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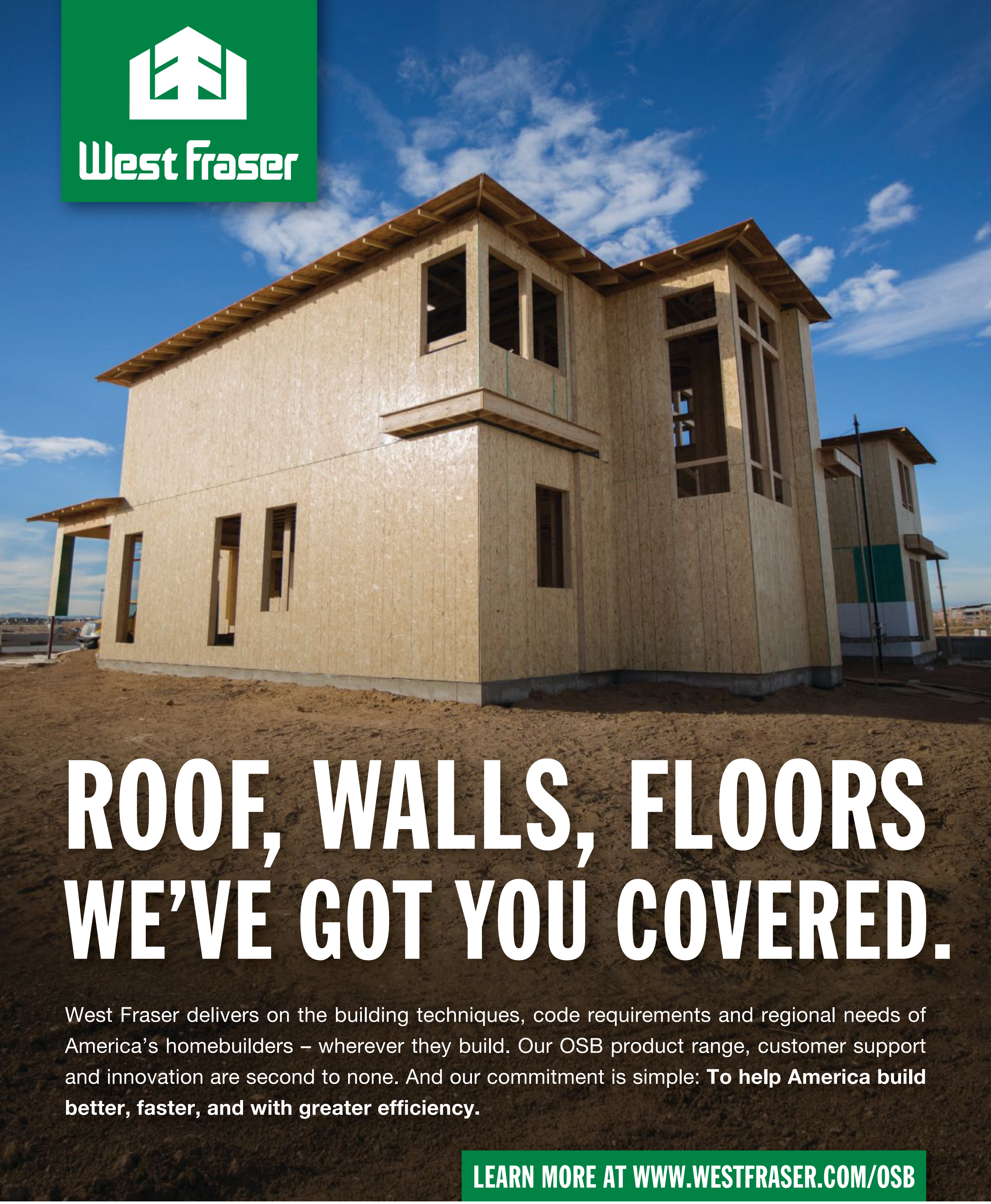
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On the cover: Ed Brady of New Dimension Construction secures an interior casingless door during the renovation of a Midcentury Modern home in Rhinebeck, N.Y. Photo by Tim Healey. See the story on page 17.

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Chief Editor, JLC Group Clayton DeKorne, cdekorne@zondahome.com
Executive Editor, JLC Group Andrew Wormer, awormer@zondahome.com
Managing Editor Laurie Elden, lelden@zondahome.com
Senior Editor Tim Healey, thealey@zondahome.com
Associate Editor, Products Vincent Salandro, vsalandro@zondahome.com

Senior Design Director Tina Tabibi, ttabibi@zondahome.com
Freelance Designer Melissa Krochmal, mkrochmal@zondahome.com

Contributing Editors Mark Clement, Ted Cushman, Dave Holbrook, Tom Meehan, Roe Osborn, Matt Risinger, Emanuel Silva, Gary Striegler, Tim Uhler

Senior Director, Print Production Cathy Underwood
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Editorial & Advertising Offices:
The Journal of Light Construction,
Zonda Media
1152 15th St. NW, Suite 750
Washington, DC 20005
202.452.0800

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Strategic Account Director
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dcapone@zondahome.com

Mark Rosenbaum
Strategic Account Director
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mrosenbaum@zondahome.com

Carol Weinman
Strategic Account Director
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cweinman@zondahome.com

Brandy Weiss
Strategic Account Director
310.591.7770
bweiss@zondahome.com

Patrick Zazzara
Strategic Account Director
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pzazzara@zondahome.com

Rita Hicks
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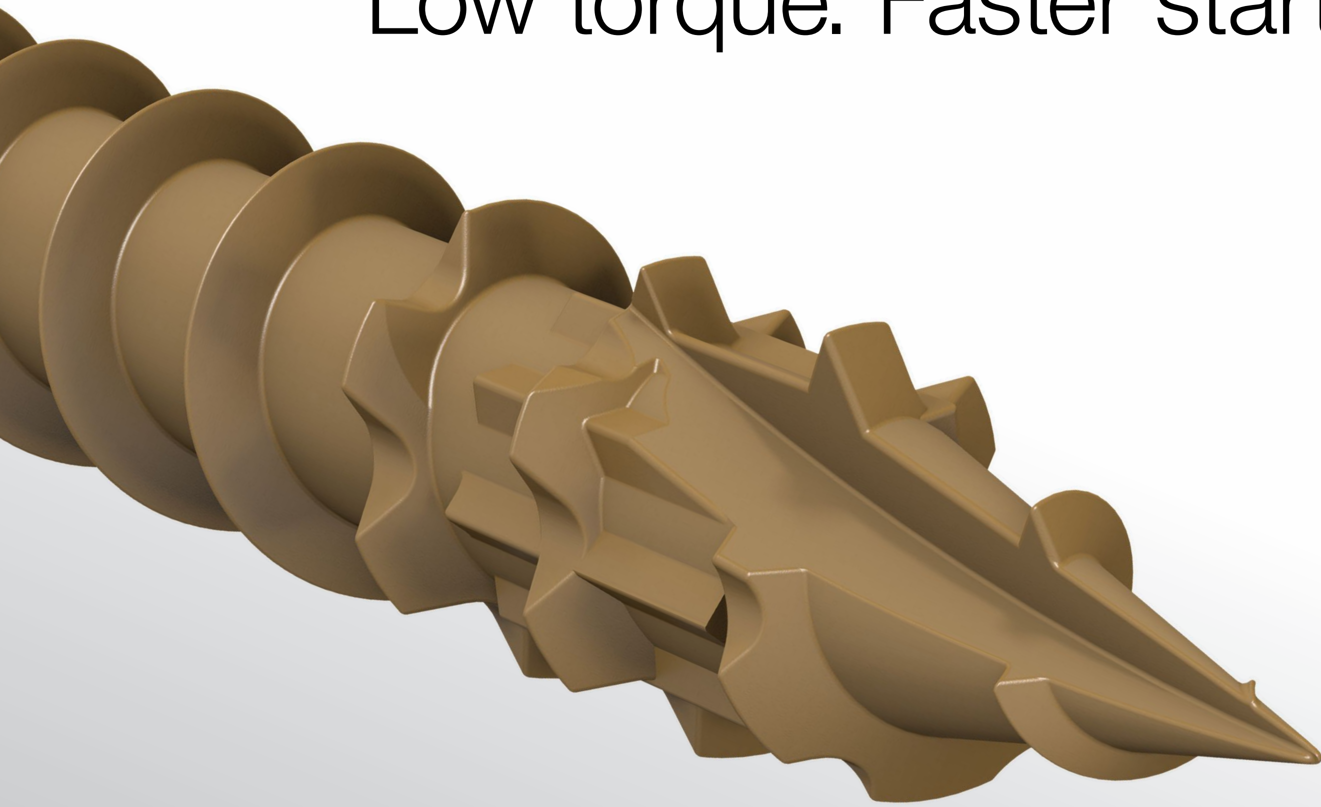

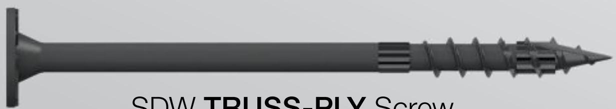

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BY DAVE HOLBROOK

Shop Saw Basics

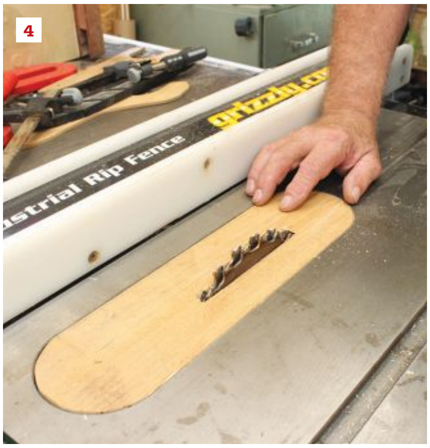
Despite the practicality of a jobsite table saw, there is no related task that I wouldn't rather perform on a cabinet-style table saw. Its solid mass (500-plus pounds is typical), along with a 3- to 5-horsepower, 220-volt motor, helps absorb vibration and deliver the smooth, stable, and precise power and performance for which these machines are prized. While my now-discontinued Grizzly GO690 is several thousand dollars from being a top-of-the-line cabinet saw, it is nonetheless an accurate and reliable machine at the center of my 222-square-foot, home-based shop. Its lack of portability, however, tends to keep it anchored in the shop. So whenever practical, I take the table-saw work home.

Prep. The cast iron saw top measures a typical 27 by 40 inches, and with a 13-inch extension table, it provides a 29 1/2-inch rip capacity to the right of the blade. (Greater rip capacity is always an option where space allows.) My workbench serves as the outfeed table, set on casters and pinned to the saw on its own mobile base. A hefty T-style fence glides almost effortlessly across the surface and locks firmly in place with a cam-style lever. To keep things, including workpieces, sliding smoothly, I periodically apply paste wax to the saw top, fence faces, and various jigs used to make specific cuts. In theory, the wax also helps control rust, though I'm constantly scrubbing little red sweat spots away.

Dust control. Cutting produces prodigious piles of sawdust, which can fill a cabinet saw interior in short order, gumming up the gears and trunnion that raise and tilt your blade. It also means that a lot of that dust is going right down your windpipe, harming you as well. When cutting, I run a dust collector, which is easily automated with a plug-in switch. In addition, I keep an eye on the cabinet interior and periodically blast it clean using pressurized air and a vacuum.

Photos by Tim Healey

An application of ordinary paste wax minimizes surface friction and provides moderate rust protection to the cast iron saw top **(1)**. Here, a hold-down clamped to the fence ensures a consistent depth of cut, with a fence board preventing lateral movement **(2)**. A small steel ruler is more legible than a tape, whose hook partly obscures increments below the 1/2-inch mark **(3)**.



A custom zero-clearance throat plate adds critical full support under small and narrow workpieces, which might otherwise jam dangerously in the gap. Here, a 1/4-inch dado stack is raised through its dedicated plate **(4)**. A switch key locks out unwanted saw activation when the author is setting up or changing blades **(5)**. A digital angle indicator ensures the accuracy of bevel cuts **(6)**.

JIGS AND TECHNIQUES

Let's look at a few jigs and techniques that impose the necessary control for precision cutting—provided that your saw top, blade, and fence are adjusted to factory specification, a basic must. Note that my saw does not have its blade guard or riving knife installed. This is a personal decision and certainly not a recommendation. Caveat aside, all techniques demonstrated in this article show how to securely and safely control a workpiece throughout the cut.

Throat plate. A standard throat plate has a relatively wide gap around the blade to provide clearance for tilting, so I replace it with a custom-made zero-clearance plate to support the workpiece when I'm cutting narrow rips. To make the plate, I use the standard plate as a pattern on 1/2-inch MDO or other smooth-faced plywood. I cut the new plate out on a bandsaw or handheld jigsaw and sand the edges so it fits snugly but not tightly in the throat. Make several while you're at it; you'll use them. Shim the plate (I use small screws driven into the underside) as needed to ensure the new plate lies flush with the tabletop. This is important, as stock can otherwise jam in a minor recess during cutting.

