(13)**.

The ladder has step support rods below each tread to keep the rails from spreading and to keep the ladder rigid. I should have drilled the holes before assembling the ladder, but I was able to drill clean holes by backing up the holes with a scrap block to keep the wood from blowing out. The 23/64-inch holes were centered on the rail and located on a line 7/8 inch below the screws for each tread. Each end of a support rod is threaded with a cap nut that screws onto it. It only took a few minutes to slip the rods in place and tighten them with a pair of Allen wrenches **(14)**.

The last shop task was attaching the bottom rollers **(15)**. The rollers have metal tabs that wrap around the bottoms of the rails and provide a lot of strength. One bolt and one screw hold each bottom roller in place. Even though the painter needed to finish the ladder before the final installation, I wanted to test fit the ladder and install the track, so I loaded up everything and headed to the jobsite.

Ladder installation. The top ladder rollers travel on a cylindrical track that mounts on horizontal L brackets. Installing the ladder was a two-person job. First, we slid the mounting brackets into the slit in the track. Then one person held the track up while the other attached the brackets to the shelves, spacing them no more than 32 inches apart. We then slipped the ladder onto the installed section of track. After cutting the second track section to length, we secured it in place with the mounting brackets and connected the two sections with splice hardware inserted into the track **(16, 17)**.

Gary Striegler owns Craftsman Builders (craftsmanbuildersnwa.com), in Fayetteville, Ark., and teaches workshops at the Marc Adams School of Woodworking. Follow him on Instagram @craftsmanbuilders.

Blending in a Crooked Dormer

BY IAN SCHWANDT

Dealing with out-of-level and out-of-square buildings is commonplace in remodeling. Whether it is an interior door or a tricky cabinet scribe, remodeling carpenters are used to being told by their client or boss to "make it look right." Occasionally, we are presented with a structure whose out-of-levelness confounds the mind at every turn. My current remodel job at a mid-18th-century house with a 1970s dormer is an extreme case of this. In addition to having out-of-level floors and out-of-square rooms, the house presented us with a challenging exterior siding project.

The second-floor dormer and its flat roof are out of level 5 1/16 inches left to right across about 21 feet. It is set back from the first-floor elevation 8 inches, and the resulting rake roof section carries around and divides the dormer from the first floor below. This soffit was parallel to the out-of-level flat roof. Our scope of work included replacing the three second-story windows and the first-floor window, sheathing with CDX plywood, installing Gutex insulation, and applying new clapboard siding with a rainscreen detail. All were straightforward tasks—but "making it look right" would require creativity.

After demo, which included removing the bisecting soffit up to the rake, we completed the scopes of work that brought us to the second-floor window install. The existing windows were installed out of level, but in a way that they stepped down across the wall elevation. We opted to install the new windows square, with the heads parallel to the out-of-level dormer roof, which gave the interior trim a cleaner look. The new first-floor window, at nearly 8 feet in length, left us no option other than to install it level.

This work left us with several conditions that needed to be tied together harmoniously—or at the very least, so that the facade looked right from the backyard picnic table. For our design parameters, we had the existing rake determining the height of our

The original sagging dormer and roof-soffit assembly below revealed the building's out-of-whack nature to the eye **(1)**. The crew packed out the wall with Gutex insulation and strapping, then fastened on a new, tapered roof-and-soffit frame **(2, 3)**. The finished facade blends the upper and lower structures together more harmoniously **(4)**.

Photos by Ian Schwandt

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To adjust for 2 1/2 inches of the more than 5-inch drop over the width of the building face, the author calculated a 1/4-inch decrease per rafter **(5, 6)**. He ripped the ledger board on a 29-degree angle and hand-planed the board to match the descending rafter angles **(7)**, before screwing the whole assembly to the house wall **(8)**.

bisecting soffit; the second-story windows running 5 1/16 inches out of level; the first-floor window set level; and the siding reveals on the right side needing to match with the face of the adjacent original structure, set back 2 feet from the dormer face.

I started with setting out the siding coursing on the right side of the dormer and locked it in at 4 1/4 inches to match the old, possibly original, west gable end of the house. I knew that I wanted the siding below the bisecting soffit run level to match the large window, but this would not look right on the dormer. The dormer siding would need to be gradually cheated on the left side to make the siding course below the windows run parallel with the sills. This meant I had less than 4 feet to make up a 5-inch variance in level. Within this span, I had seven courses of siding, the roof-to-wall flashing, and the bisecting roof-soffit assembly in which to make up the difference.

Using some remodeler rules of thumb, I decided that the left side of the siding courses should vary no more than 1/4 inch per course, the reveal of the roof flashing should vary no more than 1/4 inch, and the bisecting soffit could not be more than 1/2 inch out of level. Following those guidelines left me with 2 1/2 inches to make up in the roof-soffit assembly.

I had a suspicion the first time I saw the house that I would need to get creative with the bisecting roof to make this project look right. My solution to the remaining 2 1/2-inch variance was to taper the roof section by flattening the pitch of the roof from left to right.

The intersection of the left side rake with the dormer's face set the layout for the peak, and the fascia height set the bottom of the soffit. Knowing that I needed to drop the peak 2 1/2 inches over 21 feet, I plugged those numbers into my Trig Solver app and found that the roof peak dropped at a 0.5685-degree angle. Using this angle along with my desired 24-inch rafter spacing, the app calculated a drop in rafter peak elevation of 0.2381 inch, rounded off to 1/4 inch per rafter.

We built the roof-soffit assembly in three sections on the ground before attaching it to the wall. After laying out the 24-inch rafter centers, I subtracted the 1/4 inch in height and snapped a line through for the peak angle and ripped the ledger at the 29-degree angle of the left side rake. After installing the rafters, which were laid out individually and free hand cut on the table saw, I used an electric planer to flatten the 29-degree angle to match the angle of each rafter. The last rafter, at the 21-foot mark, had dropped to a rake angle of 18 degrees. To complete the roof section, I carried the roof around the corner at the same 18 degrees to place the hip in plane with the end of the roof section.

Ian Schwandt is a lead carpenter and estimator for Hudson Valley Preservation, in Kent, Conn.

Using Corrugated Metal for Shower Walls

BY JAKE BRUTON

We had the opportunity to build a modern addition on an 1840s brick farmhouse—the sort of marriage between old and new that is increasingly popular. The design by Brian Morgan Architects included exterior metal panels, using inexpensive corrugated metal panels and lots of glass—a design driven by the clients' interest in what is often dubbed "industrial chic," an ultra-modern architectural style that draws its aesthetic from industrial materials.

When it came to the bathroom of the addition, however, the owners got stuck on the tile selection. They had chosen concrete floors in the kitchen, which was leavened by a good amount of glass to keep it from seeming too heavy. In the bathroom, they were leaning towards a gray, slate-like tile for the shower and bath surround, but because it would not have all the glass to balance it, they were concerned that this choice for the floor and walls would be too dark. That's when I suggested we use the same corrugated metal that we had used on the exterior. To my surprise, both the architect and the owner went for it.

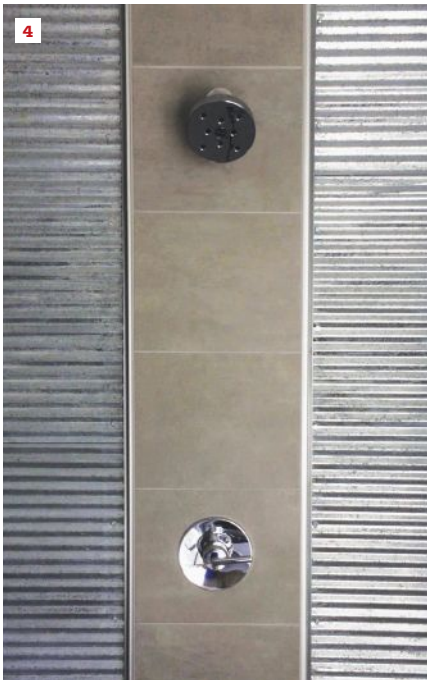
A marriage of old and new. On the exterior, the architect specified corrugated galvanized metal panels for a modern addition on the original 1840s home—a detail that the author adapted for the interior shower walls.

Great, now what? Now, I had to figure out how to implement this idea. The main issue, of course, is that there is no way for the trim of the showerhead and mixer to seal well against the corrugated surface. It would look terrible and would leak.

The solution we worked out with the architect was to build a central column for the plumbing that would stand proud of the metal surface. This column would be tiled, creating a nice, flat surface against which to seal the shower controls.

Successive stages of completion. Over a drywall base **(1)**, the author installed a Kerdi system **(2)**. Wood battens provide drainage space, and custom-bent metal channel is used to trim out the edges of the corrugated panels. The panels are secured to the battens with grommeted screws, as they would be on an exterior **(3)**. If the fasteners leak, well, there's a rainscreen.

Photos by Jake Bruton



Finishing up. The central column stands proud of the metal panels. Once tiled, it provided a flat surface for the showerhead and mixer trims **(4)**. At the corners of the tiled column, a reverse corner, using metal corner stock, echoes the detail used for outside corners on the exterior **(5)**. In the finished shower, the metal panels create a brighter space and the desired industrial look **(6)**.

RAINSCREEN SHOWER WALLS

We framed the column out, and once the plumbing was roughed in, we finished out the shower walls with the drywall.

To create a watertight shower assembly, we installed Schluter's Kerdi membrane over the drywall, just as we would for tile. We also installed the metal panels on a rainscreen assembly, as we had on the exterior, securing the metal to 1 3/4-by-3/4-inch pressure-treated pine battens (ripped from 1x4s). To avoid holes in the waterproofing membrane, we attached the battens with screws only above the showerhead level; below this level, we used Schluter's Kerdi Fix—a high-grade silicone sealant. At the suggestion of the Schluter rep, we also installed a second layer of the Kerdi membrane under the battens. This was added insurance in case there might be some interaction with the tannins or other leachates from the wood—a low risk, the rep thought, but an easy addition for a little peace of mind.

A FINISHED LOOK FOR ROUGH METAL

While the shower trims meeting on the surface were the first and most obvious issue with the corrugated panels, neatly trimming the perimeter edges of the rough metal was another trick we needed to solve. Around here, we typically refer to this type of panel as "barn metal." It's not exactly a finish material, to say the least; we couldn't just butt it to drywall at the edges and expect it to look halfway decent. The solution here was to use a custom-bent galvanized trim. We have a good sheet-metal shop that provided a U-channel with one wide flange that we screwed to the rainscreen battens. The crisp bent corners of the sheet metal married well with the surrounding finished wall and floor surfaces. To create a good seal between this metal trim and these surfaces, we applied a thick bead of Kerdi Fix, pushing the galvanized trim into it.

To install the metal panels, we slipped the edges into the perimeter U-channel and screwed off the panels with the usual grommeted screws that we used to secure the exterior panels. These aren't the most leakproof fasteners in the world, but with a rainscreen behind the metal, it wouldn't cause problems if they occasionally leaked.

One final detail: Rather than lapping the tile on the outside corners of the central column, we installed the tile right to the corner on each side and filled the space at the corner with metal corner stock. This "reverse corner" was the detail we had used on the exterior where the metal panels joined at an outside corner. This detail, along with the overall shower design, provided a nice echo of the exterior.

Jake Bruton runs Aarow Building based in Columbia, Mo. Follow him @jakebrutonlive on Instagram.

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BY PAUL WINANS

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What Often Kills a Business ... and How to Prevent It

A business is a fragile entity. Contracts need to be signed. The projects need to be estimated accurately and brought in on budget. The financial reports must be reviewed regularly to ensure they are accurate. Clients need to feel smart because they worked with the business. While all of this is going on, the company must be building a significant cash reserve, just in case.

And all of the above always needs to be happening.

What are the alternatives? Perhaps contracts are not getting signed because "Your price is too high," so the company starts cutting its margin. There is so much pressure to move projects through design and estimating that the resulting plans, specs, and scope of work are incomplete, leading to loss of profit as the projects that do get signed are finished. Because the owner is often the salesperson and is now distracted and distressed, the financial reports are not given proper attention, leading to the possibility of even greater problems and, sometimes, embezzlement. The company's reputation in the community drops as former clients share their experiences with their friends.

The outcome? Debt.

Debt, once it starts to accumulate, grows and grows. It is incredible how large it can become before a business owner finally realizes how bad things are.

It is difficult, but not impossible, to recover from a large amount of debt. The recovery process entails some of the same steps that avoiding debt does. Here are some of them.

CONTACT YOUR CREDITORS

Once the light bulb goes on and the owner has accepted reality, it is important to contact the company's creditors. Some will be fine with deferred payment. Others will accept a payment plan, with modest monthly payments. There will be those who insist on getting their money sooner rather than later.

Take all the input from your creditors and lay it out in a spreadsheet. By seeing it month-by-month, you can assess the company's ability to make the needed payments on time.

If it cannot make the payments, then you need to meet with those creditors that you think might give you some flexibility.

Do not avoid meeting with your creditors! To a great degree, your trade contractors, vendors, and professionals *are* your company. And they need your business. Engage their help in your efforts to get out of debt.

CUT OVERHEAD EXPENSES

It amazes me how much money a business can spend in overhead without getting the results it thought it was paying for.

The most egregious example is marketing. The company hires a marketing company to provide a range of services that are supposed to bring in more business. But the marketing company gets paid for activity, not results. The company is left high and dry.

Debt, once it starts to accumulate, grows and grows. It is incredible how large it can become before a business owner finally realizes how bad things are.

Rent paid to someone else besides the company owner is another item that can often be reduced. Yes, the location of the office might be great, but the company is losing money.

Look at every item in the company's overhead. Question it.

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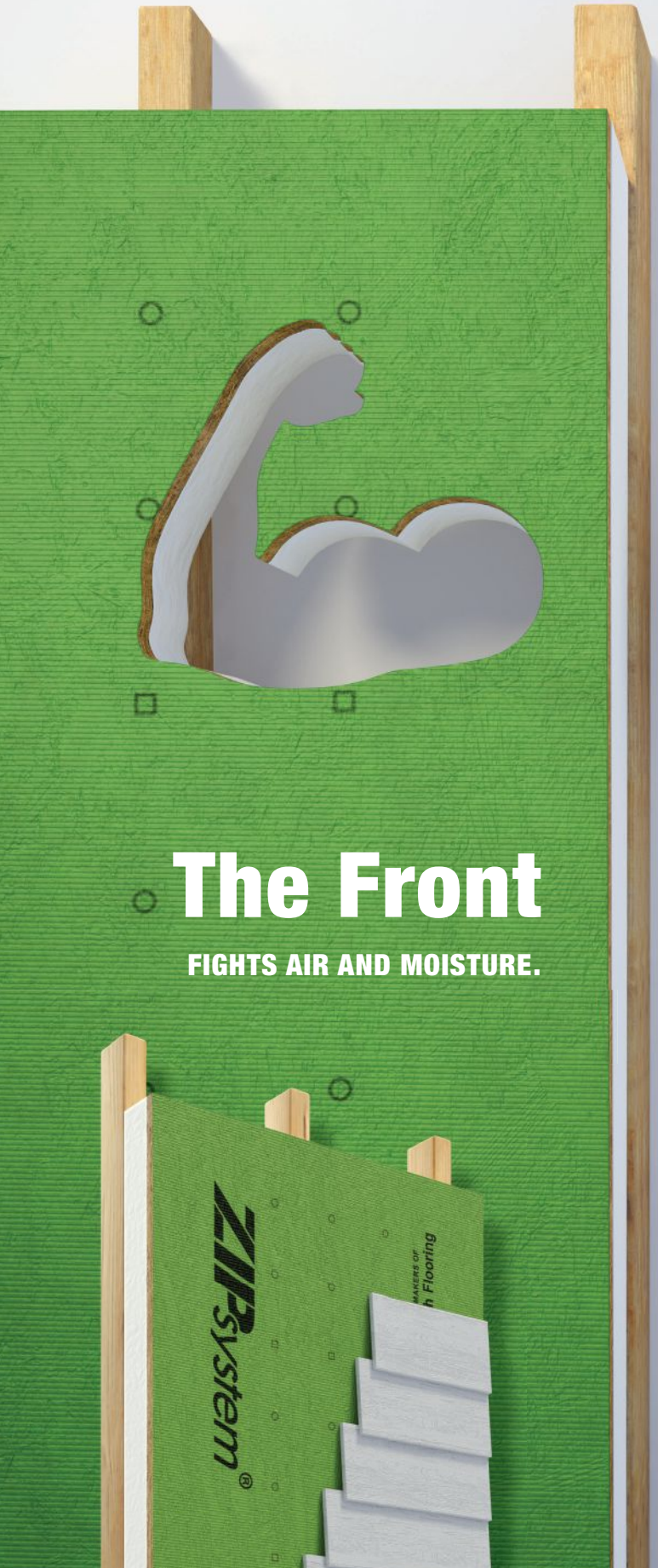

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Keep in mind that the company is now in survival mode. Is the amount of money being spent on this item bringing us value? Or is this item really needed?