With the blade fully retracted, insert the plate and turn on the saw. Using a block of wood to hold the plate down, raise the blade through the plate to the approximate desired height, and you're good to go. You can use the same approach for beveled cuts as well as dados any time you need full support around the blade. To complete cuts, you may need to push the stock fully beyond the blade with a sacrificial piece rather than a push stick.

Turn the saw off immediately; since both hands are typically engaged up top, I like the ability to shut the saw off with a nudge of my thigh. I've also developed the habit of dropping the blade after the final cut, just to be safe. A lockout key is another feature I use when my hands are in the throat, since it prevents the saw from being turned on accidentally.

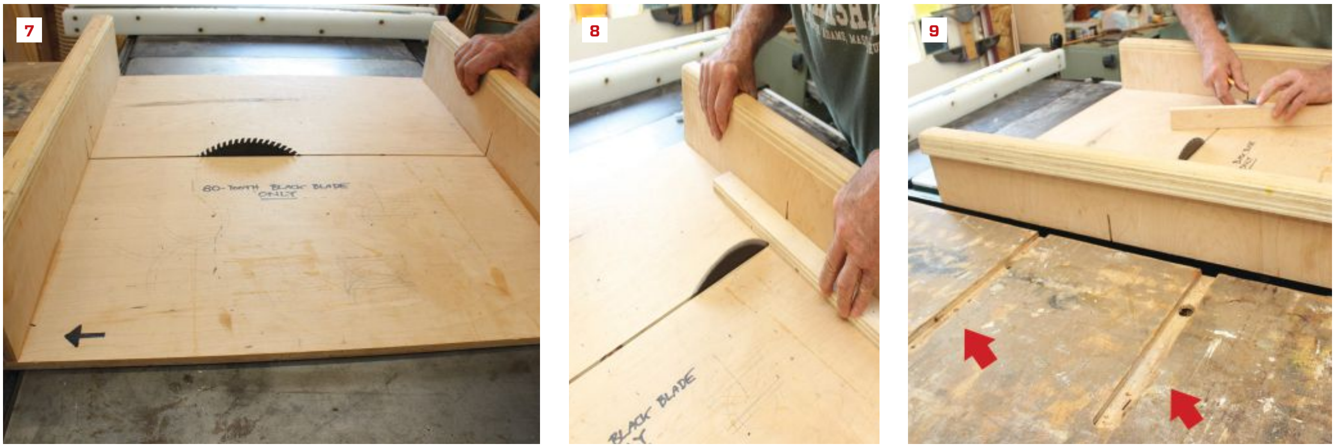
Hold-downs. Many joints, including rabbets and dado ploughs, call for controlling the depth of cut. Simply pressing the stock down and against the fence by hand is no guarantee against minor lifting over the blade's attack, or drifting from the fence, resulting in an inaccurate kerf. To limit this action, I employ hold-downs and feather boards.

Here's how I set up the cut: First, I set the cut distance between the blade and the fence, then drop the blade below the surface. Next, I place the workpiece against the fence and lay the narrow edge of a straight piece of lumber on top of it. I use a hold-down that isn't much taller than the fence so that I can clamp the two firmly together to prevent the piece from lifting off the table during cutting. I turn on the saw, raise the blade gradually, and establish my depth of cut on a test piece. To prevent possible movement, I tighten the knob in the center of the handwheel used to raise the blade. To prevent lateral drift, I use a feather board against my workpiece.

Thin slices. A hold-down is also useful when I'm cutting very thin wood strips. If thin strips are not secured, the blade can shatter rather than cut them. To prevent that, I raise the blade fully into the underside of the fence-mounted hold-down. Thus, the workpiece is fully captured against unwanted movement.

Perfect 90 degrees. On most saws, the angle indicator is not to be trusted for accuracy. Obviously, for true square cuts, the blade must be perfectly perpendicular to the table. There's a positive stop in the tilt mechanism that must be adjusted if the stop doesn't deliver a true 90 degrees. Sometimes a little sawdust buildup interferes and must be removed. I periodically check the alignment with a trusted manual square. Set its vertical edge directly against the blade body, between the teeth that, being wider, would otherwise hold it off.

Bevel cuts. For trustworthy angle settings, I use a $30 Wixey digital angle gauge that attaches magnetically to the blade. After



This crosscut sled uses both miter slots, left and right of the blade. To avoid distorting the kerf, the sled is best always used with the same saw blade **(7)**. Accurate cuts are as simple as lining up the tick mark with the sled's kerf **(8)**. The saw's miter slots are extended onto the outfeed table a fixed distance to prevent excess travel **(9)**.

With an angle aligned to the sled's kerf, the author affixes a temporary fence for identical repeat cutting **(10)**. In this repeat-cut setup, a fall-off block clamped to the fence greatly reduces the chance of post-cut jams between the fence and blade. The desired cut is measured between the sled kerf and block **(11)**. Otherwise dicey cuts are performed safely and finger-free on the sled **(12)**.

first ensuring the blade is truly square to the table, you then press the calibrate button to zero the gauge. Now tilt the blade to the desired readout.

Crosscutting by sled. Table saws come equipped with a miter gauge, some better than others, including sophisticated after-market units that really exploit its usefulness. Equipped with an auxiliary scrap-wood fence, you can use the standard gauge to make repeat cuts against a fixed stop, box-joint cuts, variable angle cuts, and a raft of other cuts. I use mine, but not as often as I turn to my sled for crosscuts. I won't waste space here on sled design; you can find a slew of design choices online. They all do pretty much the same thing, which is provide excellent control over otherwise slippery cuts. A sled can straddle the blade, as shown in the photos above, using both miter slots as runners, or work from one side of the blade only, as in bevel and dado cutting. Either way, by riding the workpiece on the sled, friction between it and the tabletop is eliminated and the cut follows the precise track of the miter slot.

The sled shown here is wide enough to accommodate crosscutting standard 24-inch-wide cabinet panels, ensuring truly square corners. To allow the sled's back rail to travel fully to mid-blade and no further, I've extended the miter grooves a limited distance out onto my worktable. The blade can thus project through the back rail at the

Use the right blade for the job: Dedicated crosscut (black), ripping (silver), and combination (red) blades are each designed for optimal perfomance in specific applications **(13)**. Here, ripping a scrap of spruce with a sharp combination blade produces scorch marks on the lumber. A dedicated ripping blade's tooth configuration eliminates the friction responsible for the burn **(14)**.

For this test-piece tenon, the author first adjusts for depth of cut against the layout line **(15)**. To safely cut a tenon while preventing unwanted movement, clamp the workpiece to a simple tenoning jig **(16)**. After readjusting the blade height, complete secondary shoulder cuts directly against the fence. To guard against violent waste-piece ejection, use a push stick to drive it past the blade **(17)**.

end of a cut, a potentially dangerous condition that smart designs address with a small box enclosure (which I should add to mine).

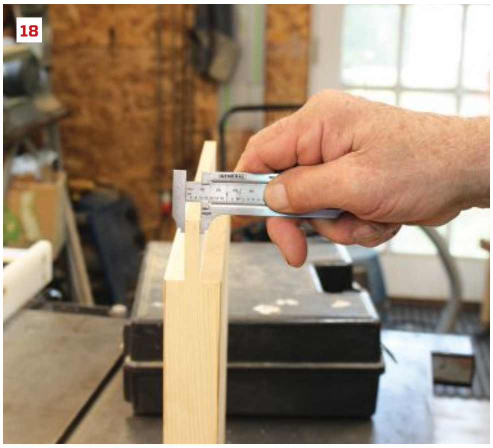
Once you add a sled to your saw, its potential reveals itself with every use. The saw kerf provides flawless alignment between your tick mark and actual cut, if you use the original saw blade every time you use the sled. Different blades make different kerfs, distorting the original track. Despite writing a note-to-self on the sled in the photos, I've been lazy and used it without switching to the design blade. Although nothing's lost in function, the penalty is a little slowdown to alignment.

You can tack or clamp a stop to the bed or back rail of the sled to cut repeat lengths and angles. The fence can also be used with the sled for repeat cutoffs, provided you first clamp a fall-off block to it to eliminate the possibility of a seize-up between the blade and the fence beyond the cut.

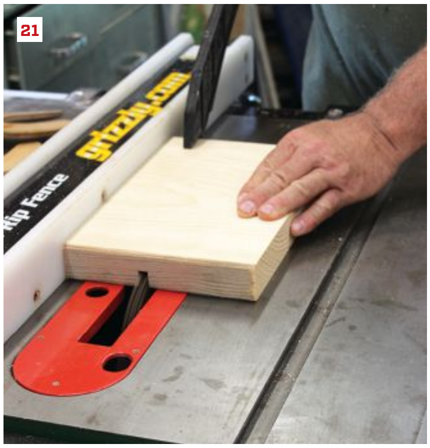
Controlling a small piece is a snap, too, with the sled fully supporting it throughout the cut.

Rip blade. I've seen other carpenters smile at my rip blade, because its relatively few, rough-looking teeth appear cartoonish to the uninitiated. But if you feel undue resistance and see smoke pouring from the cut and attendant burn marks on your piece, either your blade is dull, or you're ripping with a dedicated crosscut or combo blade. This is generally true for solid lumber, less so for plywood. When I'm ripping solid lumber, I install a rip blade. The ease with which it passes through the lumber and the cleanness of the cut are all the persuasion I need.

Tenoning. There's more than one way to accurately cut a tenon in the end grain of a board. Handheld on a tablesaw is likely the most dangerous method. Don't do it. Instead, either buy a dedicated tenoning jig or make your own. Again, slick online designs abound. Given their simplicity, I'm inclined to make essentially disposable jigs. In the photos, a box that fits over my fence supports an upright



A caliper provides a quick and accurate check on tenon thickness **(18)**. Using the caliper, the author adjusts dado thickness to match the tenon, adding washer-like proprietary thin metal shims between blades and chippers as needed **(19)**.



To avoid interference and inaccuracy, adjust the throat plate to be flush with the surrounding saw table **(20)**. Set to depth, the dado blade cuts a wide kerf, sized to snugly fit the tenon **(21)**. As a hedge against miscalculation, the tenon can first be run long, then trimmed to the precise depth of the slot. This joint is ready for glue **(22)**.

panel against which the demo workpiece is clamped, rigidly supported through the cut. The box and fence are treated with paste wax for smooth operation. After defining and cutting both sides of the tenon, I lower the blade as needed and make the secondary shoulder cuts directly against the fence.

Stack dado. A dado blade is an adjusting thickness blade that is useful for making grooves and interlocking joints. There are at least two basic dado blade designs, stack and wobble. I bought a Freud stack set long ago, and it's what I am most familiar with. Matching the stack to the desired cut often involves trial and error, though a caliper is helpful.

Plywood thickness is notoriously nominal; 3/4-inch ply is typically about 1/32 inch thinner than that. My stack provides buildup in 1/8-inch increments, with one 1/16-inch chipper in the kit. This leaves those 32nds and 64ths up for grabs, which is where proprietary thin metal shims come into play, interspersed between the blades and chipper until a perfect fit is reached. A full stack typically provides a maximum 13/16-inch dado width. Standard dado throat plates allow for this width, making them a little scary—that is, less supportive—under narrower ploughs. I like to use a zero-clearance throat plate with a dado set to provide full support. Wide and deep dado cuts can put a heavy load on the dado blade and motor, so make successive passes. It's a good idea to make a test piece, ensuring a perfect fit, before attacking the actual workpiece.

Maintenance. The best advice I can give is to make a habit of periodically checking the saw's various settings for consistent accuracy, and cleaning and adjusting its mechanisms when it isn't dead-nuts precise. In return, you'll get ease of use and the satisfaction of accurate work.

Dave Holbrook is a freelance carpenter and a JLC *contributing editor, based in South Orleans, Mass.*

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Q When faced fiberglass batts are installed, does the fold have to lap over the edge of the stud facing the room?

A *Editor Clayton DeKorne responds:* This is a question we get a lot, partly because of an ad that used to run in the magazine that showed the tab on faced batts being stapled to the wide side of the stud (a method known as inset stapling). Often the question is asked with obvious dissatisfaction at seeing an installation method that is "wrong." But from an insulation manufacturer's perspective (and hence a code perspective), inset stapling is acceptable. It might not be the best way, but it is allowed.

When you inset-staple faced batts, the tab needs to be positioned along the room-side corner of the stud and must lie flat without crinkles or buckles. In the worst case, installers push the batt into the cavity so they can get a straight swing on the tab with a hammer tacker, and they even occasionally catch the facing and leave a tear. That's two strikes against a good insulation installation: compressing the batt and tearing the facing. But taking care to avoid compression and get the tab flat and well aligned on the corner will take more time. Whereas if you have cut the batt correctly to fit the stud bay in the first place, you can fold the tab over the facing edge and smack it down with a hammer tacker without ever risking a gap or tear in the face of the batt. This is reason enough in my book to choose face stapling every time. That is, unless you're using drywall adhesive. It's not common in residential construction, but if you are using drywall adhesive, inset stapling is the only way to go with faced batts.

The readers asking the question have two specific objections to inset stapling that are worth covering.