Do not avoid meeting with your creditors! To a great degree, your trade contractors, vendors, and professionals are your company. And they need your business. Engage their help in your efforts to get out of debt.

BUDGET REALISTICALLY

Get honest about the signed business the company has in hand and the gross profit dollars that are expected to be generated from that activity. Not what you hope will be generated, but what you think based on the company's usual outcomes. If X percent slippage from estimated to produced gross profit percent is typical, then factor it in.

Often a company with significant debt actually has a fair number of signed contracts. It simply has not been estimating accurately. Get real to survive.

IMPROVE YOUR SALES SKILLS

Improving your sales skills so you are able to sell at a higher gross profit percentage is one of the most powerful ways to get out of debt or to avoid getting into it in the first place.

Read books on how to become a better salesperson. Meet with business owners who impress you with their sales skills. Meet with fellow contractors who you think are outselling you.

From every book read or interaction you have, take at least one tip and give it a try.

Contact the Service Corp. of Retired Executives (SCORE) and see if you can work with a retired salesperson, who might be able to coach you, often at no charge to you.

After every sales meeting you have with a potential client, assess what went well and what could have gone better. Do more of the former and less of the latter in your next sales meeting.

Avoid signing contracts with potential clients you know are not a fit for your company just because "I really need the work." Some of the worst jobs we ever did were for such people. They cost us money; they didn't make us money.

SET ASIDE 5% TO 10%

Every time a payment comes into the company, set aside a given percentage to build a cash reserve. Five percent adds up over time. Only by building up a cash reserve will you give the company the protection it needs going forward.

If you are not in debt, the best way to avoid debt is to do everything that I am suggesting. These are all sound business practices. The road back from crushing debt is hard. Do the best you can. That is all you can do.

Look at every item in the company's overhead. Question it. Keep in mind that the company is now in survival mode. Is the amount of money being spent on this item bringing us value?

But don't kill your business by simply hoping things will get better on their own.

Paul Winans sold the 30-year-old remodeling business he owned with his wife, Nina, and is now a consultant and facilitator for Remodelers Advantage on owner issues, business management, and best practices. Paul's new book, The Remodeling Life: A Journey from Laggard to Leader, *is now available on Amazon. Learn more at winansconsulting.com.*

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BY CLAYTON DEKORNE

Highlights From Building Science Summer Camp

Every summer for the last 23 years, Joe Lstiburek and Betsy Pettit have hosted the Westford Symposium on Building Science, more popularly known as "Building Science Summer Camp." Legend has it that Joe and some other regulars of the Symposium (including Marc Rosenbaum and Andy Shapiro, who—for the last 23 years, presumably—have sat front and center asking insightful questions, and who, because of their constant presence and intense scrutiny of the speakers, are often fondly compared to Statler and Waldorf, the two cantankerous old men who critique Muppet performances) rued the fact that most industry conferences slot speakers for 50-minute presentations. They thought "Wouldn't it be great if we had our own conference where we could present for up to three hours at a time on a single topic." If learning new material is the goal for attendees, that amount of time is needed by speakers to present complex topics and answer the questions that will inevitably arise. The idea was just too good to let go of, and Westford Symposium was born. What made it summer camp was Joe's playful style and Betsy's gracious manner: Each night after the sessions, they turned their house and company grounds into a big party, complete with both Texas- and Louisiana-style BBQ (and for a long spate of years, Cuban BBQ along with cigars that were custom-rolled as you watched).

As in most past years, this year's lineup of topics included a mix of residential and commercial work. Here, I'll highlight just a few of those focused on residential construction.

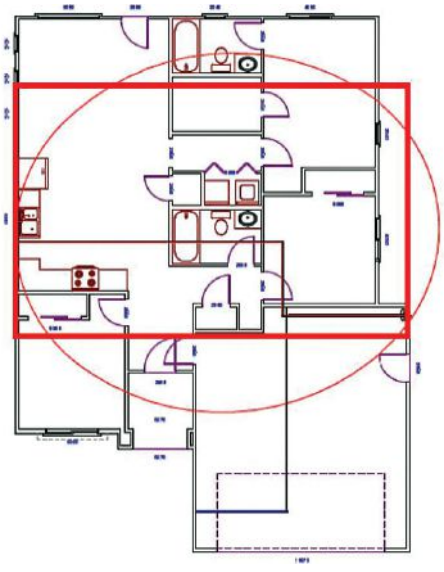
Head counselor Joe Lstiburek presides over the 23rd annual Westford Symposium on Building Science.

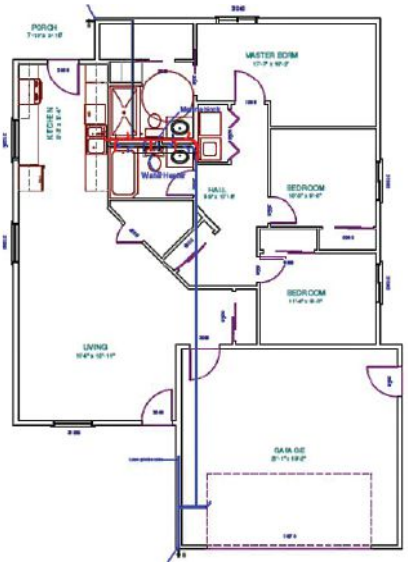
Photo: Clayton DeKorne

One year with AeroBarrier. Gorde Cooke, the well-known building-science educator with Construction Instruction (constructioninstruction.com), provided an in-depth report on his work with AeroBarrier. Gorde, in addition to his work educating building professionals and consulting on projects, runs a building-performance contracting company in Toronto and for the last year has been installing AeroBarrier as an air-sealing solution for new homes and retrofits.

His company has long experience with AeroSeal—the duct-sealing system that was developed and patented in 1994 at Lawrence Berkeley Laboratory and that, by 2015, had sealed the duct systems in more than 100,000 homes and more than 30 million square feet of commercial space. Using a similar material but with a different delivery mechanism, AeroBarrier was launched in 2016 and is already largely seen as a transformative technology, owing to its automatic shell-sealing process, which not only allows you to dial-in the air-tightness limit you want (what the budget allows) but also provides blower-door verification. Gorde provided a detailed explanation of the AeroBarrier rig he uses ("a well-thought-out, self-sufficient trailer" that hauls all the apparatus required, including a generator, compressor, control module, and the "peristaltic," or roller, pump used to deliver the sealing material), and of the process (namely the sealing of holes and gaps you don't want to seal, like vents and unfinished plumbing hook-ups, and the protection of "everything you don't want to have to clean the sticky stuff off of").

The "big aha" for me hearing Gorde's insights from the field came when he got into the fine detail on seal time. AeroBarrier coagulates around the edges of building leaks when the air increases velocity as it escapes through a hole. Thus, the size of the hole is a key limiting factor. The sealant is carried in a manufactured fog (water vapor) and the amount of sealant that can be pumped into a building *without the vapor condensing* is also affected by the outside temperature and relative humidity, indoor relative humidity, and house pressure. These limits are monitored by the control module, and everything works swimmingly in the Toronto region until around October when the outdoor temperatures get cool enough that the system doesn't have





A portable heater (left) blows directly into the blower-door fan—Gorde Cooke's solution for extending the installation season for AeroBarrier in a cold climate. In Gary Klein's study of hot-water-piping efficiency, he analyzed floor plans for "architectural compactness." A typical plumbing layout (center) ropes in 1,279 sq. ft. An excellent layout (right) covers less than 10 sq. ft.

enough heat to keep that indoor air above the dew point when the blower door is blowing outdoor air inside to pressurize the building. Gorde's ingenious way to extend the installation season in a cold climate is to use a salamander heater in the path of the blower door's intake (see photo, above left).

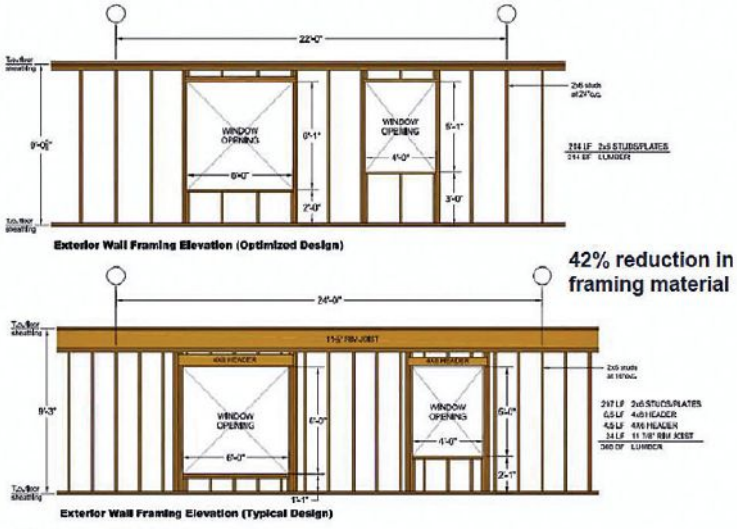
It's on this point that Gorde largely answered the question of when it's best to seal: before insulation, when you can seal the framing shell, or after drywall? For much of the season in a northern climate, it's best to seal after drywall (which is also after MEP rough-in and insulation and when the building can be heated). Sean Harris of AeroBarrier of Austin, Texas, was on hand in the audience to provide the flip-side experience: In a warm climate, it makes more sense to seal the framing shell—a chief reason being that it's just a whole lot faster to prep the building because you don't have to worry so much about protecting surfaces. (Definitely, a big part of Summer Camp is the caliber of the audience!)

Hot-water-piping update. As a result of Gary Klein's Summer Camp presentation, *JLC* is at work on an update to Gary's *JLC* classic, "Efficient Hot-Water Piping" (Mar/13). Stay tuned for that in the near future. I won't go into a lot of detail now, except to explain a useful concept for designing an efficient hot-water system that Gary refers to as "architectural compactness." In a detailed study for the California Energy Commission aimed at developing code-change recommendations to improve the energy efficiency of hot-water systems, Gary's team had to analyze the draw patterns (the frequency of occupants turning on their faucets and drawing hot water from the water heater). The general idea is that every time you draw hot water into a pipe, hot water stays in the pipe and heat dissipates out of the system whether or not the pipe is insulated (insulation reduces the magnitude, but there is still a loss) and whether or not any hot water actually reaches the faucet. For the study, as a way of rating the hot-water efficiency of houses built in California, Gary's team analyzed thousands of floor plans of completed homes and derived a ratio (expressed as a percentage) for each plan of the hot-water-system rectangles (the area encompassed by the hot-water heater and all fixtures drawing hot water) to the overall floor area of the building. The lower this number, the more efficient the hot-water system. A typical system (shown above center) has a ratio of 79%, and the plan with a single plumbing wall (above right), about 0.8%.

One small but revelatory insight for me came when Gary mentioned the popularity of single-handle mixers in both kitchens and baths. Often the handle is in the middle—"because occupants think it looks better that way"—and every time the faucet is turned on, it draws some hot water whether it's needed or not (say, for, rinsing hands or a vegetable or a utensil). That idea alone has changed my habits at home.

Even more advanced framing. Mike Steffen of Portland, Ore.- and Seattle-based Walsh Construction, a major Pacific Northwest (PNW) builder of large multifamily housing projects, provided a fascinating case study on seeking "radical simplicity" for lowering construction costs. In keeping with a true vision of housing affordability, the case-study project is built to near Passive House Standards, so that the living, not just the rent or mortgage, is affordable for occupants. In the last few years, there has been an extreme

Photo: Gorde Cooke; Floor plans: Gary Klein



Framing comparison: Walsh Construction

Walsh Construction's efforts to optimize framing led to the wall framing system at top (compared here with typical northwestern wall framing, above) that achieves a 42% lumber reduction. Rather than a rim joist, 9½-inch joists are hung from the top plate, saving lumber, eliminating a thermal bridge, and reducing labor for installing drywall on the interior.

escalation in the cost of multifamily housing, in part because the multifamily housing market is booming in the PNW—subcontractor schedules are full, and they are increasing their margins, and the shortage of skilled labor has slowed production schedules. The result has been a 5% to 15% escalation in building costs annually for the last two years. These conditions have forced Walsh to pursue serious "cost discipline" for the 68% or so of a building's costs that a builder "controls" (acknowledging that "cost control" is not possible).

This project needs its own article, but the gist is that Walsh has used the project to explore "cost-efficient design and construction" (CEDC) practices. Those aim at optimizing building layouts and finding simple designs for the hidden elements that comprise 80% of a building (such as the structure, enclosure, hidden exit stairways, MEP systems, and the like) and making the most of the 20% of the building that is directly experienced by occupants (such as the building plan, public stairways, community rooms, public roof decks, and so on). Mike is keen on emphasizing that CEDC is not a race to the bottom, which is often what happens when developers seek affordable solutions but end up providing rather grim living experiences instead. Look for more from us on CEDC. The illustration above gives a taste of its practicality for all wood-framed buildings.

Same questions after all these years. Martin Holladay, the long-time but recently retired editor of GreenBuildingAdvisor (greenbuildingadvisor.com), opened with "When I began working at the *Journal of Light Construction* in 1999, I was assigned to edit the magazine's Q&A column" ... and went on to say that for the last 20 years, he has been answering the same three questions: 1. How do I insulate a cathedral ceiling? 2. How do I insulate a basement wall? And 3. Why is my HVAC contractor specifying oversized equipment? On the first two questions, Martin offered clear advice. For cathedral ceilings: "Having an airtight ceiling solves most problems." To make this happen, builders need to be wary of following online advice, and the airtightness of the ceiling must be verified with a blower door. Generally, this means no can lights in the ceiling, and if you have a cut-up roof, don't rely on a vented approach. For basement insulation, the answer is to insulate on the interior with closed-cell spray foam or rigid insulation (the latter installed with close attention to airtightness), not batt insulation of any kind. The goal is to create an airtight and vapor-tight assembly.

But the real question Martin was interested in addressing was, why are these questions still being asked. His goal was to shine a bright light on our industry's need for "a paradigm shift." The reasons these three questions continue to be head-scratchers, he contended, is that there is so much conflicting information, much of it perpetuated by building product manufacturers, who continue to sell bad products (for instance, flimsy polystyrene vent chutes for cathedral ceilings and fiberglass blankets specifically marketed for basement and crawlspace walls) and provide bad advice (for instance, insulation manufacturers recommending roof venting without mentioning air-sealing or a weather-barrier maker saying you can't tape sheathing or you will create a continuous, wrong-side "vapor barrier"). Codes are also part of the problem, Martin said, in part because code officials don't understand the codes, particularly around unvented roof assemblies, and in part because the code itself allows for batt insulation in crawlspaces and basements (the insulation requirements table even references R-13 and R-19, which are fiberglass-batt values). The solution, he said, is an alignment of building codes and manufacturer instructions with best practices.

Martin's most scathing criticisms were leveled at the HVAC industry, which he said is in crisis: Most HVAC contractors can't perform a Manual-J calculation, even though it is mandated by code; most equipment is grossly oversized; many duct systems are unacceptably leaky; and many, if not most, ventilation systems don't work. Here again, Martin leveled many of his criticisms at manufacturers, in part for not making furnaces, boilers, and mini-splits that have lower capacities and modulate (Dettson is one exception he pointed to that makes a 15,000 Btu/h furnace that modulates down to 6,000 Btu/h in low-load conditions). The rest of his criticism was aimed at HVAC contractors (who he claimed are the worst as a whole of any trade) and building codes (namely for not providing enough training for code officials, who, he claimed, can't distinguish a relevant Manual-J report from a bogus one). The ultimate answer, he suggested, may be national legislation mandating contractor education and licensing, following the German model.

It's a radical idea. But then, most everything about Summer Camp is somewhat radical.

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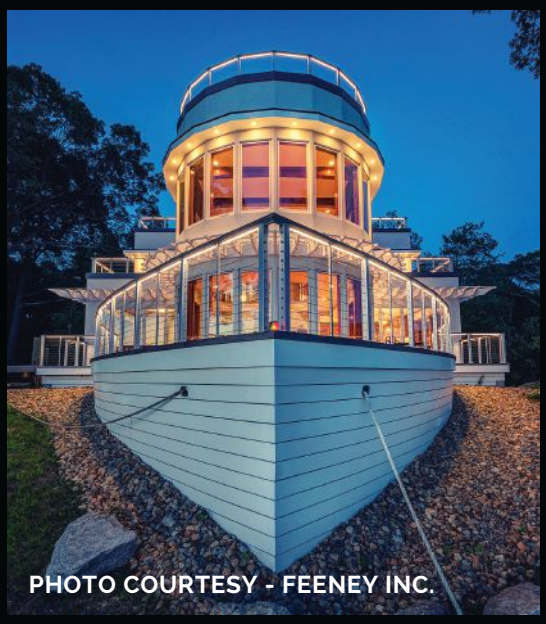

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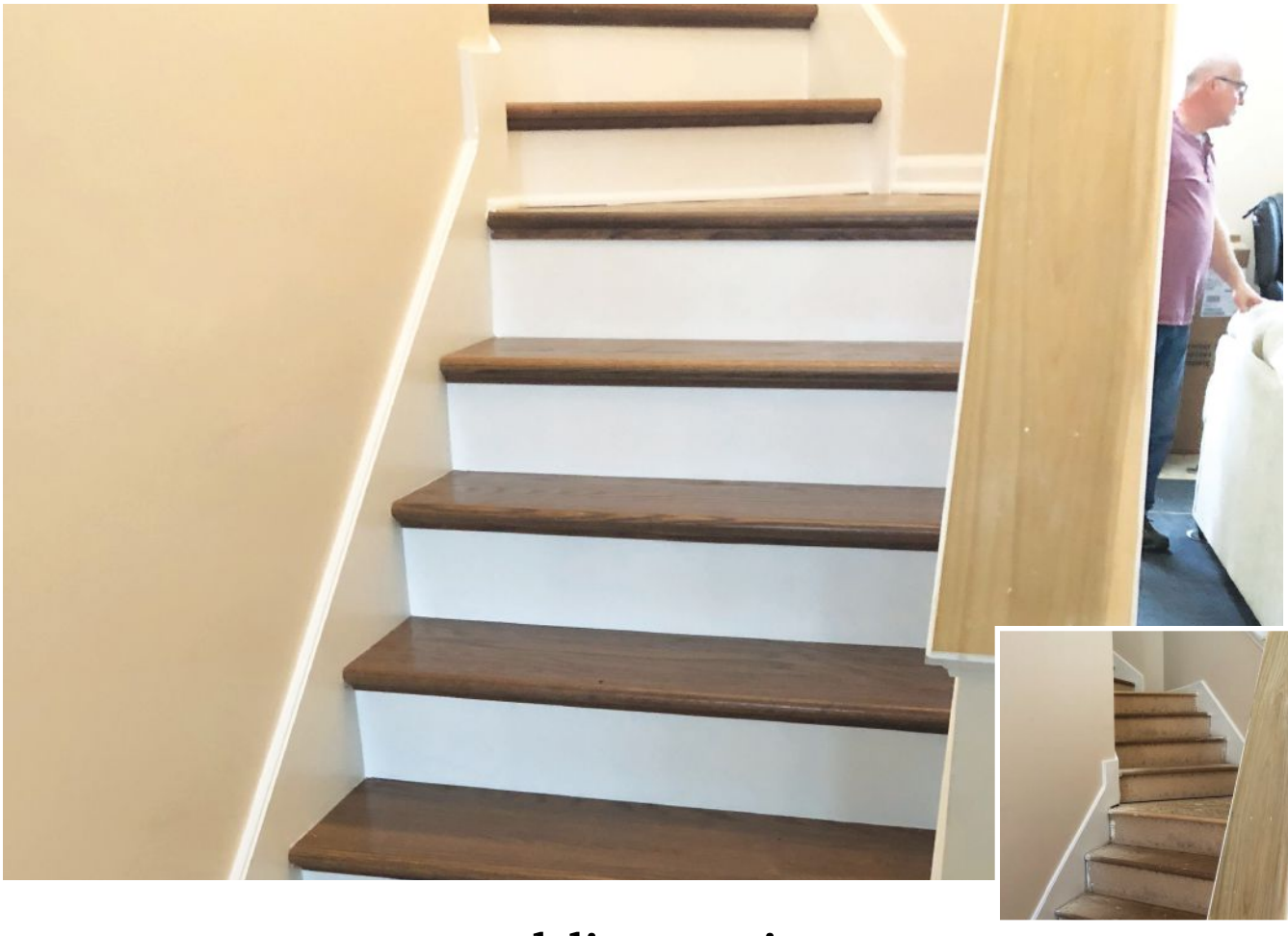


Remodeling a Staircase

From sagging carpeted steps to brand-new solid hardwood

BY JASON HAMMER

We've all had the experience of walking down a staircase covered in worn-out carpet, with each step sloping down just enough to make it feel uncomfortable and questionably safe. Our company, The Carpenter Pros, specializes in transforming these staircases, replacing the old carpeted treads with hardwood treads that are solid and level. In most of the homes we work on, there is only one set of stairs—often going up to the more private, bedroom areas of the home—so we need to do the job quickly and efficiently with minimal mess and disruption.

DEMO AND PREP WORK

The job always begins with tearing out the old carpet and pad, which includes removing any tacks, staples, and pesky tack strips. In most cases, the original treads and risers for the carpeted stairs are just made from 3/4-inch underlayment, and we take off the treads and remove any remaining fasteners **(1)**. The risers come off next; we pull any nails from those too **(2)**.

Because these staircases are often the only access that the homeowners have to the upper floor, we need to provide temporary stairs, especially if the job will take more than a single day. So we scrape off any old adhesive from the horizontal part of the stringers **(3)** and screw the risers back on as temporary treads. That way, both the remodeling crew and the homeowners have a good, temporary way to access the second floor.

Photos by Morris Ridenour

STRINGER SHRINKAGE

The majority of stairs that we remodel have stringers or carriages made from dimensional lumber. That lumber is usually still solid and strong, but the nature of wood means that there is more shrinkage near the points of the stringer, which is why many of these stairs end up sloping downward. When we remodel a staircase, we do our best to compensate for that shrinkage by shimming the treads up level.

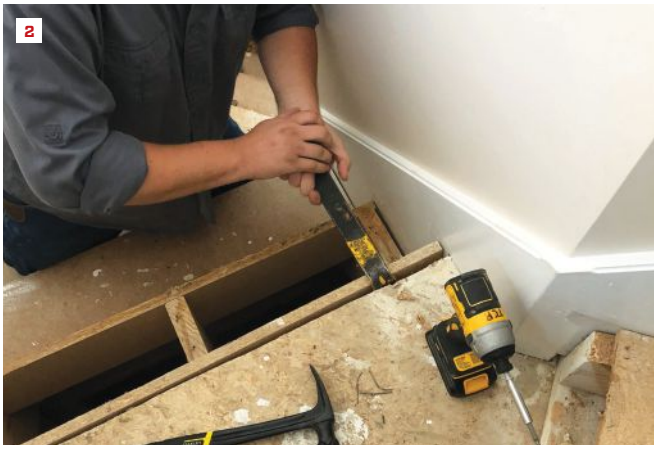
We also check the rise and run of the steps to determine if they need to be adjusted. It is important that the stairs feel even and comfortable to the people using them.

OFF-SITE FINISHING

For tread material, we use solid oak, prefinished with stain and polyurethane off-site to minimize the mess and smell for the homeowners. Generally, we use 1-by stock for the risers, but occasionally we use 3/4-inch finish-grade plywood that I prime and paint off-site.

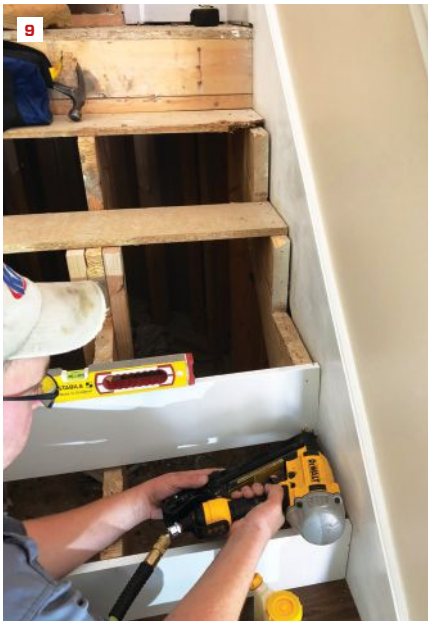
Before starting, we make sure that all the materials we will need are on site. Then we are ready to remodel the stairs, which usually takes our crew of two less than two days.

Jason Hammer owns The Carpenter Pros (thecarpenterpros.com), a remodeling company in New Palestine, Ind.



DEMO AND TEMPORARY TREADS

After removing the carpet and tack strips from the treads and risers, the author carefully removes the original underlayment treads **(1)**. All of the old fasteners are safely removed. Next, he removes the original risers **(2)**. After removing the fasteners from them, the author sets them aside to be installed as temporary treads. With the treads and risers removed, he cleans off any residual adhesive from the stringers **(3)**. He then screws the risers down as temporary treads to allow the crew and the homeowners to use the stairs **(4)**.



CUT AND INSTALL THE RISERS

To remodel the stairs, the author begins by removing the first three or four temporary treads. He then uses a Collins Tool Co. stair-tread templating tool to gauge each riser **(5)**, with the tool carefully labeled to keep the orientation straight. At the saw, he places the template on the riser stock and transfers the template layout **(6)**. After adjusting the cutting angle of the saw blade, he cuts the risers precisely to the cut lines **(7)**. Back at the staircase, he applies a liberal amount of construction adhesive to the stringers **(8)** and nails the riser on the two outboard stringers **(9)**, making sure to install it level. Nailing just at the ends keeps the risers straight and prevents them from being pulled in if the middle stringer is set in slightly. This is particularly important later when he screws the risers to the treads from behind.


10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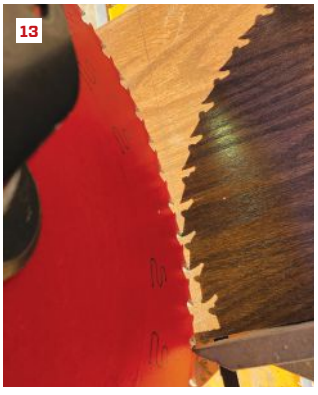
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14

CUTTING TREADS

The author uses the same templating tool for the treads **(10)**. After prefinishing the tread stock off-site to minimize mess and smell, he rips the stock to the correct width for the stairway, including a 1¼-inch overhang **(11)**. He transfers the layout to the stock **(12)** and carefully sets the angle of the saw blade before cutting the stock to the layout lines **(13)**. He dry-fits the tread and does an initial check for level **(14)**. If the gap between the stringer and tread is ⅜ inch or more, he glues in thin plywood layers to build the stringer up to a rough height for shims.

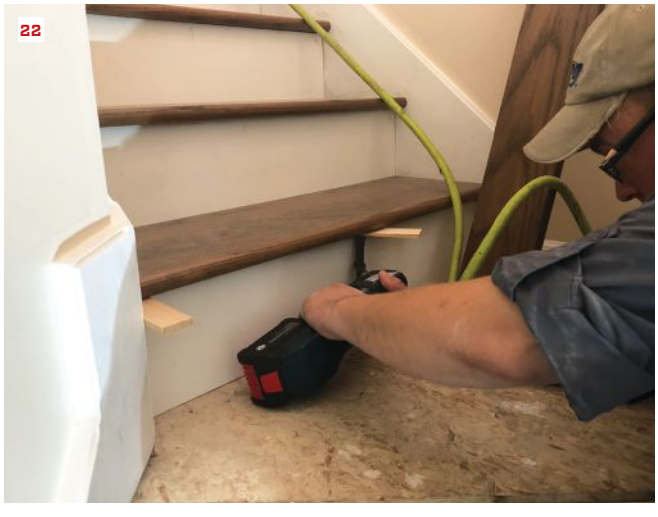

15


16


17

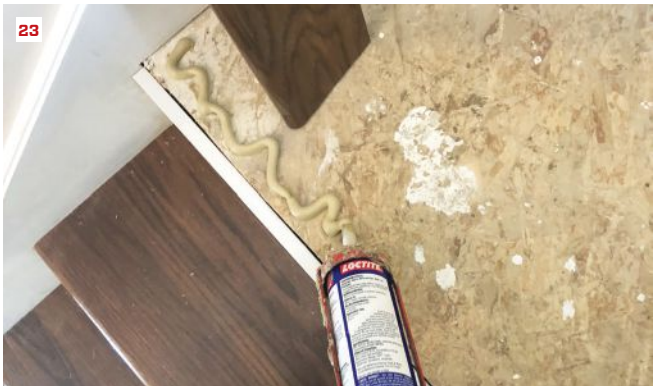
INSTALLING THE TREADS

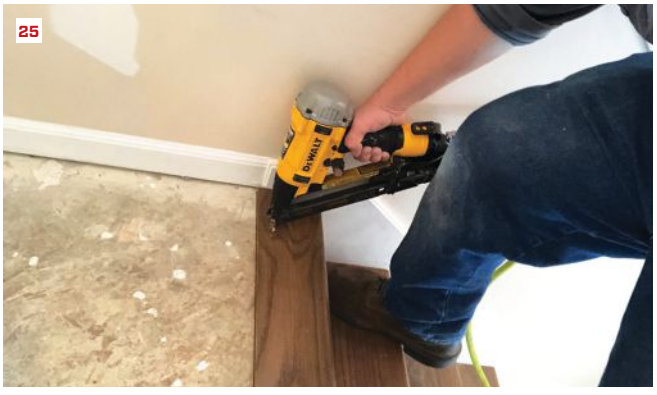
As with the risers, the author applies construction adhesive to the rough stringers **(15)**. After spreading carpenter's glue on the back edge of the tread where it will butt into the riser, he slips the tread into place **(16)**. He levels the tread in two directions using either narrow cedar shims or shims cut from 2x4s with a FastCap Fast Shim jig. Locked in place with the adhesive, the shims help to hold the treads level and compensate for any shrinkage in the stair stringers. After shimming the tread properly in both directions, he fastens the treads to the stringers using 15-gauge finish nails **(17)**.



TYING THE STRINGERS TO THE RISERS

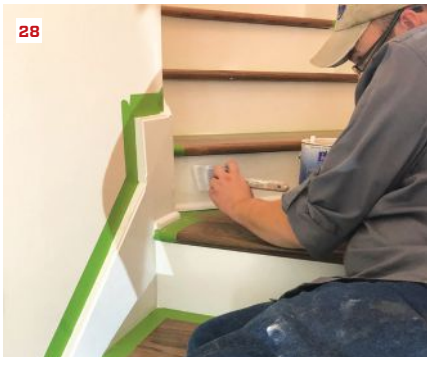
The author attaches each tread to the riser above from the back. First, he drills holes for the fasteners **(18)**, and then he drives three square-drive truss-head screws on either side of the center stringer **(19)**. These screws work with the wood glue both to keep the back of the tread from opening up and to prevent the stairs from squeaking. The author fashions triangular blocks from 2x4 stock to help stabilize the tops of the risers by joining them to the underside of the tread above. He spreads a heavy layer of carpenters glue on the adjacent right-angle sides of the block **(20)** and then reaches under the tread to press the blocks into place **(21)**. No traffic is allowed on the steps until the glue has set. When the treads are secured in place, he trims off any remaining shims **(22)**.

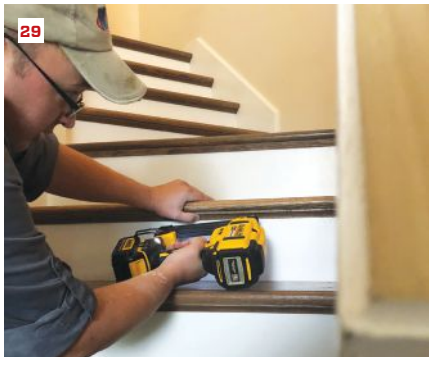




THE LANDING

After the new treads and risers are installed, the author applies adhesive for the nosing on the stair landing **(23)**, then checks the overhang **(24)** before securing the nosing in place **(25)**. Prefinished flooring fills in the rest of the landing field **(26)**.





FINISHING UP

The author installs shoe molding around the landing and caulks all the painted seams **(27)**. After he puts a finish coat of paint on the skirts and risers **(28)**, the final step is installing prestained cove molding under each tread nosing using wood glue and 18-gauge finish nails **(29)**. The remodeled stairs are then ready for service.

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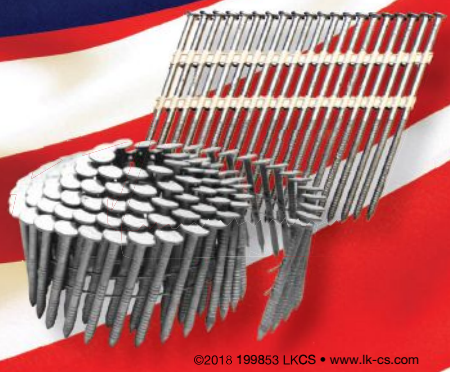

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Photos by Matt Bowers

Controlling Air Infiltration

Lessons learned from blower-door-test failure

BY MATT BOWERS

In 2015, New York State, where I work, adopted the International Residential Code (IRC) requirement for all new homes to be tested with a blower door and to pass an air leakage standard of 3 air changes per hour at 50 pascals of pressure (3 ACH50). As a certified Home Energy Rating System (HERS) rater, I perform the service of third-party verification of homes under construction. At the point in the construction process when homes are able to be pressurized or depressurized, I go to the house with my blower door and test the home's air leakage to determine whether or not the house complies with code.