Continuity. First, readers commonly urge that unless you face staple the batts, you will end up with a discontinuous vapor retarder, defeating the purpose of using a faced batt. But, no, in fact, it doesn't matter.

Why? A vapor retarder does not need to be continuous. (Don't confuse vapor retarders with air barriers; the facing on insulation is not an air barrier.) Area is a controlling factor for diffusion, which is what vapor retarders are trying to control. If 90% of the area is intact, the material is 90% effective at the perm rating for the facing. (That's not the case with an air barrier, for which pressure is a controlling factor.)

Convective looping. Another common objection is that inset stapling leaves small, triangular channels of air at both edges of stud bays that can siphon off energy in a "convective loop." While this may sound improbable, it is one of the possible convective heat flow paths within wall cavities. John Straube explored this in detail in 2007 in the Building Science Corporation paper "Thermal Metrics for High Performance Enclosure Walls: The Limitations of R-Value." Convective looping within a wall can siphon off heat if, for example, a heated interior warms the drywall, which then radiates into the wall cavity and warms the cavity air. If that air can move freely up the cavity, the warmed air will rise. If there is a gap at the top of the batt that allows the air to loop over the batt to the cold exterior, the air will give up its heat to the exterior and begin to fall. Then if there is a gap at the bottom, the now cool air will loop back toward the interior and the loop will start all over again. This effectively pumps indoor heat to the outside.

While this is a very real effect, note that in order for this to occur, air must move fully around the batt. According to Francis "JR" Babineau, a building scientist with Johns Manville's corporate research and development arm, testing in a large 8-foot-by-10-foot "hotbox" at Johns Manville showed that measurable heat loss of inset stapled batts occurred only when there were significant installation defects, namely a 1/2-inch gap at the top and the bottom of the stud bay.

Babineau aptly reframed the question for me: "People often ask, is inset stapling allowed for a Grade I or QII installation?" Here, "Grade I" refers to the installation standards established by RESNET; "QII" is the Quality Insulation Installation standard established by CalCerts that is an accepted method of meeting California's Title 24 insulation requirements. The answer to this new question is that inset stapling is allowed for both a Grade I and a QII installation. But while it's allowed, this has not been accepted without intense debate. In the case of RESNET, the standards development committee only recently issued this interpretation: "If the insulation specified achieves its labeled R-value, while including some amount of reduced thickness for inset staples, Grade I can still be achieved. Compression that exceeds 3/4 inch of that 'specified insulation thickness' would result in Grade III."

In short, as long as the inset stapling is the only compression, the insulation passes muster for Grade I. But that means the installation can have zero defects—an unrealistic bar to reach, in my opinion. It seems obvious that face stapling is the right way to go.

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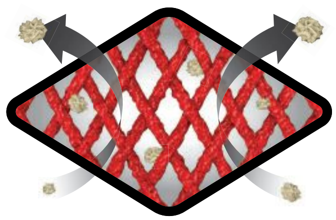

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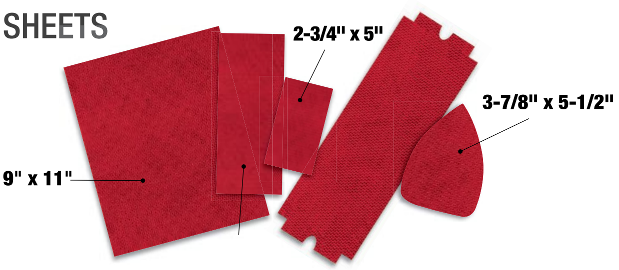

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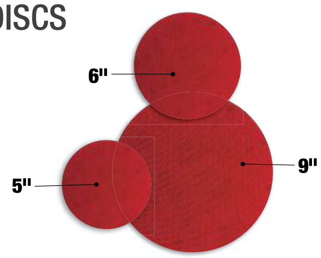

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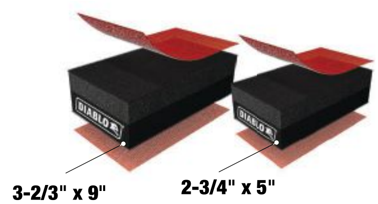

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Casingless Door Trim

BY DALE DIAMOND

For the past 18 months, my company, New Dimension Construction, has been involved in the renovation of a 3,800-square-foot Midcentury Modern-style home in Rhinebeck, N.Y. The project is a blend of design features faithful to the home's original style—namely clean and simple lines (particularly with regard to the interior finishes)—and increasingly common eco-conscious amenities such as an 85-panel solar array on the main roof, geothermal heating and cooling, and an earth roof on a detached pool house.

In this story, I focus on the installation of interior doors with butt hinges, a process more akin to assembling steel knock-down door frames found in commercial buildings than to a typical installation (and trimming out) of wood interior doors in residential work.

TIGHT TOLERANCES

The architect's plans called for Modern-style wood trim at doors and windows where the drywall edge at the rough opening would be covered by a mere 1/2-inch return in lieu of a traditional casing trim. For interior doors, the 1/2-inch returns were shown to be integral to the door frames while those for windows (and exterior doors) were to be integral to the jamb extensions. These "casingless" doors and windows would require precise framing and drywall installation at all the rough openings as well as exacting finish work.

Milled frames. With the doors, we briefly entertained the idea of splitting the frame in half to install it from either side of the wall (covering the fasteners under an applied door stop). Instead, we decided to mill the door frames into a C shape with a separate applied door stop. The C-shaped profile would require us to install the interior door frames in pieces—first the hinge side, then the head, and the strike side last—similar to how commercial steel knock-down door frames are assembled.

We contacted Clancy Woodworking (clancywoodworking.com)

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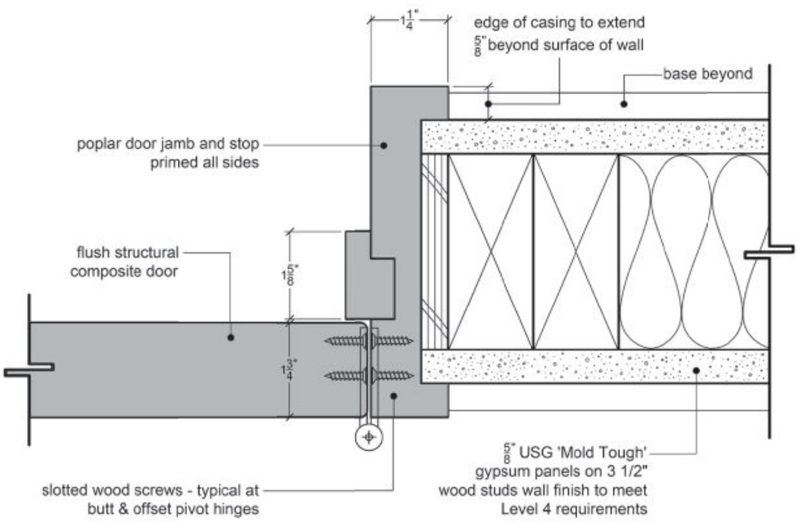

In lieu of traditional casing trim, the architect's details called for a Modern-style wood door frame with an integral 1/2-inch return **(1)**. Poplar door frame and stop materials were milled by a third-party woodworking shop **(2)**. Each rough opening was framed with LSL jack studs and padded out with 1-by stock so the drywall could run "long" into the opening **(3)**. The 1-by padding was later removed, planed as necessary, and reinstalled before drywall.

Photos by Tim Healey; illustration adapted from Pulltab Design, New York, N.Y.

The head piece laps over the jambs **(4)**. Ed Brady uses a multi-tool to notch out material on the head piece to create 1/2-inch returns, which will allow it to slip around the wall **(5)**. After setting the door upright on its side in custom-built door stands, the author routs the hinge locations using a Porter-Cable hinge butt template kit **(6)**.

The author installs the door hinges on the routed hinge-side door frame **(7)** and fastens the frame to the door **(8)**. Working inside, he and Brady position the door and frame assembly into place hands-free using a pair of Door Studs **(9)**.

out of Kent, Conn. Its shop used the combination of a molder and table saw to mill the door frames and stops. We reasoned that the precision of its machinery would be faster and more cost effective than having our crew mill the stock.

For the frames, Clancy made a 1/2-inch-deep by 4 13/16-inch-wide dado cut into 5/4-inch-thick by 6 1/4-inch-wide poplar stock—the 4 13/16-inch measurement representing the frame's throat dimension and the 1/2 inch representing the trim return. We requested that the throat be cut 1/16 inch wider than the wall assembly's width of 4 3/4 inches to account for variations in the 2-by wall framing and 5/8-inch-thick drywall and to help ease slipping the frame over the rough opening.

For the applied door stops, Clancy made a dado cut to receive our "T-shaped" stop. We had the company mill the stop material 3/32 inch narrower than the dado in the frame stock to allow for micro-adjusting the door-to-stop alignment.

Padding out the rough openings. Because of the slim margin of error involved with the door installation, we needed to frame our rough openings as straight and as accurately as possible. We installed LSL jack studs, shimmed the framing, and added horizontal 2-by blocking in the framing bays between our ganged jack-king studs and the adjacent common studs (to help prevent bowing) as needed.

Also, to anticipate possible shrinkage or bowing occurring in the time between framing and the door installation, we padded out the rough opening with 1-by stock. This 3/4-inch padding served as a cushion, albeit a small one, for accurately cutting the drywall at the minimal 1/2-inch returns. It's been our experience that drywallers typically don't spend a lot of time fussing over cutting around openings—installing the 1-by forced them to run the 5/8-inch drywall "long" into the opening. This allowed us to remove the 1-by stock and plane it down to whatever thickness we needed, reinstall it, then Rotozip the drywall perfectly to the final padded-out rough

Brady sets the hinge-side frame with three 2 1/2-inch-long screws at the top, middle, and bottom **(10)**. Next, he installs the header piece **(11)**. The strike-side piece is installed last **(12)**.

The header-to-jamb joints are fastened from the top with 2 1/2-inch-long finish screws **(13)**. The header and strike-side frames are then set with three 2 1/2-inch-long flat-head screws. Starting at the head, Brady fastens the door stops in place with 2-inch-long 18-gauge finish nails **(14)**. A scribing tool helps in marking the location of the door stop piece **(15)**.

opening. We ended up planing the 1-by stock down to anywhere from 1/4 inch to 5/8 inch thick to achieve our desired rough openings.

INSTALLING THE DOOR

During a stretch of nice weather, we set up our worktables outside. Working one door at a time, we first measured the rough opening and custom cut our jamb and head lengths, which varied only slightly thanks to the precision layout we had done upfront. The 5/4-inch poplar frames and door stops arrived on-site in bundles, and we cut the head pieces out of the longer stock.

Starting out, we needed to notch the head piece in order to assemble the frame. We lined up the milled door head and jamb frame pieces and marked the area to be removed. We notched the header piece with a multi-tool, which allowed us to fit the legs of the 1/2-inch returns around the width of the wall.

After placing one of the 100-pound, 1 3/4-inch-thick door slabs upright on its side in custom-built door stands, we routed the locations of the Baldwin 4-inch-square corner mortise hinges on the door using a Porter-Cable hinge butt template kit.

We then transferred the template to the jamb piece on our worktable. There, we lined up the template on different gauge lines to account for the spacing between the jamb head and the door, then set the template in place and routed the door jamb.

Using a corner chisel that came with the template kit, we squared up the routed hinge locations on the jamb and the door slab. We then predrilled the screw holes at hinge locations and fastened the hinges to the door jamb with the manufactured-supplied screws. Next, we fastened the hinge-side door frame to the door, then cut the screws (which ran about 3/8 inch long) flush to the back of the door frame using a cordless angle grinder with a cut-off wheel.

Securing the frames. We installed the hinge side of the door frame first. Using the Door Stud system (thedoorstud.com), we

Brady nails off the hinge- and strike-side door stops **(16)**, then checks the assembly to verify the closed door planes in perfectly with the frame **(17)**. Satisfied with the fit, Brady replaces one screw at each hinge with a 3-inch-long screw driven into the framing.

The finished door assembly has a sleek, clean look, in keeping with the home's Midcentury Modern style **(18, 19)**.

positioned the 100-pound door and attached the door jamb in place—hands-free. We purchased these handy door installation tools at JLC Live a few years ago and these movable cradles (sold in pairs to handle one door) have proved to be invaluable.

To secure the door jamb to the framing, we predrilled holes in the dadoed groove for the applied stop, then set the hinge side with three $2\frac{1}{2}$-inch-long star-drive flat-head screws at the top, middle, and bottom. We checked for level, then moved on to the door head.

We slipped the head piece into place, then fit the strike-side jamb. We removed the pair of Door Studs, then predrilled and fastened from the top through the $1\frac{1}{4}$-inch-thick head into the jamb piece below, at a slight angle, with $2\frac{1}{2}$-inch-long star-drive finish screws. We fastened off the head and strike-side jambs with three $2\frac{1}{2}$-inch-long star-drive flat-head screws.