When New York first adopted the blower-door requirement, very few builders in my Rochester market were ready for the change. Even now, four years later, some builders are having trouble passing the test. The builders who have already been through the wringer, the ones who are building more than 20 houses a year, have all stumbled and are just now starting to get the hang of it. Their prints have now been updated and their trade contractors have been trained, and they are passing on a more regular basis. But smaller contractors and owner-builders who are contracting their own homes are often unaware that they even need to have a blower-door test done, and they are still struggling to meet the 3 ACH50 standard.

In the past, I worked for many years as a home-performance technician, upgrading existing homes to make them more airtight

Studs often stand proud of the top plate—here, by a strong 1/8 inch **(1)**. This situation will hold the drywall away from the top plate, allowing a pathway for air infiltration from the attic if not addressed. The author seals this joint from the top **(2)** in a home that failed its code-mandated blower-door test.

and energy-efficient. I'm experienced at finding and sealing air leaks. So when a house doesn't pass the test (whether I did the testing or somebody else did), many builders turn to me to help them tighten up the house enough to get over the bar. In that case, we've got some work to do.

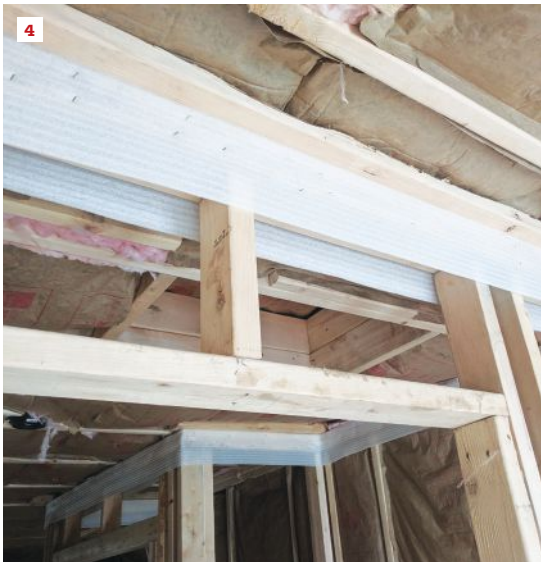
If somebody misses by just a little, we may be able to find a few big air leaks right away, seal them up, and get to passing that day. But when the numbers are way off, I have to schedule another visit to do blower-door-assisted air-sealing. So far, nobody has been unable to pass the test after some remedial sealing. Below, I've identified a few classic trouble spots that we frequently come across and need to remedy.

Even though we have been able to help builders squeak over the line with remedial air-sealing, I do not recommend that approach. In this story, I'll explain some of the ways we've solved problems at that stage. But I recommend that builders address these types of air leaks during the framing stage, when assemblies are exposed and can be sealed without drastic measures.

UNSEALED CEILING

The worst example of failure I've encountered so far was a slab-on-grade home that, based on the home's volume, needed to test at 800 cubic feet per minute at 50 pascals (800 CFM50), but was actually at about 3,000 CFM50. *[Editor's note: For an explanation of the relationship between CFM (cubic feet per minute) and ACH (air changes per hour), see "Blower Doors for Builders," by Jake Bruton (Mar/19).]* Fortunately, the builder had not yet installed the baseboard trim, so we were able to access the area at the base of the exterior walls and caulk that joint. The home's ductwork was in the attic, and none of the duct registers were sealed at all, so we took care of that. Then there was a large room with a vaulted tongue-and-groove ceiling with no air barrier behind it. This unsealed ceiling was applied to a scissors truss, so, luckily, it could still be accessed from above.

We quickly realized that we weren't going to be able to air-seal the back of the tongue-and-groove ceiling with all of the insulation in the way, so we emptied the attic of insulation. Next, we cut



Here, the builder has applied sill-sealer material to the top plates in a home **(3, 4)**. When drywall is installed, the sill sealer will form a gasketed seal and prevent air infiltration at the top of the wall.

Tyvek housewrap the width of the trusses and rolled it down on the top side of the ceiling between the trusses. Then, using two-part foam, we sealed the Tyvek to the sides of the trusses.

TOP-PLATE JOINTS

The joints between the wall drywall and the top plates—specifically, top plates that are exposed to an attic space, whether they are exterior-wall top plates or interior-partition-wall top plates—are often huge air-leakage areas. When you're framing a wall, if the stud is proud of the top plate by even 1/8 inch **(1)**, the wall drywall is pushed far enough off the top plate to create a gap along the top plate that communicates between the wall cavity and the attic. Air from the unconditioned attic moves everywhere from there: I find air infiltration at interior door strikes, at all of the outlets, at switches, and at heating and cooling registers.

With the blower door running, usually the first place I look is at the door strike for an interior door. Where the strike is open to the rough opening, you can feel air blowing in between the frame and the opening. If it's cold enough outside, you can see it with an infrared camera, blowing down from the attic. The remedy is to flip the blower door around and pressurize the house, and then climb up into the attic and feel the air blowing up between the top plates. After you pull all the insulation away and find the top plates, you can apply caulk and gun foam **(2)** and fairly quickly—in just an hour or two—knock off 300 to 800 CFM by sealing the drywall to the plates.

Of course, it's better to make the air-seal during construction, instead of as a repair after failing a blower-door test. One solution that I recommend to builders is to use sill-sealer gasket material on their top plates to help cover that void **(3, 4)**. When you roll out this 7-inch or 8-inch sill-seal gasket over the top plate, it makes a nice little gasket that the drywall can seal up to. Habitat for Humanity started doing that in my area and saw a significant improvement. The first house that I ever tested for the organization was at 9 air changes per hour, and now its houses are at about 2.

ENTRY FOYER STAIR LANDINGS

In my market, two-story entry foyers are common, and it's typical to find stairs to the second floor in that room. I frequently find leaks at the stair landing where it connects to the balloon-framed wall **(5)**. The leak occurs where the drywall contacts the landing. If it's a carpeted landing, sealing that joint is as simple as pulling the carpeting back and caulking under the trim **(6)**, and then tucking the carpet back in. If it's a finished hardwood floor, things are a little bit trickier: Sealing the joint requires pulling the trim off to access the joint between the drywall and the floor.

STAIRCASES ON GARAGE WALLS

Another trouble spot I see quite often is where a staircase attaches to a wall between a house and the garage **(7)**. In this case, there's usually a false ceiling on the underside of the staircase, and a wide-open air gap between the stairs and the garage wall. If the drywall on the garage side isn't sealed to the slab, which it's

Here, the framing juncture between a stair landing and a balloon-framed wall has no solid blocking where drywall will meet the floor **(5)**. This creates a gap for air leakage. The author pulls back the carpet at a landing in a finished house and seals the joint with gun foam **(6)**. A stair against a garage wall **(7)** creates a highway for likely air infiltration.

usually not, then air can readily find its way into the garage wall, and then into the underside of the stairs, and then into all sorts of framing cavities in the main house.

To address this air-leakage pathway, I ask the builders I work with to seal the joint between the drywall and the garage slab or the band joist on the garage side of the wall. I also recommend installing an air-barrier material such as rigid foam board over the air gap between the staircase and its false ceiling. This is not a condition that can be easily addressed once the house is finished, so it should be taken care of at the framing stage.

ATTIC-TO-WALL INTERSECTIONS

Another condition that I often see involves the juncture of a first-story scissors-truss roof (or flat attic) with a second-story wall. A potential problem exists wherever a laminated beam or girder truss is required to carry the second-floor floor joists with hangers. A typical situation is a one-story morning room abutting the back of a two-story main house. In the example shown here, a tripled-up girder truss supported the floor framing for the second floor of the main house, with the floor joists hung off of the truss **(8, 9)**. The vented attic of the lower space contacted the wall of the second story and its floor framing—which is also the ceiling framing for the first floor of the main house.

The hangers of the floor joists hold the drywall down from the girder truss, and the second-floor subfloor can't reach all the way out to the edge of the girder truss because the chord members are in the way **(10)**. As a result, a pathway is opened up for unconditioned air in the ventilated lower attic to move into the first-floor ceiling assembly and down into the room through recessed lights—or, depending on the air pressures, for conditioned air to find its way into the attic. This is just about impossible to fix once the house is finished.

The time to address this problem is at the pre-drywall phase. At that point, critical air leak points can be identified and sealed with gun foam. The bottom of the girder truss or laminated beam should

be gasketed as well. I usually recommend that the builder or framer staple sill-seal gasket material on the underside of any place there are hangers supporting the second-story floor joists. This gasketing will seal the joint between the drywall and the beam or girder truss.

EDUCATING BUILDERS AND TRADES

The requirement for a blower-door test and the need to pass an airtightness spec is old hat for Energy Star builders. But for builders who haven't been participating in any above-code program, it's a new challenge and an added cost. It's new for them to have to pay me $75 an hour to come to their house and test it. But it's even worse when they have to pay me to come back a second or even a third time to remediate their house if they fail the first time.

Obviously, the ideal time to address these air leaks is before you do the final blower-door test. But for that, you have to know what to look for, and what to do, at the framing stage. I've offered to sit down with builders to go over recommendations with them, but I've had very few takers. Instead, they end up paying me more to go up into their attics and fix problems.

The learning curve is a challenge for the building trades, as well as for the builder. At some point, somebody has to take responsibility for air-sealing—but who? When a house fails to pass, the finger-pointing starts. Was it a trade's fault, or the builder's, or the architect's (because, after all, the air-sealing details weren't on the prints)?

When I'm walking through a house with a builder after it has failed a blower-door test, I like to stop at an outlet near the door between the garage and the main house. I'll ask, "How many people put their hand on that outlet before I told you to seal it?" The framer was there; the insulator was there; the electrician was there; the drywaller was there; the painter was there; and the builder walked by the outlet every single time he walked in the building. Yet nobody sealed the outlet to the drywall. This is generally true: Multiple trades are dealing with components that leak air, and any of them could theoretically take responsibility for it. But because it's not in any of their contracts, nobody is doing it.

Matt Bowers is president of Rochester Passive House Consulting in Rochester, N.Y.

A scissors-truss roof abuts a carrying beam for a floor system **(8)**, as does this flat ceiling truss **(9)**. The leakage pathway is visible when the framing junction is viewed from the other side **(10)**.

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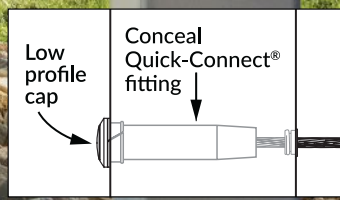

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Foolproof Octagon Layout

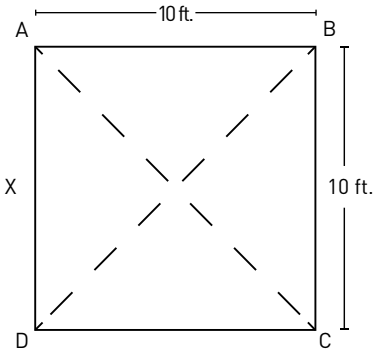
by Harvey Edwards

Whether you're building a concrete patio, a deck, or an elegant pergola, if it's in the shape of an octagon, the layout will be more challenging than for a rectangular structure. But there's no reason to fear the trigonometry; instead, follow this process using these three multipliers to help lay out the sides. ❖

A former builder, Harvey Edwards currently works as a theater set carpenter in Loami, Ill.

Multiplier #1 = 1.4142

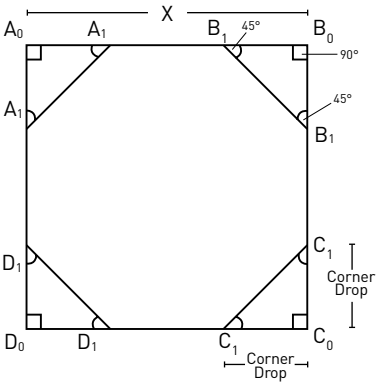
diagonal (AC, BD) = side X x 1.4142
= 10 x 1.4142
= 14.142
or 14 ft. 1 11/16 in.



1. Stake out the corners of the square footprint of the octagon with batter boards and string lines where it will be located. To check for square, measure the diagonals (AC and BD). The length of a diagonal equals the length of a side of the square multiplied by 1.4142.

Multiplier #2 = 0.2929

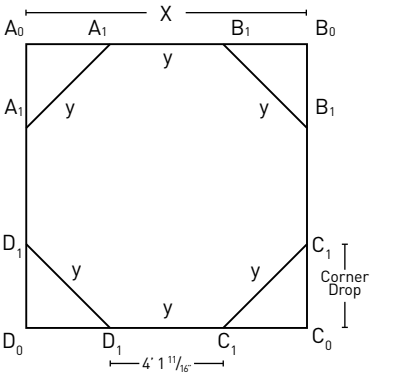
A_0 - A_1 = side X x 0.2929
= 10 x 0.2929
= 2.929
or 2 ft. 11 1/8 in.



2. To find the corner drop (the distance from the corner of the square A0 to the octagon corner A1), multiply the length of side X by 0.2929.

Multiplier #3 = 0.4142

side of octagon (y) = side X x 0.4142
= 10 x 0.4142
= 4.142
or 4 ft. 1 11/16 in.



3. When staking out the eight corners of the octagon, multiply the length of side X by 0.4142 to verify that each side of the octagon is equally sized and the corners are properly located.

Send Us Your Tips

We want your best deck-building tips and are partnering with different tool manufacturers to give away a power tool to the reader who sends the best tip to prodeck@hanleywood.com. The prize for the March 2020 issue is a Camo Drive three-way stand-up fastener tool. 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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Lag Screws vs. Structural Screws for Ledgers

Q For installing a deck ledger, structural screws such as LedgerLoks (which don't require predrilling) are so much easier to use than the lag screws and through-bolts referenced in the IRC. But are they a one-to-one replacement for lag screws?

A Glenn Mathewson, a consultant and educator with BuildingCodeCollege.com, responds: No matter how strong anyone can make them, structural screws are not interchangeable with lag screws and never will be ... unless they are as large in diameter as the lag screws they are replacing. I can say this with certainty because it has nothing to do with the strength of the screw. In this application, the limiting factor in the connection is the wood ledger and band joist.

To understand why, consider Sir Isaac Newton's Third Law of Motion (for every action, there is an equal and opposite reaction). When you stand on a floor, for example, you put your weight on the floor, while the floor basically applies an equal amount of force back on your feet. Now, imagine standing just on the balls of your feet, so that the same amount of weight is concentrated on a smaller part of each foot. You're probably not as comfortable as when using your whole foot, right? And that's the key: Because a structural screw has a smaller shank diameter compared with a ½-inch-diameter lag screw, the same load is placed on the wood over a smaller area, and—similar to standing on the balls of your feet—the wood can't handle it.

When designing wood connections, engineers consider the crushing effect on wood grain when loaded and limit the load so as not to crush the wood. For this reason, the limits of a ½-inch-diameter lag screw assume that the fastener will be in contact with about ½ inch of wood, while a 5/16-inch-diameter structural screw will be in contact with less wood. Even if the screw were magically invincible, more structural screws would be required than lag screws to provide the same load-bearing capacity.

For that reason, structural-screw manufacturers that market fasteners specifically designed for ledger connections provide engineered fastener patterns and load tables, and these are the ones you must use. You cannot use the spacing published in the IRC for ½-inch-diameter fasteners. But, there is a benefit to using structural screws in addition to ease of installation: You'll find that structural-screw manufacturers often provide more design flexibility than the code, such as more options for different band-joist materials, and design load capacities that are greater than 40 psf.

Prep for a Grade-Level Deck

Q When I'm building a grade-level deck, is it necessary to remove the sod underneath the deck's footprint prior to construction?

A Mike Guertin, a Rhode Island contractor and frequent contributor to *PDB*, responds: I can't think of any requirement that the grass should be removed from beneath a deck, but it's always a good idea to follow the installation recommendations from the manufacturers of the products that you will be using. For example, some brands of composite decking require a certain clearance above the ground in order to provide airflow beneath the deck. In some cases, it may be necessary to remove the sod to provide that clearance.

In addition, some pressure-treated lumber that is used to frame decks is rated for ground contact, while some is rated for above-ground use only. You can tell the difference by checking the end tag stapled to each piece of PT lumber, which indicates the particular preservative that's been used during treatment, the preservative retention level, and the AWPA-certified use category. PT lumber that is approved for ground contact will have an AWPA UC4A tag, while PT framing lumber that is only approved for above-ground use will have a UC3B tag and require a minimum 6-inch ground clearance.

If the decking and framing meet these clearance recommendations, I don't think that leaving the sod in place is a problem. Sure, some grass might grow up through the gaps between decking boards, but that could happen even if the sod is removed and some weed seeds started growing. And removing the grass won't appreciably lower the moisture content underneath the deck, as airflow tends to equalize humidity levels between the space beneath the deck joists and the atmosphere above. More important is positive drainage away from the building. Finally, leaving the grass may make the space more appealing to mice and other critters, but that hasn't been my experience. ❖

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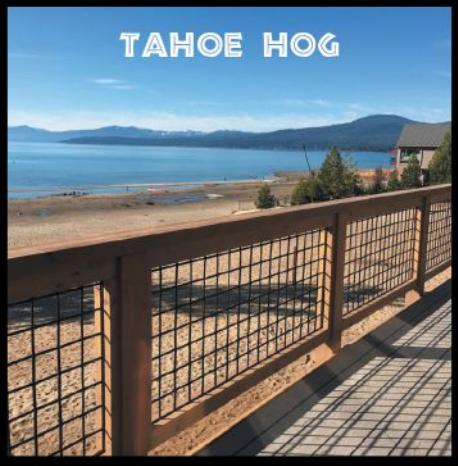

Building an Asymmetric Portico

Fussy zoning and framing requirements complicated the construction of this practical North Carolina porch

by John Carroll

Like many houses built in the post-World War II building boom, this modest cape (built in 1951) originally had no roof over the front porch. The brick and concrete stoop served the most basic function of a porch, but anyone waiting at the front door was exposed to the weather until the door was opened. And because the area just above the concrete slab got soaking wet when it rained, the wood siding, trim, door, and mudsill had all been repaired for rot over the years. In addition to these practical shortcomings, the sad little stoop detracted from the appearance of the otherwise attractive and impeccably kept house and yard.

To create a more practical entry, the owners hired their niece, architect Sophie Jonson, to design a portico (a structure consisting of a roof supported by columns, which is often attached to a building as a porch). The design had to be approved by the Historic District Commission of the town of Hillsborough, N.C., and it had to conform to the rules and regulations of the town's Building and Planning Division. The historic commission was easy to satisfy: The design fit the architecture of the house and specified traditional materials (brick, stone, and wood) that would have been used in 1951.

The building and planning division proved harder to please. The existing stoop was in violation of current setback limits but, because it had long been in place when the setbacks were enacted, it was grandfathered into legal acceptance. That meant that we weren't allowed to tear down the stoop and build the new portico from scratch. Instead, we would have to improve the existing porch without encroaching further on the setback limits. We could add to the sides of the stoop but not to the front, and we were required to leave the existing stoop in place. To satisfy these requirements, Sophie designed the portico to more than

PHOTOS BY MATTHEW CARROLL NAVEY

double the 6-foot width of the stoop while maintaining the 40-inch depth.

Extending the Brick Stoop

Because I was required to leave the existing stoop in place, I had to build two separate foundations, one on each side of it. After digging and pouring small rectangular concrete footings, I laid up two rectangular concrete block foundations and set rebar dowels in the cores with grout. I covered the visible sides with bricks that matched those on the house (**Figure 1**).

In keeping with the town's requirements, I left the brick walls of the existing stoop in place and ran the new brick into it, then ran the top two and a half courses of new bricks over the top of the existing ones. Since evidence of the existing stoop was rapidly disappearing, I took numerous photos to document that I had indeed left it in place.

To tie everything together, I took off the concrete top of the existing stoop and poured a single slab that bridged the three separate foundations. The dowels I had inserted tied the slab to the block foundations. In case the three foundations settled unevenly, I reinforced the slab with a grid of ½-inch rebar to keep it from cracking.

The slab rested on the blocks but ended inside the brickwork, which I used as a form to strike off the concrete. I had laid out the brickwork so that the tops of the two sides sloped a full inch downward away from the house. Doing this insured that the top of the slab would also slope about ¼ inch per foot over its 40-inch width to shed any rainwater that might blow onto the deck.

Before mixing the mud for the straight-edged Pennsylvania bluestone pavers, I laid them all out over the entire slab, cutting them as needed with a 4½-inch angle grinder equipped with a diamond blade. Along the outside perimeter, I overlapped the wall 1 inch; along the house, I tucked the stone under the siding and

Figure 1. To expand the original front entry (A), the author removed its concrete slab deck and laid up a pair of block walls faced with brick on either side of the masonry stoop (B). Before pouring a new slab flush with the brickwork, he installed vinyl flashing to serve as a vapor barrier between the concrete and the mudsill and primed the cut edges of the siding and trim (C).

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Figure 2. The author dry-fit the bluestone pavers (A), numbering them to keep track of their location, then trimmed them to size as needed with a diamond blade mounted in an angle grinder (B). The pavers were set in a thick bed of type S mortar (C). After the mortar bed cured, he grouted the 1/2-inch-wide joints with the same type S mortar. A strip of wood clamped to the pavers where they overhung the brickwork supported the grout while it cured (D). The author used a tuck pointer to pack the joints (E), and he cleaned up the joints afterward with a damp sponge (F).

trim. To keep the joints uniform in size, I used a 1/2-inch plywood scrap as a gauge. After laying out all the stones, I numbered them and removed them from the slab.

Next, I set the stones in a bed of Type S masonry cement mortar mixed to a ratio of two and a half parts sand to one part masonry cement. The stones were natural cleft, meaning they were split and, thus, not uniform in thickness. To ensure that they were fully embedded in the mortar, I mixed the mortar fairly wet and spread it slightly high. I set each stone into position and tapped it down to its final resting place, making sure to keep the top surface in a straight plane that sloped down towards the outside edge (**Figure 2**).

Once the mortar bed had time to cure, I grouted the joints using the same Type S mortar mix. Around the perimeter, I used spring clamps to hold a strip of wood to the underside of the stone. This strip supported the mortar as I packed it into the joint in the 1-inch section that overhung the side.

After finishing the masonry part of the portico, I built a step that was 17 inches wide and extended the full 13 1/2-foot length of the masonry base (the step was exempted, surprisingly, from the setback restrictions). I poured a footing, and then built the step with bricks and stones to match the porch.

Framing the Portico

When I first looked at the plan, there seemed to be no provision for keeping the ridge from dropping and the rafters from thrusting out at the bottom. When I voiced my concerns to the architect, she reassured me that she had consulted with a structural engineer and was confident in the design, explaining that the narrow width of the roof would mitigate most of my concerns. She agreed that the connection of each pair of rafters would need to be reinforced by securely fastened collar ties located just under the ridge. She also emphasized the importance of a strong connection between the new roof and the existing roof.

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Figure 3. After removing the trim at the house corners and eaves, the author used a multitool and sharp chisel to cut pockets in the solid 4x6 corners for the beams that would support the new portico roof (A). To accurately lay out and support the triple 2x6 beams and 2x8 ridge, he installed vertical posts and diagonal bracing fastened to a temporary plate on top of the new masonry stoop (B). The plate was held in position with strategically positioned blocking (C).

Figure 4. The author used a Pivot Square (chhanson.com) to accurately measure the slope of the existing roof, placing it against a level to find the 8-in-12 pitch (A). Then he set the tool to that pitch and used it to lay out the birdsmouths and plumb cuts on the rafters (B).

Because of the asymmetrical design of the 1951 home's front entry, both the entry door and the ridge were off-center, with different wall heights on each side of the projection and different rafter lengths. Sixty-eight years later, I would have to extend the off-center ridge and install beams at different heights to match the existing structure. All had to be supported on temporary posts over a stone floor that sloped a bit more than ¼ inch per foot. It was a head scratcher at times.

I began by laying out the positions of the triple 2x6 beams and the 2x8 ridge in plan view directly on the stone deck. Before installing the ridge, I double-ripped the top to match the 34-degree pitch of the roof so that the plywood sheathing could be tightly nailed to it. Then, when I extended the beams and the ridge out from the house, I used a straightedge and a level to position and brace them directly over the layout (**Figure 3**).

With a stone deck to work off, bracing was challenging. Since I couldn't nail a temporary plate to the stone pavers, I extended my plate across the full width of the porch and over the sides. On both ends, I placed a block of wood tight to the edge of the pavers, then screwed through the plate into the blocks to hold the ends of the plate in place. To secure the plate front-to-back, I cut blocks of wood that ran over to the wall of the house and fastened them to the plate and house with screws. With this plate in place, I was able to anchor the bottoms of braces that I used to plumb the three temporary posts that held the 2x8 ridge and beams precisely above the layout.

Installing the Roof

Before laying out the rafters, I measured the pitch of the existing roof using a level and a handy tool called a Pivot Square (**Figure 4**). To find the rafter length, I measured from the beams to the ridge, then used the Pivot Square set to 8-in-12 to lay out the plumb cut at the top of each rafter and the birdsmouth at the bottom. I doubled the first pair of rafters and fastened them to the rafters on the house with 6-inch TimberLok heavy-duty wood screws, placing about a dozen in each rafter. Hurricane ties connect the rafters to the beams.

I used ¾-inch plywood to sheathe the roof to match the solid-sawn 1x6 sheathing on the house and to provide a stiff structural diaphragm in the new roof's deck. At the seam between the old and

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Figure 5. A local supplier fabricated the custom steel column brackets based on a plywood prototype supplied by the author (A). Each column consists of four 3x3 posts connected via the brackets to the masonry stoop (B) and beams (C).

Figure 6. The author fastened collar ties to the rafters and ridge with structural screws (A) and blocked out the roof framing with 2x4s to provide nailing for the plywood ceiling (B). The completed portico was painted to match the house (C).

new roof frames, I used an abundance of nails in both the plywood and the solid sawn sheathing on the house, tenaciously attaching the new frame to the old.

After fastening collar ties to the rafters and ridge with structural screws, I built the ceiling down 3 1/2 inches. This covered the flat section created by the collar ties and allowed the ceiling to run up to a point. It also created a second layer along the gable end, where I installed a pair of rake frieze boards under the last rafter and about 5 inches in from the rakes.

I cut the rafter tails in place and simply continued the eaves, which were about 5 inches wide, out from those on the house. To build the rakes, also 5 inches wide, I simply cut the plywood 5 inches outside of the last rafter, then clamped a 2x4 barge rafter in place under the plywood and drove screws through the plywood to attach the rafter. To provide a nailer for the plywood on the underside of the rake, I nailed 2x4s to the side of the last rafter.

Built-up Columns

Each of the two finish columns consists of four custom-milled 3x3 posts fastened at the top and bottom to custom-fabricated steel brackets. After bolting the brackets in place on the underside of the beams, I plumbed down to mark their positions on the stone deck, pre-drilled holes for 3-inch Tapcon concrete screws, then bolted the brackets to the stone deck (**Figure 5**).

I milled the four 3x3s that make up each column out of 4x4 PT posts that I sanded smooth, rounded over the corners of, and stained. Each post also had to be routed to fit over the thickness of the steel brackets. I installed them one at a time, bolting through holes in the brackets to attach them securely at top and bottom and also driving deck screws through the sides to tie the wooden pieces together.

While construction took longer and was more expensive than my clients anticipated, they're pleased with their home's new portico. And because this part of North Carolina sometimes gets struck with hurricane-force winds, it's nice to know that the strong, bolted connections between the deck, columns, and beams might just keep the roof from being blown away (**Figure 6**). ❖

John Carroll is a mason and builder in Durham, N.C.

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PHOTOS BY MIKE GUERTIN

Installing Lateral-Load Connections

Part 3. Specialized hardware transfers loads from the deck frame directly to the frame of the house

by Mike Guertin

[Editor's note: The final installment of this three-part series on deck ledger installation addresses the connections that transfer lateral loads from the deck frame directly to the house.]

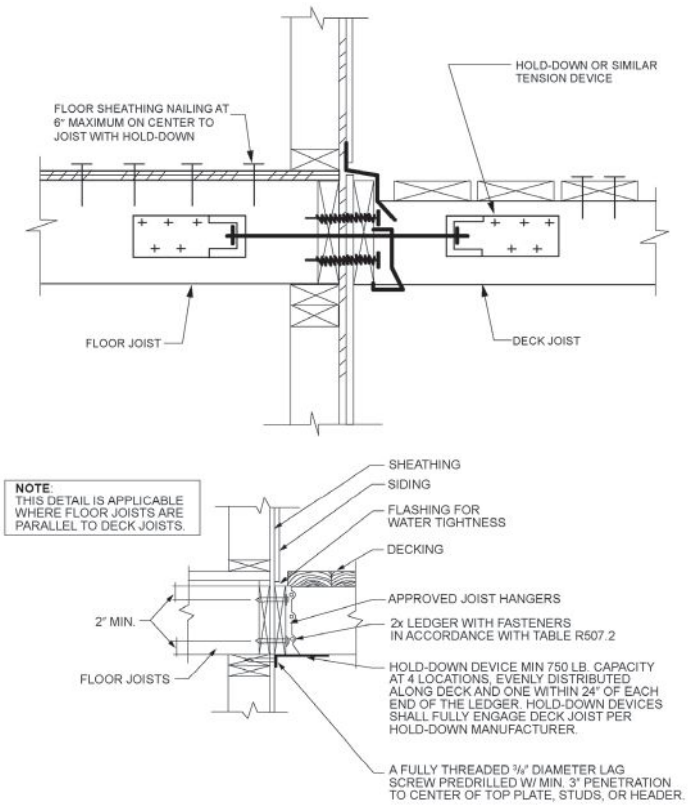
The International Residential Code has always required that any deck connected to a house be designed and built to resist lateral loads. But it wasn't until the 2009 edition that the IRC provided a prescriptive method for meeting that requirement. Along with the design figure in the 2009 IRC, a second lateral-load figure was adopted in the 2015 IRC. While the code doesn't specifically require that either of the designs be installed, their inclusion in the IRC raises the lateral-load-connection issue to the forefront of code officials' minds during plan reviews and inspections (**Figure 1**).

Deck lateral-load connections resist forces—from earthquakes, from wind, from rowdy parties—that pull a deck away from the house. While a well-fastened deck ledger is capable of resisting lateral forces, that connection can fail if the ledger or house rim board is compromised by rot. A dedicated lateral-load connection transfers the loads from the deck frame directly to the frame of the house.

Like many code figures, the lateral-load-connection details in the 2009 and 2012 IRC are generic and don't address all deck and house framing configurations. However, over the past few years, hardware manufacturers, engineered-lumber manufacturers, and industry associations have developed alternative configurations for lateral-load connections that meet the intent of the code. From the array of hardware and installation options available, deck builders just have to choose the solution that works best for the deck and house they are working on.

Two at 1,500 Pounds

The two most common 1,500-lb. deck lateral-load ties are the Simpson Strong-Tie



FIGURES R507.2.3(1) AND R507.2.3(2)
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Figure 1. In the lateral-load detail introduced in the 2009 IRC (top), the deck framing is connected to the house framing with a pair of hardware ties and a ½-inch bolt or threaded rod. Each tie must be mounted within 2 feet of the ends of the deck and have a capacity of 1,500 lb. or more. In the detail introduced in the 2015 IRC (above), four 750-lb. ties are required, two located within 2 feet of each end of a deck and the other two spaced equally along the deck's length.

Figure 2. The two most common 1,500-lb. deck lateral-load ties are the Simpson Strong-Tie DTT2 (top) and the MiTek/USP DTB-TZ (bottom). Two are needed per connection, along with a ½-inch-diameter bolt or threaded rod, and structural screws to mount the hardware to the framing.

DTT2 and the MiTek/USP DTB-TZ. Both are G-185 galvanized (the DTT2 is also available in stainless steel) and come kitted with 1½-inch-long structural screws to mount the hardware to the side of a joist. Two are needed per connection, along with a ½-inch-diameter bolt or threaded rod (**Figure 2**).

Installation of the two 1,500-lb. connections as shown in the code illustration is simple when the house joists run perpendicular to the rim joist of the house and there is access to the joist bays inside the house (when it's new construction, for instance, or there is an unfinished basement or crawlspace). Simply screw a metal tie to the side of a house joist and another to a deck joist, drill a hole through the ledger and rim board for the ½-inch-diameter connecting rod, bolt the two ties together, and you're done (**Figure 3**).

But what if a deck joist doesn't line up with a house joist? What happens when the joists run parallel to the rim joist? How can the hardware be installed in an existing house with a finished ceiling—without cutting an access hole (and patching it later)? And what about existing homes where the nailing frequency of the subfloor sheathing can't be verified (the IRC detail requires 6-inch-on-center subfloor nailing at the joist where the hardware is mounted)? Fortunately, there are work-arounds and solutions.