Door stops. As mentioned before, we had the door stops milled $\frac{3}{32}$ inch narrower than the dado in the frame stock to allow for micro-adjusting the door-to-stop alignment. We measured and cut the door stop material, starting at the head. We fastened it in place with 2-inch-long, 18-gauge finish nails. We then checked the door's alignment to the frame to verify that the door flushed up with the frame before moving on to the jamb stops.

Using a Kreg Multi-Mark scribing tool (kregtool.com), we marked the micro-adjustment location of the door-stop piece on the two jambs. Once satisfied, we secured the stops with 18-gauge finish nails and checked to see that the closed door planed in perfectly with the frame. Satisfied with the installation, we replaced one screw at each hinge with a 3-inch-long screw driven into the framing.

The finished door assembly had a sleek, clean look, pleasing our clients and the architect. While the doors did indeed have simple lines (in keeping with the home's Midcentury Modern style), they were much harder to install than typical prehungs.

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

Restoring Structural Concrete

BY JAKE LEWANDOWSKI

On a recent job, we needed to restore a section of structural concrete. This particular job was a repair to an overhead section in a lighting niche in the mechanic's well at a garage that services school buses. Though it's not the most usual example, it provided a textbook case on concrete restoration.

Surface prep. The first step was to remove the damaged concrete, using a rotary hammer to chip away the bulk of the loose material and a grinder to take the concrete down to solid material. The goal was to work back to a solid base and to fully expose the existing rebar so we could fully encase it in repair mortar. In addition, we used a grinder to remove the old paint around the repair area. This would help blend in the repair so when the final work is painted, you won't see where the new concrete meets the existing surface.

Some surface corrosion of the rebar had occurred but not enough to decrease the dimension of the steel to any significant extent. We used a wire brush to clean up the rebar and then painted it with Rust-oleum Green Rebar epoxy paint. It's important not to get any paint on the surrounding concrete; otherwise, it can interrupt the bond of the new concrete with the old material.

Repair mortar. For the mortar, we used Sika's VOH (which stands for "vertical and overhead")—a fast-setting repair mortar. We used this to first mix up a loose "slurry mix," which we painted on with a mason's brush after spraying the surfaces with water to achieve what is described in the engineer's spec as "SSD," or saturated surface dry.

As the slurry mix cured, we set the form. For a small form like this, we simply used WD-40 as a release agent, being careful to spray down the form away from the repair area. We then mixed up a new batch of VOH to a stiffer spec and packed this material in small lifts, working it in to make sure we wouldn't have any voids when we stripped the form. There was also one small overhead section at the back of the niche, outside of the form area, that we would need to fill by hand after the form was stripped.

Jake Lewandowski is a construction manager with Great Lakes Builders, which specializes in structural repairs in Elk Grove Village, Ill.

1


The outside corner of this lighting niche in a mechanic's well had become unstable **(1)**. Repair work began by chipping out the corner **(2)** and removing enough material that new mortar could fully encase the existing rebar **(3)**. In addition, the crew used a grinder to remove the old paint in the area where the new concrete meets the existing surface **(4)**. This way, when the new concrete work is painted, you won't see where the new concrete meets the old.

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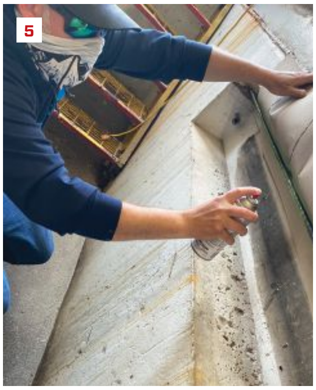
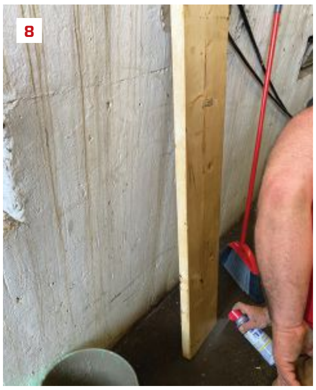
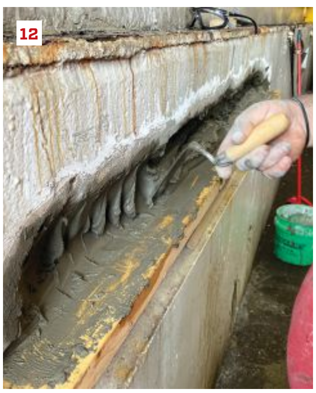
Photos by Jake Lewandowski

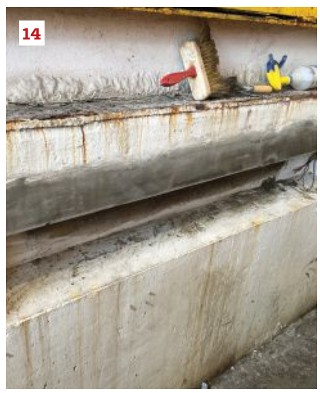


After masking off the concrete and wire brushing the steel, the author painted the rebar with an epoxy paint **(5)**. The next day, the crew wet down all the surfaces **(6)** and brushed on a slurry mix, working it into the rough surface of the concrete and rebar with a mason's brush **(7)**.



Before setting the form, a crew member sprays the form board with WD-40, which, on a small job like this one, works well as release oil **(8)**. The form in this case is simple—a single 2x8 braced against the top edge of the concrete lighting niche **(9)**. This closeup shows the fully prepped repair surface and form, ready for packing in the repair mortar **(10)**.





A crew member packs the repair mortar in short lifts **(11)**, working it behind the rebar to eliminate any voids **(12)**. The repair mortar sets up to a strength of 1,500 psi within three hours **(13)**, allowing the crew to strip the form by the afternoon **(14)**. Within one day, the mortar sets to a compressive strength of 3,000 psi and in 28 days, to 5,500 psi.

Preserving a Stone Retaining Wall

BY GERRET WIKOFF

The middle third of a leaning, unreinforced stone retaining wall collapsed during excavation by the homeowner **(1)**.

At the street-adjacent curved section of wall, a steel anchor post was driven into undisturbed soil **(2)**. A come-along attached to the steel anchor and a 4-by wall brace pulled the wall back to plumb. Workers reset the 2x4 angled bracing after plumbing up the wall **(3)**.

Last spring, a returning client asked me about repairing a leaning retaining wall for a large planter in his driveway. (The year before, I had repaired the porch on his late 1920s Storybook-style bungalow home in Los Angeles; see "Repairing a Bungalow Balcony," Feb/21). I suggested if he were to dig the soil out from behind the stone wall, we could add rebar, push it plumb, pump in some concrete to bond it together, and Bob's your uncle. Possessing a shovel and the gumption to use it, the homeowner started excavating behind the wall. A few days into the project, the middle section collapsed; he thought that the clay soil must have been holding it in place, but I suspected otherwise **(1)**.

I investigated the collapsed section and found that it was an unreinforced wall with no rebar connecting the stone to its concrete footing and that the site's expansive clay soil had managed to push the stone wall beyond the edge of its footing. Over the years, the clay soil would get saturated, push the wall a little, and then contract, with the remaining gap eventually filling in; the cycle had repeated itself to the point that the wall had nearly sheared off its footing, particularly in the area where it collapsed.

Complicating any repair efforts, the circa-1920s stone wall had been rebuilt in the 1970s using Portland cement mortar, which was stronger than the stone it held together (the stone broke when we tried to chip the mortar off). The original wall would have been built using lime mortar, which is relatively soft and would have been easy to break apart from the stone. As a result, we needed to reassemble the wall with large, salvaged pieces while I tried to get my hands on similar stone for infill.

I didn't want to attempt to move the wall back onto the footing with a Bobcat and risk further collapse while repairing the wall, so my plan was to rebuild the collapsed portion, then bond the driveway wall in situ to a new, poured-concrete retaining wall, doing an end run around its precarious balancing act.

Caught between codes. The client's house is located in one of Los Angeles' several HPOZs (Historical Preservation Overlay Zones), which in this case translated to "keep the wall as close to original as possible." Working in these zones typically involves submitting plans to the local HPOZ committee for review, then several back-and-forth submissions until the committee's satisfied you are maintaining the integrity of the original structure.

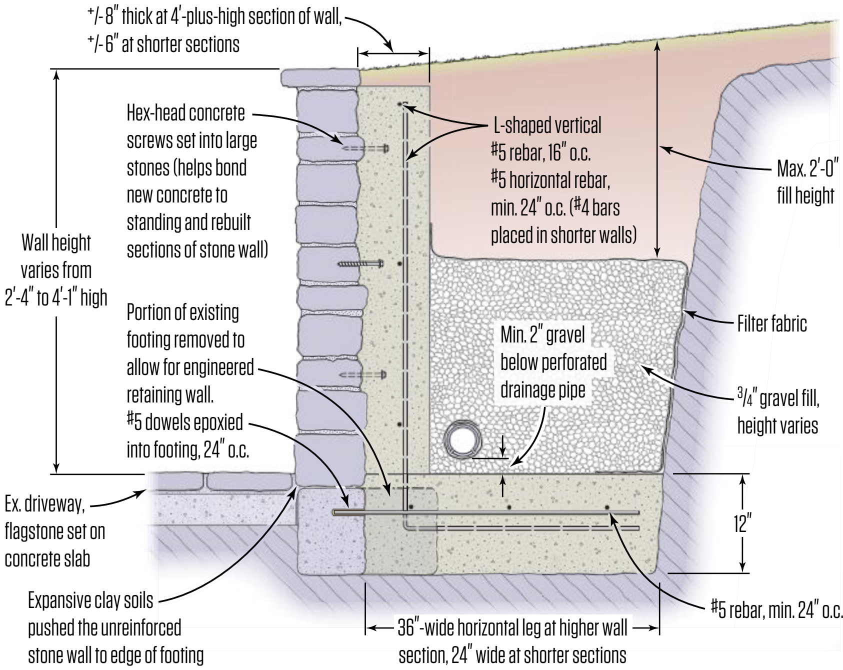
To avoid this potentially long, drawn-out process,

Photos by Gerret Wikoff; illustration by Tim Healey exacerbated by the pandemic, I proposed to the planning official that we replace the fallen-down portion with salvaged original stones as much as possible, which she approved. But, because a portion of the wall exceeded the Los Angeles Department of Building and Safety's maximum height of 4 feet, the wall required engineering and would need to be approved by the city's building department as well.

The design. The driveway wall was a curved "J" shape and was roughly 30 lineal feet long. Its height varied from 2 feet 4 inches high along the curved section adjacent to the city sidewalk to roughly 4 feet 1 inch high where it butted into the home by the garage doors. The middle third of the wall had partially collapsed while the rest of the wall (the curved, shorter wall at one end and the 4-foot-plus-high section at the other end) remained standing.

Going forward, the only practical way to install a new, poured-concrete retaining wall without tearing up the homeowner's

Reverse-L Retaining Wall



After the interior side of the standing wall sections were pressure-washed **(4)**, the rebar was placed and the footing was poured using 3,000-psi pea-gravel concrete **(5)**. Horizontal wall rebar was installed, and perforated drainage piping was dry-fit **(6)**. Hex-head concrete screws set into the stones help bond the new concrete to the stone **(7)**.

The collapsed portion of the wall was rebuilt using salvaged and new stone **(8)**. Sheets of 1/4-inch-thick Masonite, 2x4 horizontal blocks, and sandbags were used as wall forms on the shorter curved wall sections **(9)**.

driveway was with a "reverse L" retaining wall. Where I work, the typical retaining wall has the L pointing away from the hill it is retaining. But, with a reverse L, the L shape points toward the hill and its success depends on the weight of the soil pressing down on the horizontal leg of the L to keep the wall from overturning. Therefore, the higher the vertical leg is, the wider the horizontal leg has to be.

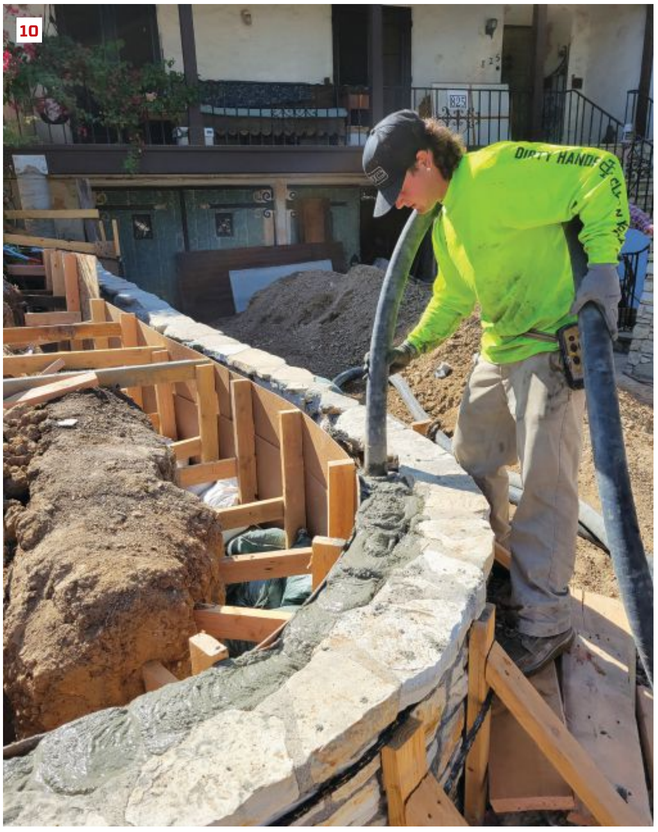
Using SketchUp (and its companion program LayOut), I drew up a set of rough plans and had an engineer size the concrete retaining wall and rebar, then tweaked my drawings to conform to the engineering calculations and submitted them to the city. Corrections ensued, due mainly to the evolution in code since the wall was originally constructed; for example, the building department wanted a guardrail on any portions of the retaining wall higher than 30 inches. Here, we had to point out that the job was in the HPOZ, and those corrections were not in compliance with HPOZ regulations (HPOZ officials have a lot of power in maintaining portions of a home visible from the street so they look original, and HPOZ regulations can trump local and state building codes).