Non-aligned joists. In a worst-case scenario, deck joists that land dead center in the house joist bays would be offset by 8 inches if both the deck joists and the house joists are framed 16 inches on-center. With one tie mounted to the left side of one joist and the other tie on right side of its mate, the net difference in the position of the bolt connecting the two ties would be only 4½ inches, given that the two opposite faces of the joists would be only 6½ inches apart and that the bolt holes in the ties are offset by roughly one inch. If the ties are mounted on 2-by blocking fastened to the sides of the joists, the difference is narrowed

Figure 3. When deck and house joists are parallel, screw a metal tie to the side of a house joist and another to a deck joist with structural screws, drill a hole for a 1/2-inch-diameter connecting rod, and bolt the two ties together.

Figure 4. When there's a finished ceiling, cut a hole to match the size of the planned access panel and bore the rod hole through the ledger and rim joist from the outside. A right-angle drill/driver may be needed to screw the anchor to the side of the joist.

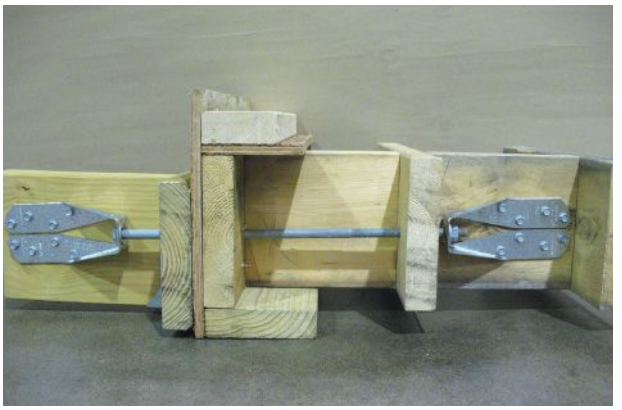

Figure 5. When house joists are perpendicular rather than parallel to the deck joists, solid blocking must first be installed between at least two joist bays, starting at the rim joist, then the tie must be mounted on the block furthest from the rim joist.

down to 1 1/2 inches, which is within the hardware manufacturers' allowable difference for angling the connecting rod.

Most of the time, of course, the deck and house joists aren't half a joist bay off, in which case simply angling the rod a bit (without added blocking) may work. Alternatively, joists that align with the house frame can be added to a non-aligning deck frame.

Finished ceilings. Fastening hardware to house joists is complicated when there is a finished ceiling but still manageable. I've installed several lateral-load anchors by cutting 6-by-9-inch access holes through the ceiling drywall alongside the joists where the hardware will be located. Removable low-profile access panels cover the holes and allow the building inspector to verify installation (**Figure 4**).

There are already plenty of utility penetrations through the ceiling of a finished basement, including HVAC registers, recessed light trims, and smoke detectors, so a couple of access panels, which can be painted to match the ceiling, don't add much to the clutter. A false HVAC grill is another option.

If you don't want to break through the ceiling, you can install a lateral-load anchor entirely from the outside. Before mounting the deck ledger, cut out a section of the rim joist between two joists. Reach in and fasten the tie to the joist, then double-nut a threaded rod to the tie so the rod is trapped onto the tie by the nuts. Before reinstalling the removed section of rim joist, drill a hole in it for the threaded rod. The ledger can then be installed over the rods, with the ties mounted to deck joists aligned with the rods. If you use this method, make sure

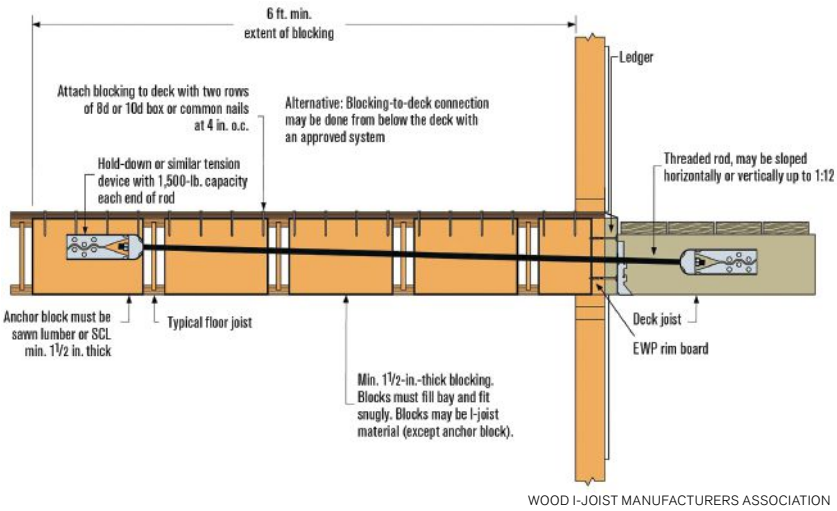

Figure 6. When there is an I-joist floor system running perpendicular to the deck joists, install solid wood blocking between several inboard joists to a point at least 6 feet back into the floor system before mounting hardware.

Figure 7. The IRC 4x750-lb. lateral-load detail is well suited for retrofits, since it doesn't require access to the house interior; here, an SST DTT1 tie connected to a ⅜-inch lag screw embedded at least 3 inches into house framing is being fastened to the bottom of a deck joist (above left). Examples of hardware that meets the 750-lb. requirement include (above right, from left to right in photo) MiTek/USP ADTT, MiTek/LTS19, Simpson Strong-Tie DTT1, and FastenMaster LTS.

to take photos before putting the rim-joist blocks back in place for confirmation at inspection that the work was done on the inside.

Existing subfloor attachment. The subfloor sheathing must be nailed at 6 inches on-center to any house joist with a 1,500-lb. tie fastened to it. This isn't practical to verify on existing houses, so hardware manufacturer Simpson Strong-Tie offers an engineered solution that involves screwing several A35 angle brackets to the side of the house joist and the subfloor to transfer the load. You can find this detail (and several others) in SST technical bulletin T-C-DECKLAT19, "Installation Options for Deck Lateral Load Connections," at strongtie.com.

Joists parallel to the rim joist. Often, the house joists are perpendicular rather than parallel to the deck joists. In that case, solid blocking must first be installed between at least two joist bays, starting at the rim joist, before mounting the tie on the furthest block from the rim joist (**Figure 5**). This detail requires access to the floor joists from below to install the blocking, so it is best suited to new construction or floors with unfinished ceilings. The blocks need to be nailed through the subfloor above as well as to the joists. If there's no access to drive nails through the subfloor, angle brackets can be screwed between the subfloor and blocks, as described above.

Attaching to a masonry wall. When the deck surface steps down below floor level, you'll need to follow the hardware manufacturers' minimum vertical overlap requirement (typically 4 inches) when installing the ties. If the deck ledger is fastened to the foundation wall instead of the house framing, adhesive concrete anchor rods can be connected to the ties mounted on the deck joists. Be sure to follow the manufacturer's instructions for embedment depth and edge clearance when installing the concrete anchors to ensure they meet the 1,500-lb. load requirement.

Mounting to wood I-joists. I-joist manufacturers and the Wood I-Joist Manufacturers Association offer details for mounting 1,500-lb. ties to engineered I-joists. They all call for a 3-foot (or longer) 2x6 (or deeper) block clinch-nailed to the web; the tie can then be screwed to the block. When the I-joists run perpendicular to the deck joists, solid wood blocking must be installed between several inboard joists to a point at least 6 feet back into the floor system. Then the tie is screwed to the most inboard block and a long rod extended through the joists (**Figure 6**).

Four at 750 Pounds

If access to the interior framing is problematic, you might want to use the 750-lb.-tie solution introduced in the 2015 IRC. While four connections rather than two are required, all the work can be done from the exterior, so it's ideal for building a deck on an old house or retrofitting lateral-load connections to

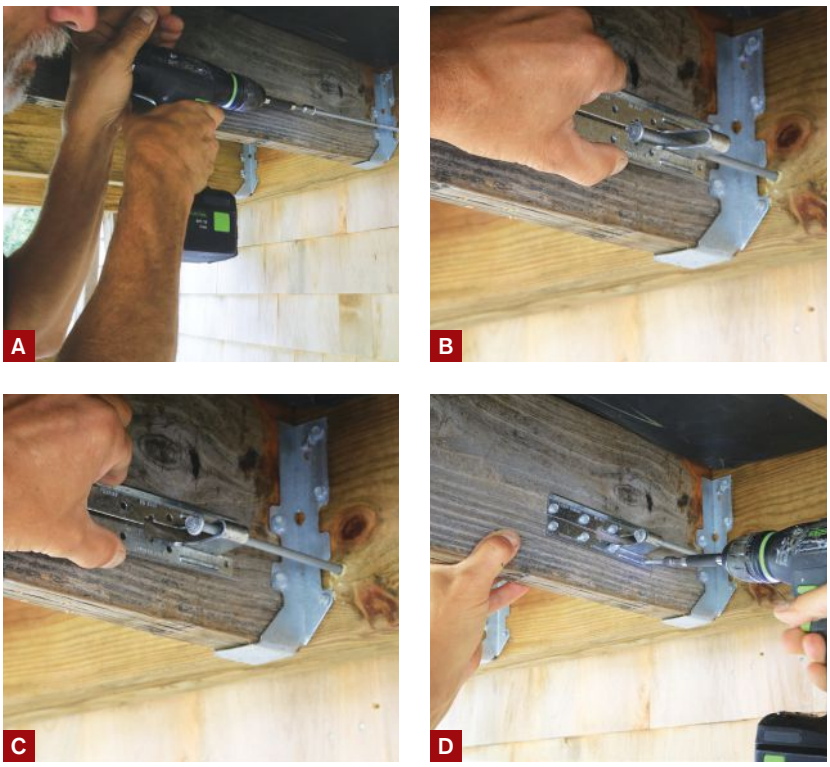

Figure 8. To install FastenMaster's LTS tie, first drive the screw to the proper depth (A). Next, slide the tie over the screw (B), position it on the deck joist (C), and fasten the tie to the joist with the supplied structural screws (D).

Figure 9. When installing the SST DTT1, slip the plate screw through the hole in the tie before driving it to the proper depth into the house framing (above left). Then fasten the tie to the joist (above right).

an existing deck frame (**Figure 7**). This connection detail requires a 3/8-inch-diameter lag screw embedded at least 3 inches into the house framing, which can present difficulties if the deck framing and plate aren't aligned just so. Also, the 750-lb.-tie connections can only be installed on decks attached to the side of the house where the house joists are parallel to the deck joists and rest on the wall plate—the bearing walls of a house.

Generally speaking, 750-lb. ties can't be fastened to the plates of nonbearing exterior walls, though it's worth checking with your local code official regarding this limitation. There may be cases where the official will permit the use of the 750-lb.-tie option along a nonbearing wall. For example, mudsill attachment is a condition a code official may look favorably on since the mudsill is anchored to the house foundation. And in my area, the floor systems in many newer homes are framed with blocking between the first inboard joist and the rim joist along nonbearing exterior walls. These blocks are nailed through the subfloor and to the wall plate, so there's load path continuity from the wall plate to the subfloor.

Most 750-lb. ties are available kitted in boxes of four with connector screws to mount the ties to the deck joists or blocks, and proprietary structural screws that substitute for the 3/8-inch lag screw that's driven into the wall plate.

The FastenMaster LTS and Simpson Strong-Tie DTT1 ties can be installed in similar arrangements. With both, I find it easier to drive the screw into the plate or stud at the correct depth and

Lateral-Load Connections and Floor Trusses

The Structural Building Components Association (SBCA) has developed prescriptive designs for mounting a lateral-load connection to decks attached to open-web floor trusses using four 750-lb. ties. Where the deck is attached to the bearing wall, the detail calls for 24-inch-long gusset plates made of 7/16-inch-minimum OSB or plywood nailed to one side at the end of each of the four trusses with 10d nails spaced 3 inches on-center. The lag or structural screw is driven into the double 2-by end of the truss. Along nonbearing walls, the design calls for 2-by blocks fastened between the end truss and the first inboard truss to reinforce the vertical uprights in the end truss or for blocking installed between the top and bottom chords. You can find the detail in SBCA's research report SRR No. 1408-01, "Deck Ledger Attachment to Residential Wood Truss Floor Systems," at sbcindustry.com/deck-ledger-attachment.

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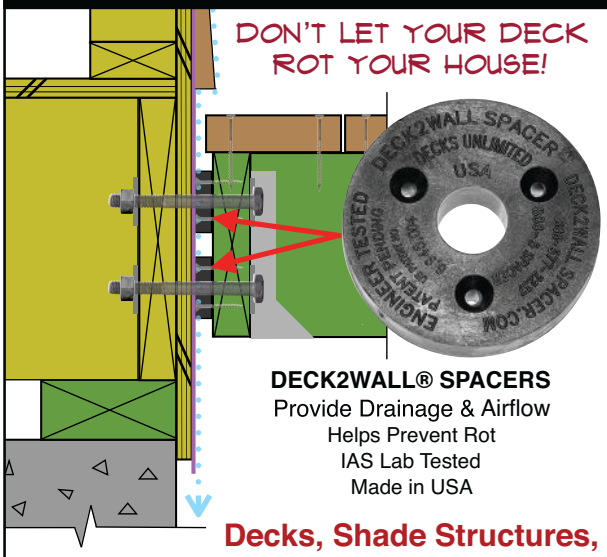

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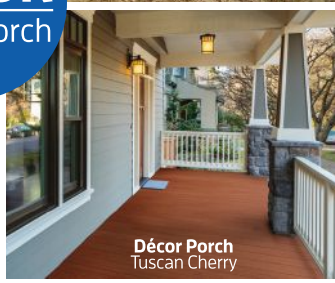
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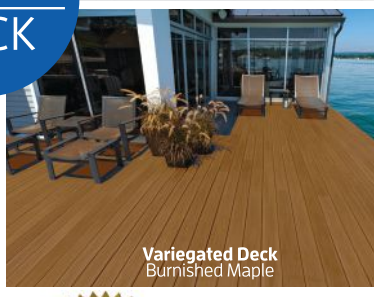
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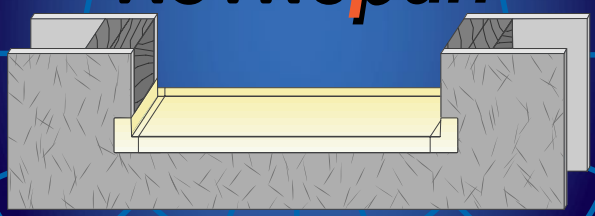

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Figure 10. Blocking can be installed to help align the hardware with the deck and house framing. Here, the author fastened the block to the joist with SST TimberHex HDG screws (above left) before installing the DTT1 tie (above right).


Figure 11. MiTek/USP's ADTT hardware can be adjusted to match the height of the wall plate (above left). The legs screw to the sides of the deck joist to form a triangle; the plate screw can be driven afterward (above right).


Figure 12. To fasten ties to wall studs rather than a plate, the author installs 2x8 blocking across the bottom of the deck joists (above left). The lateral-load hardware—FastenMaster LTS in this case—can then be accurately positioned for the 3/8-inch lag screws to penetrate the studs (above right).

then mount the tie to the joist or block. Unlike the code illustration that shows the short leg of the "L" in contact with the wall, the LTS and DTT1 ties can be (and usually are) installed with a space between the wall and the leg the plate screw shoulders on.

Side mount. When a deck is one step down from the level of the inside flooring, the deck ledger will be roughly centered over the wall plate. After verifying the exact position of the wall plate, drive the screw through the ledger and wall sheathing and into the plate. The tie then can be fastened to the side of the joist at the level of the wall plate.

The LTS has a contoured knockout that allows it to be slipped over the plate screw head so the plate screw can be driven first, then the tie (**Figure 8**). When installing the DTT1, you need to slip the plate screw through the hole in the tie before driving it (**Figure 9**). The MiTek/USP LTS19 can be side mounted, but the short leg of the "L" must be in contact with the ledger.

Lowered block mount. On floors framed with tall I-joists, the wall plate is often lower than the bottom of the deck joists. To align the ties with the plate, I fasten 24-inch-long 2x8 or 2x10 blocking to the side of the joists with structural screws so that the bottom of the block lines up with the location of the ties (**Figure 10**).

The MiTek/USP ADTT has a unique design that allows it to attach to a wall plate that falls anywhere within 4 3/8 inches below the bottom of the deck joists. You unfold the tie and bend it to the level needed for the screw hole to match the wall plate (**Figure 11**).

Stud connection. Instead of fastening the screws into a wall plate, you can drive them into the center of a stud. This option is useful when you're attaching a stair landing that falls mid-way between floor levels. If the landing or deck joists orient squarely on studs, then the ties can be fastened to the bottom of the joists. When a stud falls between two deck joists, I fasten a 2x8 block to the underside of two adjacent joists with structural screws. The tie can be positioned along the block where it centers on the stud (**Figure 12**). ❖

Mike Guertin is a builder and remodeler in East Greenwich, R.I. He'll be leading Deck Workshop demonstrations on ledgers and other topics at the 2019 DeckExpo in Louisville, Ky.