RESTORING THE WALL

Permit in hand, my crew and I started in earnest. The first step was to brace the unreinforced stone wall. This was done by making screwed-together 2x4 angled bracing and bolting it down with large Titan concrete screws to the sidewalk and driveway on the outside of the shorter curved wall. We then braced the wall to the interior side with horizontal 2x4s to keep the wall from falling inward. With excavation complete on the short wall, we drove a steel anchor fabricated by a welder into undisturbed soil **(2)**. We used a come-along attached to the steel anchor and a 4-by wall brace to pull the wall back to plumb, then reset the 2x4 angled bracing **(3)**. Because the short wall was broken into two large sections, we forced the second one into position after moving the first.

Given the greater mass of the upper 4-foot-high wall, we braced the wall with 4-by lumber taller than the wall, then sledge-hammered two steel anchors into the soil. Next, we hooked up three come-alongs with chain wrapped around the top of the 4-by wall braces and pulled the wall gradually back to plumb. We then braced the inside of the wall against the soil embankment to keep it locked in place. The next step was to rent a pressure washer and clean the interior side of the standing wall sections of soil and debris **(4)**.

The placement of the rebar was our next priority. In general terms, we used #4 bars (which were easier to bend) horizontally on the shorter curved section and #5 bars on the taller section by the house. We increased the thickness of the concrete wall from 6 inches to 8 inches and widened the horizontal leg of our reverse L from 24 inches wide to 36 inches wide as the wall approached the higher 4-foot section (see illustration, page 25).



The walls were poured without any blow-outs **(10)**. The author's crew finished off the top of the wall, working around the irregularly shaped capstone **(11)**. The completed retaining wall **(12)**.

Because of the wall's wavy shape and the space constraints for formwork, we installed the reverse-L retaining wall in two pours. At the horizontal leg or footing, we epoxied #4 dowels into the existing footing, then ran #4 bars the length of the footing (switching to #5 bar in the straighter, higher section). Using a rebar bender, we bent #5 bars into L-shapes and tie-wired them together.

After obtaining the approval from the inspector, we poured the footing using 3,000-psi pea-gravel concrete **(5)**. I prefer this stronger mix to the standard 2,500-psi concrete minimum prescribed by the city because the additional cost is minimal compared with the benefit. But, since we were essentially rebuilding a retaining wall for a large planter with proper drainage, the additional cost of using an even stronger "big rock" concrete mix with an accompanying larger pump wasn't justified.

With the footing in place, we placed the horizontal rebar and dry-fit the drainage piping **(6)**. The hillside face of the stone was irregular and the new concrete would lock into this toothy surface fairly well. But to improve the bond, we drilled holes into the larger stones and set hex-head concrete screws **(7)** with a battery-powered impact driver.

The next step was to rebuild the fallen-down portion of the wall. I was able to buy a few hundred pounds of similar stones, and we mortared the wall back together with Spec Mix mortar, trying to match the original style as much as possible **(8)**.

Next, we worked on the wall forms. Due to the pandemic, plywood had tripled in cost, so I wanted a cost-effective alternative. This idea, Mickey Mouse as it was, worked surprisingly well: We placed 2x4 vertical ribs approximately 2 feet on-center and braced them with sandbags at the bottom and with 2x4 horizontal blocks to the side of the excavation **(9)**. This was to hold 1/4-inch Masonite in place around the curves. In the 4-foot-tall section, we placed 7/16-inch OSB and braced the forms similarly. We poured the walls without any blow-outs **(10)**, and our crew finished off the top of the wall, working around the irregularly shaped capstone **(11)**.

Finishing up, we installed the drainage piping in a sock, buried it in gravel, wrapped filter fabric, and backfilled. Then we loaded the rest of the soil into a dumpster and hauled it off. With the job complete **(12)**, the Los Angeles city building inspector signed off on it.

Gerret Wikoff is a builder-remodeler based in Los Angeles.

BY BRYAN UHLER

Working Cooperatively With Building Inspectors

I began working with building officials when I was 16 or 17 years old, so I've been involved with building departments for more than half of my life. If you include my dad's experience, which I learned from, you could say I've been doing this since the first part of the 1970s.

Over time, my company has worked with a number of authorities having jurisdiction (AHJs) and many building inspectors. We have had struggles with a few inspectors, but with most of them, we've had excellent relationships. Hopefully, some of the lessons I've learned will help you in your building endeavors.

I'll break this down into three main parts: what the inspector's job is, what my company does to prepare for an inspection, and what we do when we disagree with an inspector.

UNDERSTAND THE INSPECTOR'S JOB

A refrain that's currently popular in our industry goes something like this: "A house built to code is the worst built home that is legally allowable." I couldn't disagree more. While the building code isn't perfect, I have yet to find a section of the code that is "stupid." If we view the code as helping to ensure that a home reduces the likelihood of occupant death or injury, it meets the purpose nicely.

Think of code officials like public health officials. A code official's job is to ensure safety. For the structural code, that means ensuring that a building doesn't fall down on the occupants or occupants don't fall down unsafe stairs or off decks and balconies. Then there's the fire code: A building shouldn't catch fire easily and if it does catch fire, the occupants must be able to escape safely. The plumbing code is all about sanitation and health, so occupants have clean water and can get rid of human waste, and the waste doesn't mix with the clean drinking water. And we have mechanical codes so that gas leaks and combustion gases don't kill occupants, and so on. Of course, if a code has been adopted where we are building, we are bound by law to that code. Some of us feel a strong moral and ethical binding to build to the code.

The building inspector's job is to ensure the house is built to code and, depending on where you are, ensure it is built to plan. I've found that most building inspectors have certain items that they are most focused on. Our area is in a high seismic design category, so inspectors are not likely to double-check cabinet layout dimensions, but they will check the rebar, hold-downs, and anchors. At final inspection, they will use a gas detector and check for leaks at gas appliances. They will also check for functionality of smoke detectors. (They inspect plenty of other things, too; this is just a sampling.)

The point is, focusing on *why* the inspector is inspecting may temper somewhat the animosity some builders feel for the inspection process. Structural inspections are, to a reasonable degree, intended to prevent catastrophic failure or death to the occupants.

WHAT TO DO FOR A BUILDING INSPECTION

There are things we do to improve our chances of having a successful inspection. First, we try to schedule inspections early enough to prevent panic. When I first started in this business, if we had a concrete pour, we could call in at 3 p.m. the day before the pour, ask for a morning inspection for concrete, get the inspection, place the concrete, and Bob's your uncle. Now, it could be seven days or more after calling in an inspection before the inspector can get to the site. Then again, we might be able to call day-of and be given a window of time for an inspection. But even if they give us a window, it may change; we can never plan the exact time for the arrival of an inspector. This means that, for high-stakes inspections—like the placement of concrete referred to above—we cannot fail. We need to be dialed in because if we fail, it is 100% critical path. No dominoes fall without the foundation.

For other inspections, we have more flexibility. Say the plumber forgot to put a stud shoe on. In our area, the inspectors will just check it with a later inspection. They will also give us the OK to insulate as long as any corrections we need to make will be inspectable. We're able to do more with photos and videos for certain things, but communication is key. If remote-style inspections are going to be a part of the process, we try to find out exactly what the inspector wants to see. For example, if we're installing underslab insulation, we make sure photos are taken of the insulation R-value.

Having the plans and permit card organized is helpful too. We don't get fancy: I have a bunch of folders from Staples that I keep everything in. I get the permit set scanned as well as copied and laminated. In general, the permit set is only for the inspector, not to build from. Some AHJs may require permits and plans to be posted and present on-site at all times, so make sure you know what's needed where you're building. Some builders have job offices or command centers that stay on a project from start to finish, but we don't. In our case, we deal with the Pacific Northwest rain, and we build from clearing to final. We just make sure that the permit and plans are on-site for any scheduled inspections.

Another tip is to have the jobsite tidy and clean. If you went to a doctor's office and the place looked like a bomb went off, you might be inclined to think that this professional doesn't have his house in order. The same is true for a jobsite. It doesn't have to be spotless—no need to go overboard. But if it is broom-swept and piles are tidy, the inspector has less mental "noise" to contend with.

Sites should also be safe for the inspector to visit. Passive fall protection (like guards and rails) and paths of travel should be given due attention.

Usually either my brother or I will be on-site for an inspection. Sometimes we wait around for hours, but failing an inspection is far more likely if we don't have a company representative on-site. All of our primary employees are competent to meet with the building inspector. However, some employees have more of a core competency than others. Also, some of our employees may be able to care for an item during the inspection more readily than others. For example, my brother is our lead for structural concrete and framing. Having him walk through on a foundation or framing inspection is helpful. When it comes to a final inspection, my brother-in-law, who also works for us, is a good person to walk through with the inspector because he is adept at punch list items.

Sometimes I walk with the inspector, sometimes I don't. There is a balance between speaking too much and too little. Being affable and showing that I'm trying to connect on a human level are things I've found helpful. It isn't about manipulating the inspector; rather, it is about demonstrating that we're shooting for the same goal. This goes back to respecting the code and the inspector.

In construction, much attention is paid to the technical side of things, but we should also focus on honing our "soft skills." Listening to an inspector's questions, responding respectfully, and having good questions all help build a strong working relationship. There may be things we did that an inspector doesn't understand but will agree with once we provide a clear explanation. We should also be willing to acknowledge when something is wrong and then humbly correct it.

WHEN WE DISAGREE WITH AN INSPECTOR

Sometimes, we don't see eye to eye with an inspector. Not all situations are the same, and each builder, project manager, or owner needs to navigate them individually. Some builders will tend to do what an inspector says, and there are at least two reasons for that: Some do it to keep on schedule; others may be intimidated by the building code.

To stay on schedule, some builders may feel it's best to lose the battle and win the war, so to speak. In other words, they are facing pressure related to the project and the cost/benefit of getting into an argument tilts toward the benefit of moving on.

Other builders may not have comfort dealing with the building code, and this is perfectly reasonable. Many builders and subcontractors have a predilection to building with their hands, creating something tangible, and the highly specific language and technical organization of the code do not come naturally. Because building inspectors work with the code all the time, it is natural for builders to default to the position that an inspector is right. However, following that logic, you could say that builders always build right because they do that for hours every week.

We do need to respect building inspectors for their broad knowledge of the building code. At the same time, we should recognize that they aren't infallible. A good builder should seek to understand the building code as well as its intent. When we do this, we can engage in a productive dialogue with a building inspector in an educated, respectful manner. This is the same thing we want from the building inspector. He or she will know about construction and how it works, but we want them to respect us for the many hours of every week we do our jobs, too.

AN EXAMPLE OF PRODUCTIVE DISAGREEMENT

I had a recent experience with a building inspector having to do with fireblocking. I got into Chapter 3 of the IRC (International Residential Code) regarding building planning and felt the inspector was wrong, but I was also willing to accept the possibility I was missing something. So I emailed him, and he stuck to his guns. But I wasn't sure he understood where I was coming from. So I called and left him a detailed voicemail (his salutation encouraged that). I didn't hear anything, so I emailed him again. He acknowledged that he hadn't had time to review it, but he still stuck to his position. However, we've worked together a lot, so he graciously gave me the name of another person at his office and the state code council as further contacts if I wanted to pursue the question. So, I typed up a letter, sent it to his co-worker, cc'd him, and before long received a response that my understanding of the code was correct.

Is going to that level wise? It depends. This inspector and I get along well. But if I had let this matter pass, our team would have lost time having to take care of it. And not just once. We build a lot in his jurisdiction, so we would potentially have to multiply that time by every fireblock in every house where this would have applied. I'd like to add that I wasn't all wound up about it; keeping emotion out of it allows an inspector to hear what we're saying with a clearer head.

CONSIDER IT A SKILL

If you work in an area with building inspectors, strive to become skilled at working with them, just as you work at being skilled in construction. It is a necessary part of the process. When we respect the code, empathize with inspectors, prepare well for an inspection, comport ourselves professionally during an inspection, and respectfully engage in productive dialogue when there is a disagreement over the code, we justify our being called "professional builders."