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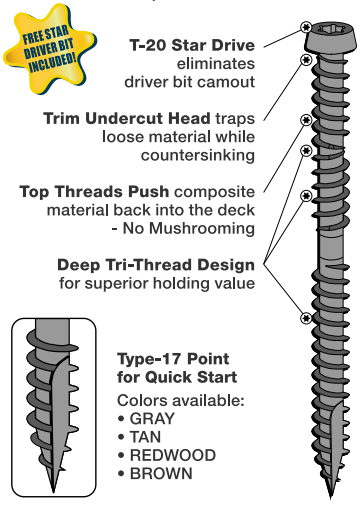

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Camo Drive Deck Fastening Tool

by Matthew Breyer

Over the last decade, my company has acquired and used collated fastening tools from every major manufacturer (and several of the smaller ones), so my team has experience running everything from dedicated stand-up screw guns to pneumatic fastening systems. As a result, they're very opinionated about what works and what they want to use. For the past few months, we've been putting Camo's new Drive deck fastening tool (camofasteners.com) to use, with mostly positive results.

One feature of the tool—which is basically an extension attachment for a drill—that the team especially appreciates is that they can use their own drill/drivers (and their current battery platform) with it, rather than having to use one supplied by the tool manufacturer. This allows them to continue working with a tool that they are already familiar with and like, rather than risk grumbling about (or worse, not using!) a fastener because they didn't like the brand of the gun that was included with the tool. The Drive tool simply chucks into a drill/driver (impact drivers are not recommended) like any other hex bit.

Another feature we like is the wide variety of fasteners, materials, and manufacturers that the tool is compatible with. It can be loaded with the company's collated edge or face screws for square-edged decking. It can also be used with the company's new EdgeClip hidden fasteners for grooved decking. You still have to position the clips between the deck boards by hand, but then it's quick work to drive the fasteners home using the Drive tool and self-centering clip guide attachment. Because we install a lot of different types of decking, from PT to high-end composites, being able to switch it up between fasteners for different jobs is money-making versatility. It just takes a few seconds to switch between the three different guides that come with the tool and swap out the fasteners.

Besides being easy to figure out, set up, and work with, the tool performed well, without jamming or going out of alignment. The Camo Drive simply "works."

For example, the tool does a good job of keeping the small plastic "leftovers" from the collated fasteners out of the way, so you don't have to worry about tripping on them and so there's less risk of them scuffing the deck's surface. It's designed to collect the plastic debris, which is then cleaned out with the installation of the next clip of fasteners.

And when installing face screws for PT decking, we were able to place the screws accurately and sink them to a consistent depth, all without bending over. At about $175 (for the tool only), we'll definitely be purchasing more of them for all of our team members to have on hand. ❖

Matthew Breyer, CGR, owns Breyer Construction and Landscape, in Reading, Pa.

Backyard Alpenglow

by Dale Ervin

Located in Aurora, Colo., this fire feature was built mostly in-house, starting with a custom frame that we fabricated from aluminum hollow square stock to keep the weight down. We clad the frame with ½-inch Durock backerboard so that we would have a solid substrate for the stone veneer cladding. The assembly is topped with stone, with the openings sized to fit fire-pit pans and burners supplied by American Fire Glass (americanfireglass.com).

Because the fire pit wraps around the corner of the deck, we had to purchase three of the company's aluminum fire-pit pans and weld them together to fabricate the three-legged L-shape. Three of the company's burners daisy-chained together provide the fire pit's heat.

The project included an outdoor kitchen with a large grill that also had to be fueled by the natural gas. To accommodate the demand, we upgraded the meter and ran an extra-large gas line that could supply 1,000,000 Btu (the fire feature alone pushes out more than 600,000 Btu). We also installed an electronic ignition for convenience.

The etched glass panels were supplied by Denver Glass Interiors (denverglassinteriors.com), with a sand-blasted design that resembles Colorado's Rocky Mountains, including Pikes Peak. Below the glass, we installed LED strip lighting that changes colors to illuminate the panels at night. Another LED strip light installed under the stone cap lights up the base of the fire pit, creating a terrific nighttime ambiance. Finally, we filled the fire-pit pans with a mixture of decorative broken fire glass, reflective glass fire drops, and fire diamonds, all provided by Star Fire Direct (starfiredirect.com). ❖

Dale Ervin is president of Custom Decks, a Denver-based deck company with offices in Los Angeles, Portland, Ore., and Seattle.

PHOTOS: DALE ERVIN/CUSTOM DECKS

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BY SYMONE GARVETT

1. Durable Aluminum Railing

Deckorators ALX Classic Aluminum Railing aims to provide a durable, yet minimal, deck railing made of heavy-gauge aluminum with a thick powder-coated finish. It is available in 6- and 8-foot lengths and 36- and 42-inch heights in four colors—satin black, matte black, textured white, and weathered brown. According to the manufacturer, the product is easy to install whether deck builders choose the preassembled option or the railing kit. Kit pricing ranges between $40 to $45 per foot; preassembled runs $50 to $55 per foot. deckorators.com

2. Paver Support

Designed specifically for thick porcelain tiles rated for exterior use, the Schluter Troba-Level paver support system, or pedestal, supports tiles above the substrate with no bonding required. Because the tiles are not bonded in place, the system allows for natural drainage, ventilation, and easy access to utilities or systems beneath the patio floor. The system is available with several accessories to allow an installer to create a level patio with flush seams and corners. The individual components generally cost $3 to $10 each. schluter.com

3. Cedar Shingle Look-Alike

New siding profile Artisan Shingle, the latest addition to James Hardie's Aspyre Collection of fiber-cement siding panels, emulates the width, pattern, and color of cedar shingle siding. The panels measure 5/8 inch thick and are available primed for paint or in James Hardie's ColorPlus Technology blends. Like all Aspyre products, the Artisan Shingle profile is engineered for particular climates and is made to resist the specific conditions of the climate zone it will be sold in. Contact a local distributor for pricing. jameshardie.com

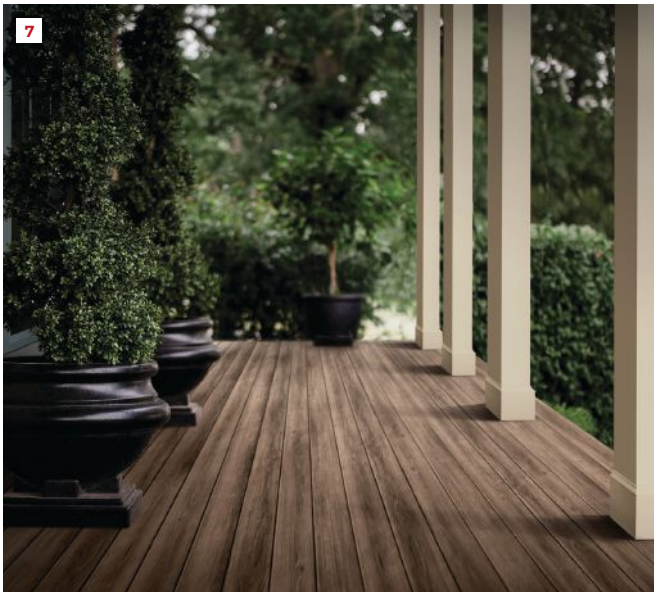
4. Surface-Mount Barn Door Lock

Inox's Surface Mount Barn Door Lock was designed to be easy to install on today's popular barn doors. The stainless steel lock can be installed on the surface of any type of wall or jamb casing to add privacy and function to a room. Its surface installation is ideal for renovation or remodeling projects. Two one-touch thumb levers are available, including an ADA option. Pricing ranges between $118 to $188. unisonhardware.com

5. Tankless Electric Water Heater
Rheem EcoSmart Tankless Electric Water Heater uses the EcoSmart brand's self-modulation technology to optimize energy use when heating water. According to the manufacturer, this reduces the unit's potential for energy loss and allows for savings on water heating costs. The whole-home models include the ECO 18, 24, 27, and 36, each named for its kilowatt use. The units are compact and may be installed anywhere with a power source. Pricing ranges from $200 to $600, depending on the model. ecosmartus.com

6. Fresh Air Machine
The QFAM QuFresh by Air King Fresh Air Machine provides a constant supply of fresh air from outside the home, allowing builders to meet requirements for residential fresh airflow. Installers can set the precise airflow desired from 40 to 120 cfm for the unit's quiet, energy-efficient fan system, and adjust intake levels for outside humidity and temperature. The unit may be mounted in the home at any convenient point, such as the attic, garage, or laundry room, with the proper duct and power connections. Pricing starts at around $320. airkinglimited.com

7. PVC Column Wraps
Royal Building Products' cellular PVC Royal Column Wraps are now available in a new finish, sand dune. The PVC column wraps are available in four widths, made to fit around 4x4, 6x6, 8x8, and 12x12 structural posts. Each of these is available in two standard lengths—10 feet and 8 feet 6 inches. A new, 12-foot length is also available in white for 6x6, 8x8, and 12x12 column sizes. The wraps are resistant to moisture and can help to prevent rotting, warping, and insect damage. Contact a local distributor for pricing. royalbuildingproducts.com



8. Self-Draining Vented Wall System
Amico's new Hydrodry system combines a series of five components to create a dedicated drainage and ventilation cavity for use behind veneer stone, masonry siding, and stucco exterior cladding. The system can drain up to 150 gallons of water per hour from within the wall cavity, and vent water vapor through the top of the wall at a rate of 0.8 pounds per hour, according to independent product analysis. The drain screed, designed for use on the bottom of a wall, features built-in drainage and ventilation slots and accommodates a rainscreen up to 10mm wide. Contact a local distributor for pricing. amicoglobal.com

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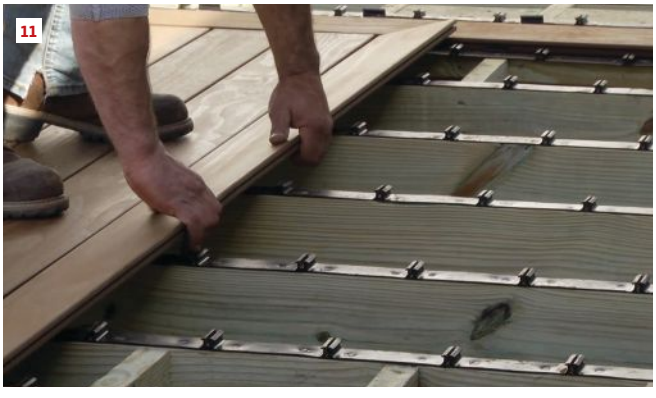

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9. Convenient Spray Foam Insulation

Dap's Touch 'n Foam Pro System 200 offers spray foam insulation in a self-contained portable and disposable system. The two-component foam package comes with pre-attached hoses and ergonomic foam applicator for roughly 200 board feet of polyurethane spray foam that, when applied, dries in 60 seconds. Other benefits include a high R-value of 5.4 per inch, a class A fire-rated formula, moisture resistance, and the ability to bond to a variety of materials, including wood, masonry, metals, and drywall. Pricing for the system starts at $350. touch-n-foam.com

10. Modern Cable Railing

Superior Aluminum Products has debuted its series 200 cable railing system to both residential and commercial audiences. The railing's 3/16-inch 1x19 type 316 stainless steel cable is made from 19 strands for high tensile strength with no stretching, while the 2 1/2-inch-square aluminum posts can be surface mounted, side mounted, or embedded into concrete. The product is available in any height, with standard heights of 42 inches for commercial and 36 inches for residential projects. Contact a local distributor for pricing. superioraluminum.com

11. Quick Installation Deck Clips

Kebony now offers its modified wood decking in a custom-profiled version that is compatible with DuraLife's Step-Clip hidden fastening system. Step-Clips are interlocking polypropylene strips that are fastened to the top of the deck joists with a pneumatic roofing nailer to minimize the time and labor spent surfacing decks. The strips have clips that fit into grooves milled into the edges of the decking; the installer inserts one edge of a board, then steps on the other edge to lock it into place. Contact a local distributor for pricing. kebony.com

12. Accessible Wall-Mount Sink

The new Metropolis wall-mount sink by MTI Baths was designed for compact bathrooms and accessibility installations. It measures 51.75 inches long, 20 inches deep, and 4.5 inches high, providing plenty of space for toiletries and a deck-mount faucet. Constructed with MTI's proprietary SculptureStone material, the surface is durable, resistant to stains and scratches, and easy to clean, according to the company. The sink can be installed at ADA-compliant heights and is available in white or biscuit in both matte and hand-polished-gloss finishes. Pricing starts at $2,845. mtibaths.com

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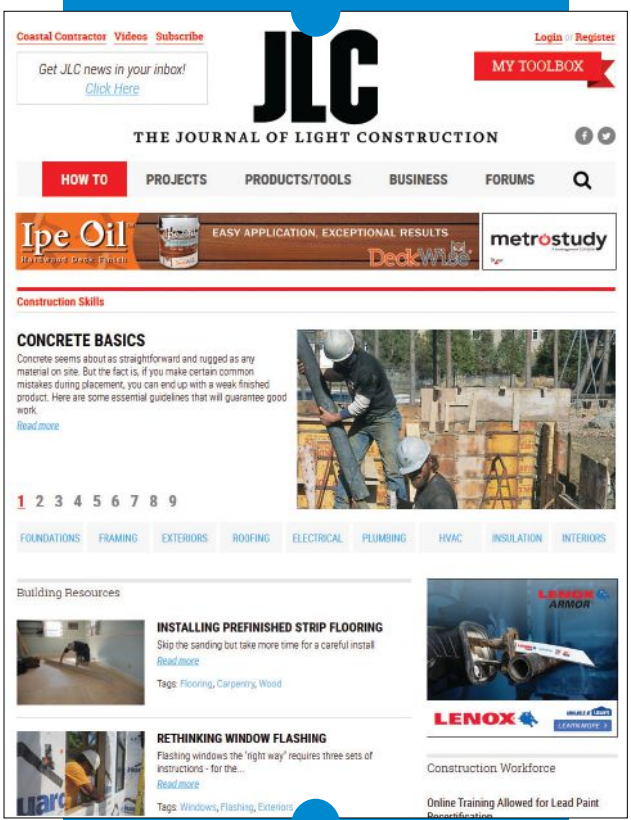

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hanleywood

Cordless Table Saw

BY NATHAN RINNE

When manufacturers first started offering big-battery tools, promising long runtimes and corded performance, I was a skeptic. I saw them as a gimmick that likely performed nowhere near the claims the manufacturers were making. It took running a substantial amount of oak through a buddy's DeWalt FlexVolt table saw for me to acknowledge that these tools were viable pro options.

Fast forward about a year or so, and I was forking over close to $700 for a cordless miter saw and its sold-separately batteries. It's a heavy price tag, but the saw is worth the money. It performs incredibly well, and I can cut all day with it and still have half a charge left. These aren't the toys I had erroneously assumed they were.

Still, those are miter-saw cuts; short cuts, by and large, compared with long rips with a table saw. The draw on the battery is different. I was curious to see how a cordless 10-inch table saw played out.

FULL-ON 10-INCH TABLE SAW

Metabo HPT (formerly Hitachi) has been making waves with its MultiVolt platform. One of the newest, and arguably most anticipated, additions to the lineup is the C3610DRJ 10-inch table saw.

You read that right: 10-inch. As in full-on, 3 1/8-inch depth of cut at 90 degrees versus 2 1/2 inches at 90 on smaller saws. And a nice, big table surface that works for me and the work I do.

While other manufacturers are offering blade diameters of 8 1/4 inches with rip capacities at or under 25 inches, Metabo HPT went all in with the 10-inch blade and a whopping 35 inches of rip capacity to the right and 22 inches to the left—more than any other cordless or corded jobsite saw save Metabo HPT's corded version of this saw.

Add to that a motor that has a no-load speed of 5,000 rpm (for reference, that's about 1,400 more than my corded jobsite saw and 500 more than the corded saw Metabo HPT sells) and the ability to use an optional AC adapter for plugging in to a receptacle and you might have the ultimate jobsite table saw.

POWER

The first question on most people's minds is power. Metabo HPT's 36-volt battery delivers 4.0 amp hours of runtime. Metabo says the battery will last four hours under continuous use; though I haven't tested that, I have put this saw to moderate use for full workdays and had more than 50% charge left at the end of the day. The tool

Photos by Nathan Rinne

Metabo HPT's C3610DRJ cordless 10-inch table saw is built on the company's corded platform. At 5,000 rpm, the saw can handle the hardwood and plywood the author works with, and he gives the outfeed support bar high marks. The optional folding stand bolts to the saw and has locking legs.

also has soft start, which reduces noise and recoil at start-up, and its electric brake stops the blade quickly for added safety.