Bryan Uhler is vice president of Pioneer Builders (pioneerbuildersonline.com), of Port Orchard, Wash., which specializes in building high-performance homes. Follow him on Instagram: @pioneerbuildersinc.

CONTRACTOR REWARDS

RIDING THE HIGH: TIPS FOR MAKING THE MOST OF THE HOUSING BOOM

A building pro shares lessons learned from the challenges and opportunities of the past year.

Lynette Rogers has run Homescapes of New England, specializing in siding, windows and decks, for over 10 years, but she's never seen anything quite like the past 18 months. She's seen data that home-renovation spending has increased by 7.3% in 2021—after having grown by 5.3% in 2020.

"My business doubled," she says. "But everything else increased too: material costs, labor costs, and lead times for materials." Wait times on windows went from two weeks to five or six. "I ordered a simple vinyl slider recently and it's 12 weeks; normally five weeks would be plenty of time."

As past president of the New Hampshire Home Builders Association, Rogers knows it isn't just siding. Appliance dealers were also experiencing shortages. "Builders couldn't get COs; without all the appliances, they can't complete the house."

It's been challenging but exhilarating, and Rogers has learned some valuable lessons along the way.

BUILD A NETWORK

"Last year was especially difficult for decking," Rogers recalls. "Pressure-treated lumber was in short supply—dealers were out of stock for months—so I had to go to multiple dealers to get the supplies for one deck."

Luckily, she had the business connections to do so. Building a network is crucial, she says. "You need to do it now, if you haven't already, because then you have something you can rely on—people you can go to for supplies or advice."

BE FLEXIBLE

Rogers quickly adapted to offset delays. "We'd order as soon as we sold the job. Whatever came first was the deck that got built first. Homeowners and consumers are pretty understanding—they're aware of the supply chain issues." Customers have also had to adjust to higher costs. "Lumber prices are up 300%—houses cost about $36,000 more to build than a year ago!"

Rogers' advice? "Order immediately or put an inflation clause in your proposals, because you may sign a contract today but not order for months. Plywood could increase $15 per piece in two weeks. Multiplied by how many pieces go into a house, it's exponentially more expensive." That hasn't stopped consumers: "People can get money cheap, so they'll do the project now even though it costs more."

GROW SMART

"I've hired additional staff and have others working more hours," Rogers says. "And we're utilizing our existing resources as well; my sales reps have stepped up and taken on additional tasks."

Rogers has also focused on more automation. "We've streamlined quoting and customer relations with new CRM systems so we're not doing everything manually—we can respond with the push of a button!"

RECOGNIZE HARD WORK

Rogers knows how to retain labor. "I have four employees and 25 subs. Many of the same guys have worked for me for over nine years," she says.

"We signed up with Contractor Rewards because we're a certified Andersen Windows installer and get points with other suppliers too. Purchasing more materials means more points to redeem. I save points to get the crews gifts, tools and more. For instance, we got a new microwave for each van so teams can heat up their lunches. I also give gift cards to thank my office staff."

ANTICIPATE CHANGE

The industry is cyclical, Rogers notes. "This is a high, so ride it while you can and plan for downtime—because there will be another downturn."

Learn more about a no-cost way to earn high-value rewards for team building and other goals at **contractorrewards.com**.

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FLOORING

A Radical Approach to Protecting Finished Floors

Applying finish to the floor at the start of a job is unconventional, but it saves time when you need it most

BY MICHAEL PURSER

Photos by Michael Purser

For a wood flooring-refinishing contractor, one of the biggest drawbacks is coming in dead last in the sequence of building trades on a work site. We come behind everyone else when there is little time, patience, or money to go around. At the core of the problem are turf wars, since the areas we need to work on are the same areas others need to tread on to do their job. In an effort to create harmony on the jobsite and reduce friction, contractors and homeowners will delay work on the floors until the very end of a project. That concept may be good in theory, but in reality, it often deprives us, the wood flooring contractors, the time needed to do our work and creates even greater chaos for everyone when we are finally allowed on-site.

About 15 years ago, a contractor friend of mine and I asked some "what if" questions about the sequencing of various trades and how this impacted the continuity of the work, especially the last 10%—that infamous finish stage. We decided to move floor refinishing work in the schedule so that instead of its being the last task on-site, it would happen just after the drywall went up and was mudded. We experimented with this variation on kitchen remodels because those gave us the most accurate overview of how this might impact a project. Instead of working around cabinets, appliances, islands, toe-kick space, and many corners, nooks, and crannies, my helper and I walked into a rectangular room with four corners and sanded and refinished the entire room.

1


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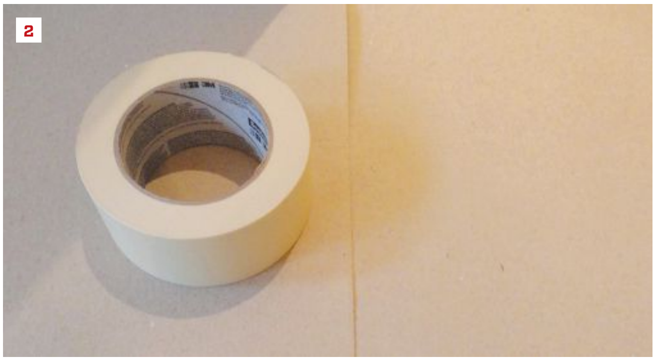

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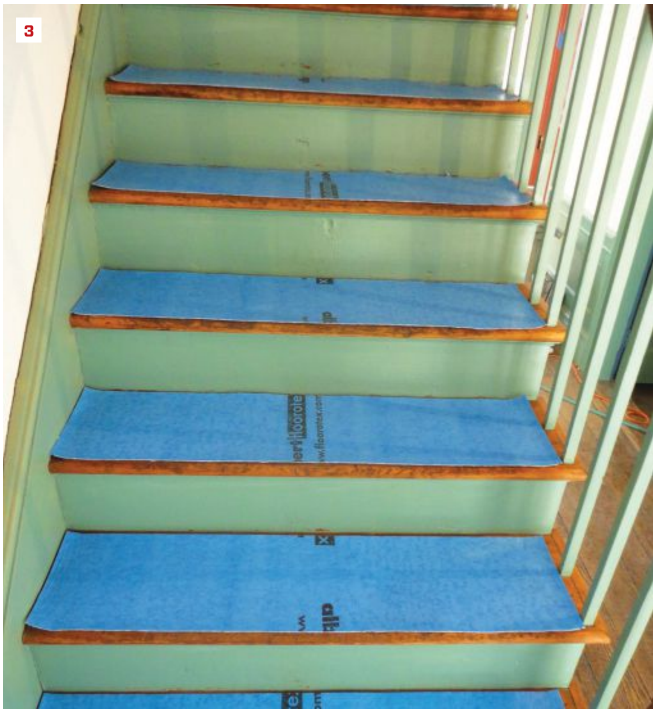


The author often wraps finished floors with a dense paper product such as Ram Board **(1)**. One trick is to flip the paper over so the curl faces down. Courses then butt easily and can be taped **(2)**. For stairs, the author prefers cushioned foam products, such as Albert Floorotex **(3)**, which sticks without leaving residue or damaging fine finishes.

Aside from the work going more quickly, this also resulted in a stained and protected surface under everything. My typical finish process always called for two seal coats over the stain followed by two topcoat applications, or four applications total. We then put down floor protection, leaving spaces for the placement of cabinets and appliances, and let the other trades do their thing.

I held off on the final application until everything else was installed and all the finish work completed. At that point, I walked into the room, removed the floor protection (which we saved for the next job), prepped the floor, and made the final application. To say this was a success would be an understatement. The difference it made coordinating the other trades and installations left us gobsmacked, and we've never looked back.

I have carried this approach into the bulk of my business, which centers on historic restoration and preservation of old wood floors. Some of these projects have been massive in nature and work was often done in phases over years. Like on other remodeling jobs, the scheduling of trades was often an issue. Once again, conventional wisdom put all wood floor work at the end of the schedule, so implementing my new approach was not an easy sell until I was able to show the principals photos and the positive impact and flexibility that rearranging the wood floor work can have on scheduling the other artisans and craftspeople involved in the project. Finish work with new construction, remodeling, or restoration all produced the same challenges: lack of time and options when you needed them most. By repositioning wood-floor restoration much earlier in the process, the painstaking restoration of other surfaces and objects could proceed over a fully protected and restored wood floor. We proved that some things written in stone can be erased.

NEXT-GENERATION FLOOR PROTECTION

For those of you who've scratched a bald spot on your head trying to figure out how we accomplished this, the answer is easy—there's been a quantum leap made in options for protecting floors. A new generation of products for protecting floors started coming on the market around 15 years ago. Since then, the offerings have expanded. Not only do these products address our needs, but most of them are also produced from recycled materials, which only sweetens the pot. They vary in composition, but all have the same goal: to protect what they cover from most materials, liquids, and activities taking place on the surface.

Heavy-duty, dense paper products. These were some of the earliest protective materials to come on the market. The two most well-known products that I'm aware of are Ram Board and Flex-Board by Protective Products.

Ram Board is sold through retail outlets, and FlexBoard is available

To allow other trades access to work on baseboards, the author may cut the cushioned film products into strips **(4)** and use them to cover a gap in the dense paper products covering the field of a room. A fabric runner, such Dura Runner **(5)**, works well for walk-on and walk-off mats at entrances to minimize the tracking in of debris and moisture.

online through the Protective Products website. Both are in the same thickness category, 45 mils, and come in rolls. For contractors, they offer different widths—38 inches for Ram Board and 32 inches for FlexBoard—that both come 100 feet in length. Ram Board offers a "home version" that's 36 inches wide by 50 feet long and around 38 mils thick, but I've always used the beefier option. These are my go-to products, as they lay down easily and are quick to install.

I typically roll the paper out and then flip it over so the curled ends face down, enabling it to flatten more quickly. The side edges of the paper are precision cut, making it easy to abut the next piece. To avoid movement, I tape the long parallel edge seams for stability, running the tape continuously to keep fine particles from getting under the paper. A wide seam tape offers excellent protection from premature damage from foot traffic you find on work sites. Both Ram Board and FlexBoard provide protection from spills and contact with various types of liquids.

Lightweight, flexible, and cushioned polyester film. Products in this category offer some options that the dense paper products don't. I'm familiar with two: Albert's Floorotex and Protective Products' Econo Runner, both available online. They come in rolls that vary in widths (40 inches for the Floorotex and 32 inches for the Econo Runner) and generous lengths. Both are flexible and have a thin polyester film on top attached to a thin cushioned material. Most important for me is the light tacky material on the bottom that allows the products to grip a surface without removing the finish or leaving a sticky residue. They both have excellent resistance to moisture, while allowing what's beneath them to continue curing. I've made good use of them on freshly refinished stair treads and landings where slipping would be a hazard with a paper product. I often cut this material into 3- to 5-inch strips. When I put down the dense paper products in the field of a room, I leave a gap at the perimeter to cover with the flexible film. The film can then be pulled back to allow other trades to work on baseboards, molding, and curved surfaces.

Soft fabric runners with non-slip backing. This material has multiple uses for me and all are good. The brand I am most familiar with is Dura Runner by Protective Products and I order it online. It has a felt-like surface on top of a waterproof backing that helps prevent slippage but doesn't have adhesion.

I love to use this for walk-off mats at the main exterior entrance. I cut it into 6-foot lengths and place one outside and often another inside to minimize the amount of debris and moisture that is tracked in. In a fully furnished home, I like to use the same length outside areas where I'm working, so I don't track anything from that area onto antique rugs, carpeting, or other hard surface materials. Since the strips are lightweight and easily portable, I place two to three next to each other to create a protected surface of about


6


7

The author restored the floors in Henry and Clara Ford's billiard room at the start of an extensive renovation to the Ford's home, Fair Lane. After the floor was wrapped with paper and fully taped hardboard, the room became the staging site for the other trades.

12 square feet for placing equipment and materials. I have had several of these walk-off mats for a long time, as you can easily clean them with a broom and take them to the next project.

Hardboard. This one is an oldie but goodie. I've been around so long I call it Masonite; the younger generations call it hardboard. It typically comes in 4x8 sheets, usually in 1/4- and 3/8-inch thicknesses. As with the dense paper, I abut sheets and continuously tape over the seams to help prevent anything getting underneath them. It's the ultimate in protection and well worth the price when a lot of rough work will be done on the job, or when something heavy shows up on the project site. More than once, I have put some under a grand piano and been able to push that sucker wherever I needed to without leaving any indentations on the floor. I don't use it often, but when I do, I'm grateful I did.

A FEW PRECAUTIONS

If you adopt my approach to doing the floor refinishing at the beginning of or during a project, instead of waiting to go in last, here are some things to keep in mind:

Curing. As with all products, make sure you read the technical specs. Finishes should be well into the curing process before being covered. It's best to check with the finish manufacturer about timing as it can vary from product to product.

Sunlight. If you have areas of intense sunlight and UV exposure, avoid putting down partial strips of flooring protection, as you may get some color variations due to fading. Cover the entire floor, or don't cover it at all, to avoid differential fading.

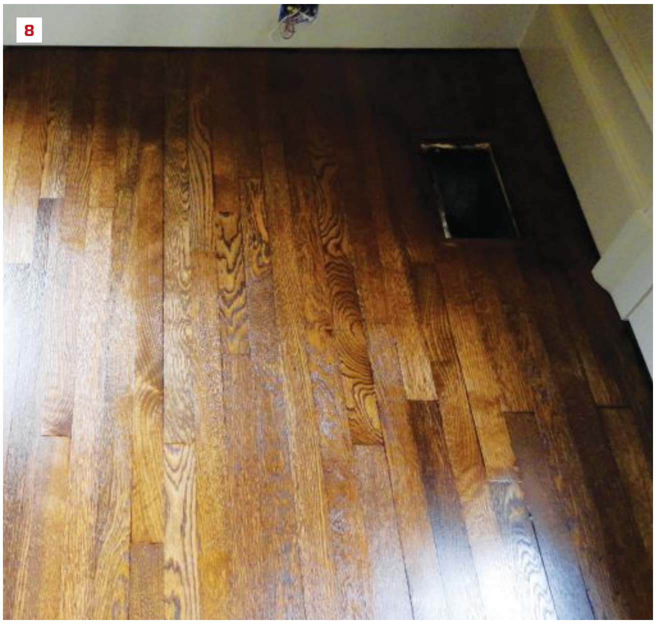
Tape. Never under any circumstances apply any masking tape of any color to the edges of these protective products to keep them in place. It makes no difference if the finishes beneath are old or new. I would extend this warning to other hard flooring materials such as marble, terrazzo, hard tiles, and terracotta, as they may have sealers, waxes, finishes, or acrylics on them that will pull off. In general, putting tape on any hard flooring material is a bad idea.

No one size fits all. I do not rely on any one product for all my protective needs. I use products from all the categories I listed above based on the needs and demands of an area.

WEIGHING THE ECONOMICS

The first time I wrote an article on the pluses of protecting wood floors, I made a mistake. The article was for *Wood Floor Business*, whose readers are primarily wood flooring contractors, manufacturers, and distributors. In the article, I used photos taken from some projects where I had completed my work and then wrapped it to protect it from the building trades that would be following me. The mistake I made was in the examples I used: One of the projects was a $2.3 million project and the other was my restoration work in Dearborn, Mich., on Henry Ford's home, Fair Lane.

Pushback from the contractors was swift. Whereas I saw the protective products as a means for enhancing the workflow for everyone, they saw it as a perk only for high-profile jobs that would increase what they charged for their clientele, thereby making them less competitive. It was a good point, and I spent a fair amount of time answering their comments in the online version of the article.



After the author sanded, stained, and finished the floor in this master bedroom **(8)**, the room was used as a spray booth for cabinet doors during the course of the renovation **(9)**. Fully taped hardboard over paper protected the flooring.

I was careful to point out that protecting my work was a collaborative effort, and I didn't bear the price alone. I also made it clear that much of my work was in houses in older, inner-city neighborhoods, and the projects were much more modest in scale and price tag. These are the old neighborhoods where there are 100- to 150-year-old houses. My business partner and I work on what I refer to as high-risk floors that cannot be sanded any more, so we are often the only building trade on-site and we make excellent use of protective products. Rarely would any of these projects have a budget of over $20,000, so I don't consider the cost of the project to be the determining factor in using protective products.

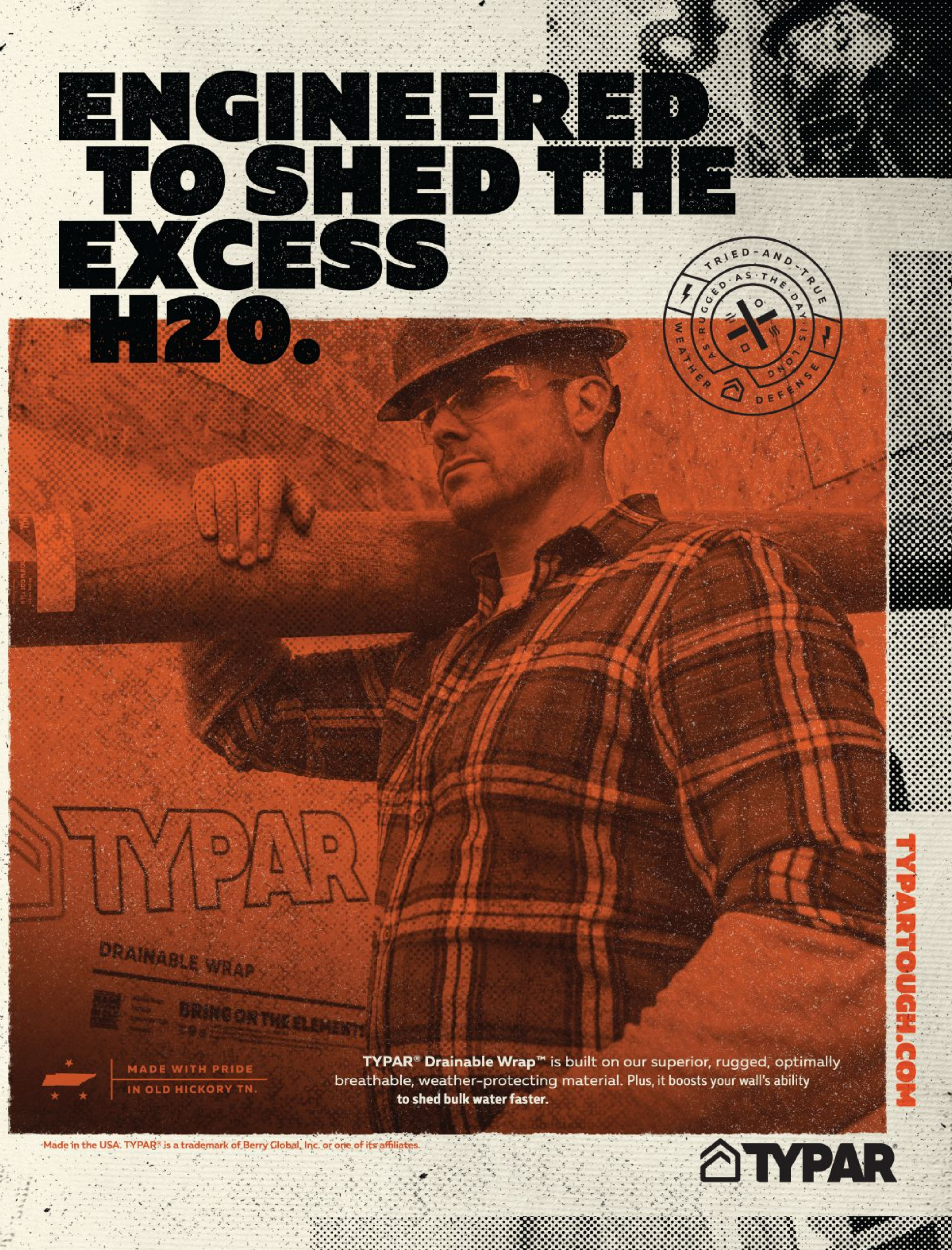
When my contractor friend and I decided to go down the road of rearranging the work of the finish trades, we had a specific goal in mind: to help make the final 10% of the work more fluid and less chaotic. Certainly, there was the additional cost of the protective products, but we learned the real value in creating time when he would need it the most. If you can minimize the potential conflicts wood floor work brings to the end of a project—when punch list items are looming, certificates of occupancy need to be issued, or delays in kitchen cabinets and their hardware are the cause of sleepless nights and ulcers—then there's another metric for measuring the extra costs. We had not anticipated how big a dividend this change would pay out until we tried it. We took a "what if" question and put it into practice, and we've never looked back. When others express skepticism, all I do is point to the pictures and provide them with proof.

One byproduct of this approach is the goodwill it generates. Aside from the fact you are virtually eliminating the turf wars at the end of a job, homeowners also see the efforts being made to protect their property. Having to explain to homeowners how damage was done to a brand-new surface isn't the way you want to spend your time at any stage of the project, but especially not at the end. You are creating the positive narrative that the homeowner will use in describing your work style to other potential clients, and as the credit-card company says about their service, that's priceless.

FLEXIBILITY IN PLANNING AND EXECUTION

I want readers, especially general contractors, project managers, and job supervisors, to walk away from this article knowing that not everything is written in stone. What I want them to understand is that innovations in materials and products in our world might achieve goals that aren't readily apparent. Temporary protection products give flexibility in planning and executing a project. They open doors you never thought existed and provide options that can exceed everybody's expectations. There is a modest cost for the protection, but the payback in increased options simply makes it a wise investment. On every project where we've flipped the sequence, everyone involved has said they would never go back to the older, outdated method of putting our trade last.

Michael Purser is a second-generation floor finisher based in Atlanta, Ga. He owns The Rosebud Company (rosebudfloors.com), which specializes in the restoration of historic wood floors. You can follow his company projects on Facebook at The Rosebud Company.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Photos by Rick Mills

Hybrid Wood/Steel Framing

Story poles and templates make it easier to integrate steel with wood framing

BY RICK MILLS

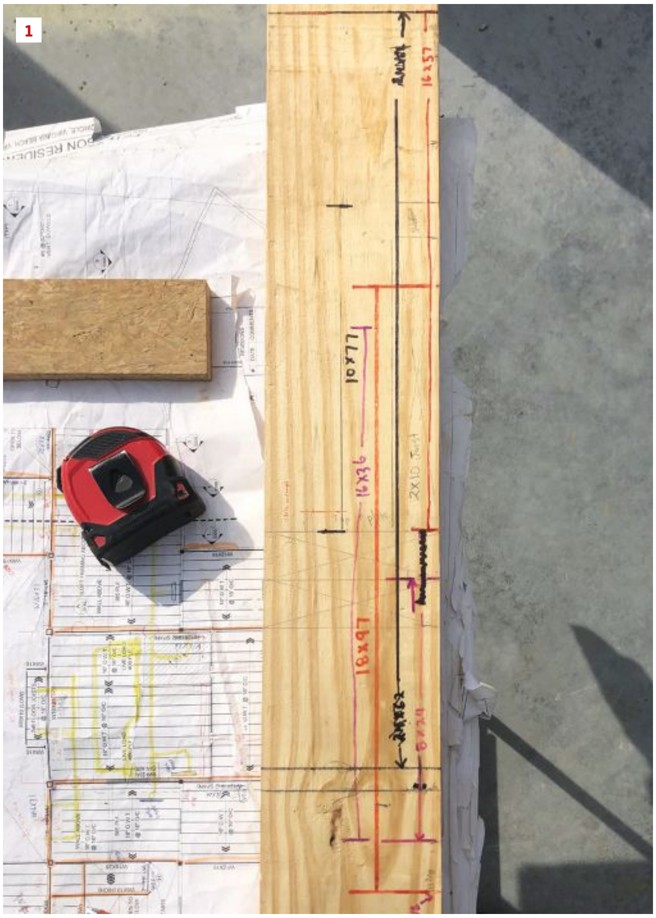
Not every job requires it, but steel has become increasingly common on our projects as engineers continue to raise the bar on their tolerances for deflection and shear strength. For anyone not familiar with the details of steel construction, it can be intimidating at first to unroll a set of structural plans with a lot of steel called out, and I remember well our first few projects that included more than just a steel beam inside a floor system. Looking at all the unfamiliar beam and post sizes and shapes, it was hard for me to transform the two-dimensional plans into a three-dimensional mental picture.

At Jackson Andrews Building + Design, where I'm a project manager, I've seen the complexity of steel and wood construction increase in recent years. Over several projects, I've deliberately familiarized myself with the different types of steel profiles and sizes so that now when I look at structural plans with both wood-framed and steel-framed details, I am able to focus on how everything will fit together.

WORKING WITH A STEEL FABRICATOR

Because a small, local shop supplied us with the steel for the large project featured in this article, we were able to assemble the steel as we installed the wood framing. This helped with scheduling, as we didn't have to wait for all the steel to be ready at once. Another benefit was that this gave us an opportunity to make adjustments to ensure better alignment with the framing members. By framing and installing steel simultaneously, we were able to complete the framing in one area while measuring for the next round of steel.