There is a slight drop in rpm when I am running 3/4-inch materials, which is typical for a jobsite table saw. It's less noticeable when plugged in to the AC adapter. Nonetheless, it powers through whatever material I use—hardwood, framing, plywood, PT lumber—and that is the bottom line.

This saw is more than ample for any task you want to throw at it. It will even spin an 8-inch dado stack at up to 13/16 inch.

BUILD

This saw appears to be well made with features that show a great deal of forethought in its design. For starters, the onboard storage is second to none. It holds the blade-guard assembly, small parts, auxiliary fence, included push stick, miter gauge, and the anti-kickback pawls, all within easy reach. The large table surface (28 3/4 inches by 22 inches) is backed up with an indispensable adjustable outfeed support bar that you will wish you had on every saw you've owned.

The rack-and-pinion-style fence is the most easily adjustable fence system on jobsite saws today. A simple release lever unlocks the dial, which in turn can fine-tune for a cut with relative ease. The fence also has a secondary narrow fence that, when flipped into the horizontal position, is used as a work support for pieces wider than the table top.

OPTIONAL STAND

The optional stand features a design that makes one-person transport much easier. Wheels that have no trouble going through gravel and other terrain make the tasks of pack-in and pack-out a bit easier. The legs operate much the same as those on my miter-saw stand, with a spring-loaded ball catch. They both unfold and collapse easily. The metal used isn't what I'd call heavy duty, but it does seem to do the job.

The saw must be mounted to the stand with bolts, which could be a pro or a con, depending on your preference. Some carpenters would prefer a quick release to separate the two, while others would rather carry the saw and stand together for fast setup. One thing worth noting is that the saw and stand together have a fairly large footprint. You aren't going to throw this in the backseat of your crew cab.

CONCLUSION

The Metabo HPT 10-inch table saw is a stellar option in the field. For me, the battery power is a lifesaver in so many situations; for instance, on a site where there are four trades but only one outlet, or on a dock, or, obviously, anywhere that doesn't have power.

Having used both cordless table and miter saws for some time now, I'd never go back to plugging in again—unless I had to, and I can with the MultiVolt system.

The included blade, dado plate, and charger with a USB port all make this great saw even better.

I found the bare tool for about $440 online. metabo-hpt.com.

Contributing editor Nathan Rinne is owner of Rinne Trimcraft, based at the Lake of the Ozarks in Missouri. Follow him on Instagram @rinne_trimcraft and on Facebook at www.facebook.com/rinnetrimcraft.

Hands On With a Green Laser

BY TONY BLUE

I didn't own a laser level prior to purchasing DeWalt's 12-volt 360, a green three-beam laser level (DW089LG; dewalt.com). A co-worker, Jason, has a Hilti PM 2-L (two-line red laser level) that we use for most tasks. In addition, I used a standard beam level, line level, and plumb bob. With the DeWalt 360 in my arsenal, those still have their place, but I use them much less often.

After shopping lasers, I decided the DeWalt 360 in green was my choice ($500; the red-laser option was about $100 less). We were in the middle of a bathroom and bedroom remodel when my laser arrived, so I put it right to work. Out of the box, it's easy to use. I quickly vowed to never hang drywall without it again.

The author illuminates premarked stud locations by rotating the laser to each stud. No more marking the wallboard with level and pencil to minimize misses.

Photo: Tony Blue

I hung the unit on a drywall screw in roughly the center of the bedroom we were working in, approximately 5 feet up off the floor (to raise it above any 4-foot sheet goods resting on the wall). I turned on the plumb laser and rotated it to each premarked stud location. This significantly sped up setting screws. Never again will I have to use a level or other straightedge so I don't miss the stud.

The next task was to frame a wet wall for a shower, with a

While the laser is mainly for indoor use, the beam, though faint, is visible from a distance for marking deck ledgers and other exterior layout.

32-inch rough opening. I made a quick pencil mark on the new subfloor and one halfway up the adjacent wall and, within a few seconds, had the laser positioned on the floor with a bright, green plumb line through both marks. I tacked my wall together plumb and square and nailed it off without reaching for a beam level.

Other uses I found were squaring tile work, installing outlets at the same height, leveling cabinets, and even installing windows. Because we build a few decks each year, I wanted to see if I could get by without using a rotary laser or string line for setting my post heights. I didn't have any deck projects coming up, so I did a quick test run on a sunny day. In daylight conditions, the beam is hard to see with the naked eye, but with the help of the included green laser target card, I could pick up the faint line well enough that I could mark off the line for each imaginary deck post.

Tony Blue owns Squared Away Contracting, in Greenwich, N.Y.

Cordless 23-Gauge Headless Pin Nailer

BY BARRETT SITES

The new Grex GCP650 pinner is a perfect fit for the work I do. At under 4 pounds and cordless, this pinner is great for the shop or the jobsite. Don't be fooled by its size, though; this gun packs a punch. I used it in hardwood (white oak) and softwood, and it didn't flinch.

For trim work or to assemble glue-ups, it performed extremely well. I used it for tasks like fastening dentil molding, for instance, and temporarily fastening patterns to pieces I scroll cut with a router. Running off two AAA batteries and a fuel cell keeps it lightweight and compact. There's minimal maintenance: Both the battery and the fuel cell are in the handle and easy to change. Of course, there is no compressor or hose to deal with, so time saved. Seeing the fasteners is easy through the window at the nose of the gun. Also, with the dry-fire lockout, there's no need to backtrack to see where the gun stopped shooting.

The tool—which I used mainly in my shop but also on site building a coffered ceiling and a mantle—shoots from 3/8- to 2-inch fasteners. Setting the depth is as easy as sliding the depth knob.

With the non-mar tip, which is removable, the nose of the tool won't ding your work. There is a back-up tip stored on the tool as well, opposite the belt hook, which I think is well designed. I also like that the nose assembly is slim for fastening in tight spaces.

With the 23-gauge pin, you rarely need to address holes before finishing. Primer and paint will seal the fastener hole nicely. And for molding and other detail work, these pins hold fast. Add a little glue and paint and those pieces aren't going anywhere.

At 1,300 shots per fuel cartridge and 5,000 per battery pair, it's made for performance and never left me hanging. This gun is a joy to use and is comfortable to hold. The black rubber hand grip on the handle keeps the tool from sliding around in your hand.

To sum it up, this is a versatile tool from shop to site. Grex has made just about the most perfect tool for the work I do. It costs about $440. grexusa.com.

Barrett Sites has owned HHI (Handyman Home Improvements) for 20 years and is a remodeler and finish carpenter in Chambersburg, Pa.

Light, powerful, well-designed, and cordless, the Grex 23-gauge pinner delivered on site and in the shop.

Photos: Tony Blue (top); Natalie Sites (bottom)

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TROUBLE-FREE METAL ROOFS

Careful fastening and a good underlayment will ensure that the roof stays dry for decades

Architectural metal roofs have a lot going for them. They look great, are suitable for relatively low pitches, and can last 60 to 100 years. However, they need to be properly installed.

As with all roofing, keeping moisture out comes down to material choice and proper detailing. Using the manufacturer-supplied flashing and trim are obviously important, but here are some other things to consider:

STANDING SEAM IS WORTH THE COST

Roof panels come in exposed fastener and standing seam types.

Exposed fastener roofs can have 70 screws per square—a lot of potential leaks. The weak points are the neoprene gaskets, which can begin leaking in as little as 15 or 20 years. And if installers drive the screws at an angle or don't tighten them enough, the gaskets won't make a proper seal to begin with.

By contrast, standing seam roofs have no exposed fasteners. Panels are fastened along the vertical seams, using clips or an integral flange, which is then covered by the next panel. Standing seam costs more but has a better shot at a trouble-free life.

BE CAREFUL WITH ADD-ONS

Even on standing seam roofs, some installers fasten solar panels, satellite dishes or snow guards with exposed screws. A better choice is to use S5 brackets, which clamp to the vertical seams and are held in place with round-point screws that don't penetrate the metal.

UNDERLAYMENT IS CRUCIAL

If any water does get behind the panels (whether from installation errors or leaks caused by falling branches), it can work its way into the sheathing around those screw penetrations.

That's where high quality, peel-and-stick underlayment membrane earns its keep. It provides a backup watershed and also self-seals around screws.

Some installers only extend the membrane 36 inches up from the exterior wall line, as required by code, then lay roofing felt above that. This protects the roof edge against leaks caused by ice dams, but if water gets behind the metal on the upper part of the roof, remember that felt has no sealing ability.

UNDERLAYMENTS AREN'T EQUAL

Although you can use a standard peel-and-stick membrane, some builders and architects want more protection. The issue is heat: underlayment beneath a metal roof will get hotter in the sun than under asphalt shingles.

"We make a membrane for metal roofs called Ice & Water Shield HT. It's a 40 mil rubberized asphalt that has been tweaked to give it better thermal stability," says Brandon Wulf, a Sales Manager at GCP Applied Technologies. "The HT product is formulated slightly differently to achieve a higher thermal stability."

Some roofs get even hotter. That's the case with copper panels, which absorb more sunlight than steel, and in extreme climates like Arizona. "In those cases, we recommend Grace Ultra," says Wulf. "It's 100 percent butyl rubber with a thermal stability up to 300 degrees."

Bottom line: careful fastening and the right underlayment go a long way toward keeping a standing seam roof trouble-free for its entire service life.

To get more tips on proper metal roof installation, visit **www.gcpat.com**.

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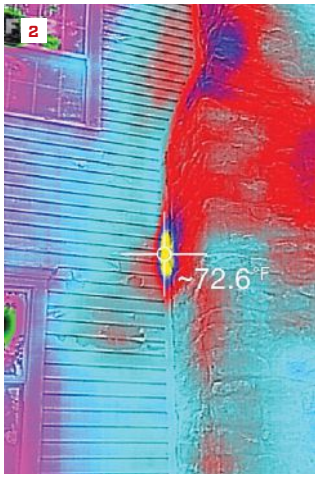
BY KYLE DIAMOND



Honey Bee Rescue

A few years ago, during an initial walk-through for an exterior restoration project, we encountered a large colony of bees nesting in the home's gable-end wall. Wild honey bees were flying in and out of a gap between the stone chimney and abutting vertical trim **(1)**. Infrared imaging taken from outside the house revealed the nest's rough size and location, which was behind the chimney in the vicinity of the second-floor framing **(2)**. The homeowners informed us that the three-story neo-colonial had been rebuilt between a couple of older stone chimneys (on either end of the house) some 30 years ago. We could see that the chimney was pulling slightly away from the wall and that the previous builder did a so-so job scribing the vertical trim to the stone and sealing the joint. This combination allowed the bees easy access into the wall cavity.

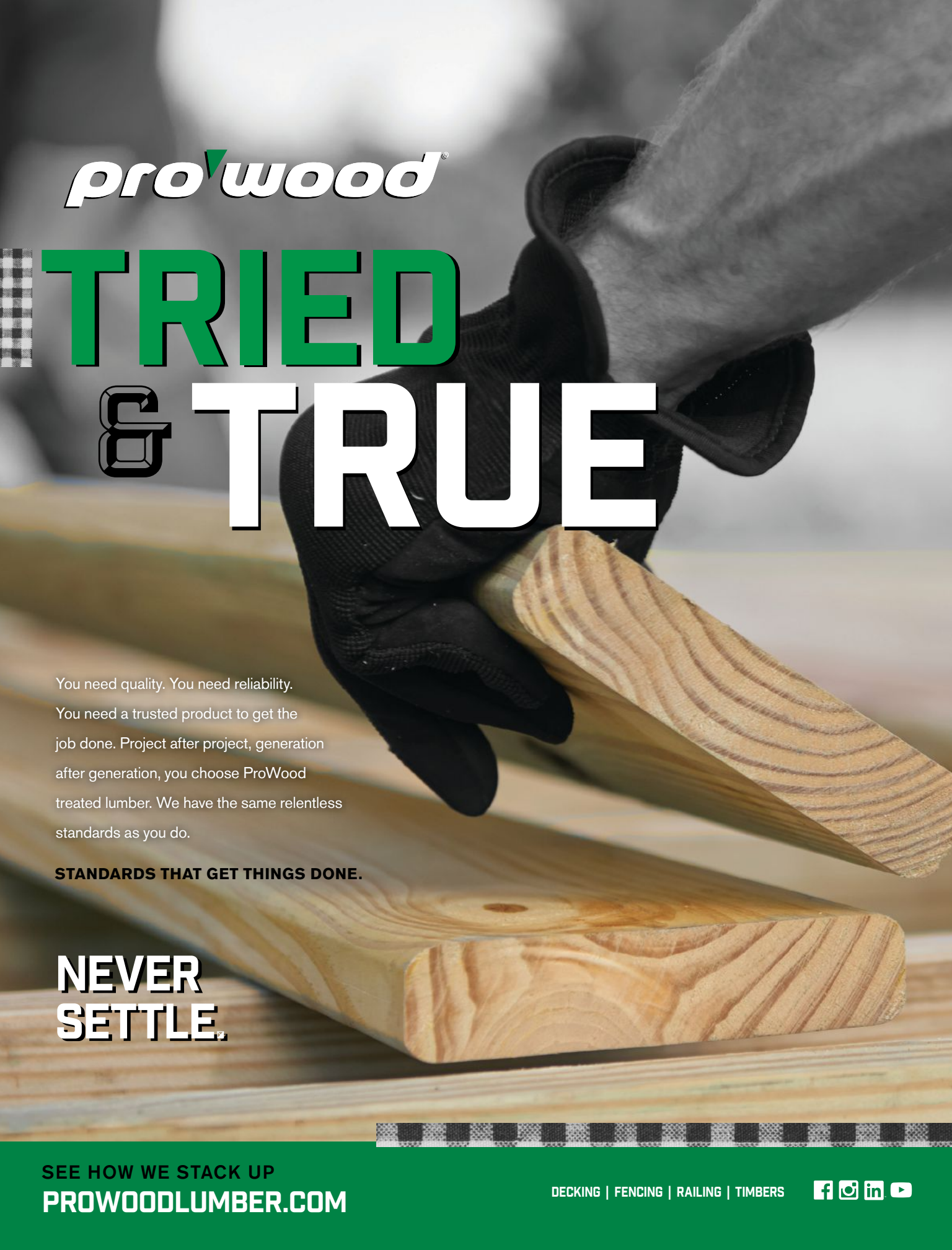
For our (and the bees') safety, the hive had to be removed before work could begin. The homeowners hired a beekeeper to capture the bees alive and remove the colony's suspected honey-laden wax comb from the walls; we were on hand to open up the walls as needed. With the beekeeper's help, our guys suited up for action. He furnished protective clothing and helped close off potential bee infiltration points, such as the wrists, waist, and ankles, with tape.

We began by removing the vertical trim covering the bees' entry point **(3)**. This allowed the beekeeper to use his bee vacuum to safely gobble up large amounts of bees. Then, we cut back some of the existing siding and sheathing in an effort to access the nest's wax comb, but hit a road block. Apparently, when the house was rebuilt, the builder made the first-floor ceiling higher and drywalled over an old fireplace located at the old second-floor elevation (the firebox ended up falling between the two floors in the new house). The bees apparently built their nest inside this old firebox, which was inaccessible from the exterior.

We moved inside and cut out a 3-foot-square hole in the interior wall at the approximate location where we had been working outside **(4)**. We found the bulk of the bees thriving in the abandoned firebox. The beekeeper vacuumed up the remaining bees and removed the honeycomb **(5)**. He took the bees (and about five gallons of honey) and relocated the hive. To prevent bees from returning and keep mice and insects from being attracted to the site, we cleaned the masonry with hot water and bleach to remove any residual honey. Our crew closed up the firebox and repaired the wall, and our painter made it look as good as new. With the relocation successfully completed, we moved on to complete the exterior repairs.

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

Photos: Kyle Diamond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Cortex for FASCIA

The First Fascia Hidden Fastener!


Counterbore predrill


Drive screw


Tap in plug

The strongest, easiest way to hide fasteners in fascia boards.

When it comes to finishing the sides of your deck, nothing beats the beauty, durability and low maintenance of Cortex for FASCIA. The first hidden fastening system for fascia and stair risers is now available to match Trex Transcend® Fascia.

- Engineered for fascia expansion/contraction
- Plugs made from Trex® Fascia board
- Featuring the TORX® ttap® Drive System
- Perfect color match
- Available in a 50 LF kit complete with: 100 screws, 105 plugs, 1 counterbore tool and 1 setting tool

For more information on Cortex for Fascia:
visit https://www.fastenmaster.com/product-details/cortex-fascia-hidden-fastening-system.html

Approved by:

Trex

FastenMaster PRO Driven