1



2

WIDE FLANGE BEAM W-SHAPES ASTM A-36

DESIGNATION DEPTH in Inches x WEIGHT Per Ft. Lbs.(Nominal Size)	WEIGHT Per Foot Lbs.	DEPTH Section in Inches	WIDTH Flange in Inches	FLANGE Thickness (Average) in Inches	WEB Thickness in Inches	Area of Section In.²	Section Modulus Sx In.³	**Surface Area Foot of Length.²
W4 x	13	*4-1/8	4	3/8	1/4	3.83	5.46	1.96
(4x4)								
W5 x	16	5	5	3/8	1/4	4.68	8.51	2.42
(5x5)	19	5-1/8	5	7/16	1/4	5.54	10.20	2.45
W6 x	9	5-7/8	4	3/16	3/16	2.68	5.56	2.23
(6x4)	12	6	4	1/4	1/4	3.55	7.31	2.26
	16	6-1/4	4	3/8	1/4	4.74	10.20	2.31
W6 x	15	6	6	1/4	1/4	4.43	9.72	2.92
(6x6)	20	6-1/4	6	3/8	1/4	5.87	13.40	2.96
	25	6-3/8	6-1/8	7/16	5/16	7.34	16.70	3.00
W8 x	10	7-7/8	4	3/16	3/16	2.96	7.81	2.56
(8x4)	13	8	4	1/4	1/4	3.84	9.91	2.58
	15	8-1/8	4	5/16	1/4	4.44	11.80	2.61
W8 x	18	8-1/8	5-1/4	5/16	1/4	5.26	15.20	3.03
(8x5-1/4)	21	8-1/4	5-1/4	3/8	1/4	6.16	18.20	3.05
W8 x	24	7-7/8	6-1/2	3/8	1/4	7.08	20.90	3.39
(8x6-1/2)	28	8	6-1/2	7/16	5/16	8.25	24.30	3.42
W8 x	31	8	8	7/16	5/16	9.13	27.50	3.89
(8x8)	35	8-1/8	8	1/2	5/16	10.30	31.20	3.92
	40	8-1/4	8-1/8	9/16	3/8	11.70	35.50	3.95
	48	8-1/2	8-1/8	11/16	3/8	14.10	43.30	4.00
	58	8-3/4	8-1/4	13/16	1/2	17.10	52.00	4.06
	67	9	8-1/4	15/16	9/16	19.70	60.40	4.11
W10 x	12	9-7/8	4	3/16	3/16	3.54	10.90	2.89
(10x4)	15	10	4	1/4	1/4	4.41	13.80	2.92
	17	10-1/8	4	5/16	1/4	4.99	16.20	2.94
	19	10-1/4	4	3/8	1/4	5.62	18.80	2.96
W10 x	22	10-1/8	5-3/4	3/8	1/4	6.49	23.20	3.53
(10x5-3/4)	26	10-3/8	5-3/4	7/16	1/4	7.61	27.90	3.56
	30	10-1/2	5-3/4	1/2	5/16	8.84	32.40	3.59
W10 x	33	9-3/4	8	7/16	5/16	9.71	35.00	4.16
(10x8)	39	9-7/8	8	1/2	5/16	11.50	42.10	4.19

Working from his marked-up plans, the author lays out the steel work for each location in full scale on a story pole **(1)**. The author refers to a printed list of steel sizes with actual dimensions when working with steel framing; the one above (from Coyote Steel) is a particularly useful resource **(2)**.

Depending on the steel fabricator and the scale of the project, you can elect to have the fabricator erect all the steel for the job at once. If you choose this approach, you need to have confidence in your layout and be willing to possibly make adjustments in the field later. Our approach is probably slower, because we rely on templates to communicate tricky details to the fabricator, but the back-and-forth process ultimately allows us to avoid making costly mistakes.

LABELS AND STORY POLES

To keep track of all the details and ultimately ensure a successful execution, we make extensive use of story poles in the layout process. Everything from elevations to the sizes of posts and beams and how they connect with the wood framing can be accurately tracked on a story pole.

Labeling system. When I first receive a set of plans, I like to go through each page with a highlighter and mark all the vertical and horizontal steel. This kick-starts the process of visualizing where things are located and where foundation and framing members intersect with beams and columns.

Once everything has been located and marked on the plans, I use a labeling system to differentiate between the various steel members, if one is not already included in the plans. I label all verticals with the letter C followed by a number, and all horizontals with an H and their corresponding number. For example, a W12x26 beam, which has a 12-inch-deep section and weighs 26 pounds per foot, might be identified with the label H23.

Next, I make a note next to the call numbers on the plans with the actual dimensions of the steel. This way, we know what size beam or column we're dealing with when we look at the plans and can transfer the actual steel sizes to our story poles or layout locations in the field. This step is necessary because there are sometimes slight variations in beam sizes from manufacturer to manufacturer and—because of the nature of the casting process—sometimes even from the same manufacturer, though most of the time those variations are less than 1/8 inch. When the steel arrives on-site, I always confirm dimensions and adjust as necessary.

Story poles. In the field, the marked-up plans make it easier to accurately lay out where everything goes, whether I'm marking up the foundation or the top of a framed wall. The project shown in this article included a poured concrete slab in a crawlspace foundation

The steel columns were shimmed to final elevation with steel shims and grouted later with non-shrinking grout **(3)** and locked in place with 2-by braces fastened to 2-by collars clamped around each column **(4, 5)**. Then framers began installing the sawn-lumber floor system in the first location, notching the framing as needed around the steel **(6, 7)**.

(see "High-Performance Crawlspace Foundation," Sept/20) and numerous steel columns located on either the foundation wall or the slab floor, with several columns extending to the roofline.

Rather than attach the steel columns directly to the footings and bury them between block work, or attach them to footing pads below the concrete slab, we decided to elevate the steel attachment points. We did this by reinforcing the CMU walls with additional rebar and grout wherever there was an attachment point and by forming a reinforced concrete "pedestal" above slab height on the interior of the foundation for each interior column. This way, if any of the steel columns needed adjustment later for plumb, they wouldn't be buried under the concrete.

Knowing how critical it was to have all the steel placements work out with the framing, we brought our framer on-site shortly after footings were poured and the CMU work was just underway. Working together on the layout gave us confidence that our steel column locations were accurate.

Using the top of the CMU wall as our benchmark elevation, I created story poles for each location with all the framing elements laid out to scale. On this project, we started with the house's main steel columns, which were located in the great room. To match the overall height of the house, which was about 30 feet, we scabbed together several long 2x8s to create the story poles.

While we waited for the first batch of steel columns to be fabricated and delivered, our team set the rebar and formed and poured the interior pedestals. Meanwhile, I began working on the vertical layout for the steel. There were enough details to keep track of in specific areas that we didn't want to lay out more than one area on a single pole if they didn't coordinate with each other.

For example, the two-story great room would have three layers of windows with steel between each window unit and a "U" shaped steel beam welded to the top of the columns to support a large roof overhang. Starting from the top of the CMU wall, our benchmark elevation, we laid out all the wood framing elements it would take to determine the top of the rafter bearing height at the roof. Then we shot grades with a transit across the top of our foundation wall and measured down to the top of each concrete pedestal location. This was the best way to ensure that each column would be level with the others. We took this measurement and added it to the story pole.

With all the wood framing elements marked on the story pole, the next step was to incorporate the steel into the layout. The first horizontal beams were in the first-floor ceiling joist system, which was being framed with 18-inch open web truss joists. All the steel that was called out in this area was +/-16 inches, depending on the exact callout; with a 2-by plate added to the top of the beam, the height works out to just under 18 inches, which is the height we would set all the second-floor steel to. The steel being slightly higher than the bottoms of the joists is actually good, because if anything deflected with load later, it would not drop into the ceiling plane.

The plans called for the second-floor ceiling to be framed with dimensional 2x10 joists, and all the steel we'd be using was around 8 inches—typically W8x24 wide-flange beams, which have a 7 1/8-inch depth and 6 1/2-inch flange width—so the same concept applied. As we added the steel locations to our story pole, we followed the same approach anywhere it would work, so that all the horizontal steel beams would be set 1 1/2 inches below the tops of the joists.

Topping off the great room was a pair of large W18x40 steel beams that spanned the entire space. As we worked through the details, it became clear that at one end of the room, the W18x40 beams would bear on HSS8x8 columns, while at the other end, each beam would need to be welded to the back of the corresponding 8x8 column, because those columns needed to be slightly taller to receive the steel for a large roof overhang. Laying out all of these details on the story pole was necessary to make it extremely clear how all the different elements would come together and to get the steel height right on the first shot.

STEEL COLUMNS

We had provided the steel fabricator with plywood templates for each column location that indicated the exact positions of the threaded bolts that hold the columns in place, so there were no surprises when erecting the steel. But we still needed to fine-tune their height and make sure they were plumb. One way to do this is by using a pair of nuts on each bolt with the flange sandwiched between them and tightening or loosening the lower nuts at each corner of the mounting flange to adjust the position of the column. In our case, the fabricator supplied us with bars of steel stock in different thicknesses to be used as shims as needed between the flange and the pier. In both methods, after the column is locked into place, the gap between the flange and the pier is filled with non-shrinking grout.

Once the first round of columns was erected, our framer devised a simple solution for bracing the free-standing steel. While the fabricator assured us that the base plate bolts would hold the 30-foot-tall columns in place while we worked on the framing, we didn't want to end up with a bunch of fallen steel if a coastal storm swooped through. To connect the tall columns to each other with simple 2-by bracing, he assembled slightly undersized sawn-lumber "clamps" that snugged up tightly around the steel when the screws holding them together were tightened. Then the braces could be fastened to the wood clamps with structural screws, tying the assembly together.

In the main part of the house, we commenced with framing the traditional "box" floor system, though at each column location, the mudsill and rim joists were interrupted. After setting all the sawn-lumber joists and laying down the subfloor, we were able to mark out the first-floor walls, which confirmed that our meticulous foundation layout was correct.

8

The framing crew erected an extensive temporary scaffolding system over a future outdoor living pavilion to install the complex steel framing for the master suite **(8)**.

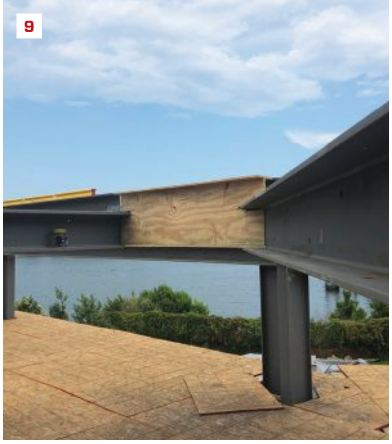
BEAMS

The next step was to take the measurements for the horizontal beams that were part of the second-floor joist system. We took all the measurements at floor level because that was the most accurate place to measure from. Despite popular belief, steel is not always straight, and any measurements taken higher up on the columns had the potential to be off.

Scaffolding. In some parts of the house, we would be installing horizontal steel more than 16 feet above ground level. To safely and efficiently install the beams for the master suite, which was located partly over a future crawlspace for the outdoor living area, we assembled extensive temporary scaffolding. Where we had a level first-floor system in place, we assembled staging, with wheels on the lowest sections so we could move the staging around as needed. Not only did this allow us to be at the proper height to take accurate measurements and make templates for some of the more complicated steel intersections, it also allowed us to install all the steel and truss joists comfortably and safely from the same scaffold.

Openings for mechanicals. While putting together the order for our steel beams, I was also working on the order for truss joists. Complicating matters, duct work for the HVAC system was going to be located within the joist system, which meant that the openings in the trusses and beams had to be coordinated. This may have been the most challenging part of the entire job.

The good news was that the client saw the value in a set of plans



Rather than attempting to cut and fit complex beam connections in the field, the framing crew mocked up plywood templates that recorded lengths, notch sizes, and other critical dimensions **(9, 10)**. These templates were supplied to the steel fabricator, which could then accurately prefabricate beams that could be welded into place with few modifications **(11)**.

for a well-designed HVAC system. For this, we partnered with Positive Energy, of Austin, Texas, which provided detailed plans for every element of the HVAC system, including all the duct paths. This facilitated determining where ducts would need to pass through the steel beams.

I provided the duct path locations to our open web truss designer, which then incorporated appropriate duct chases inside the trusses. Then I sent the designer's detailed schematic of the trusses with dimensions to our structural engineer, who calculated the opening sizes that we could put in the steel. In some areas, a round hole worked fine, but in several other locations, the round hole was too large, and we had to make equivalent size holes in rectangular form to make it through the steel beams. We were now ready to order and install the first round of horizontal beams that connected the columns.

Templates. As this area came together, there were several locations where we needed to make templates for the steel fabricator because of how certain beams intersected with other beams. Some had flanges notched into webs, while others had some 45 degree angles notching over other beams. Some of these adjustments could be made in the field, but some of the beam intersections were so complex that our framer carefully assembled plywood templates for the fabricator's reference.

As we progressed to the rooflines, we needed to keep several more beams at the top of this space under rafter-bearing height and above soffit height. The clearances were tight, but our careful planning paid off and everything came together nicely.

Packing out. Almost all the beams needed to be packed out with sawn lumber to connect to the wood-framed joist systems. The process of packing out a steel beam is—not surprisingly—time consuming. On this job, the structural plans called for using 5/8-inch-diameter carriage bolts 16 inches on-center at staggered locations to fasten the sawn lumber to the steel. While the steel fabricator had drilled the necessary 11/16-inch-diameter holes in the beams, it's still challenging to hold a 2x10 or 2x12 in place against the web of a beam while someone else safely drills the holes out for the bolts from the other side.

To quickly clamp the 2-by material to a beam for safe, hands-free drilling, our framers cut some 3-inch-square scraps of plywood to make what they called screw blocks. They drove wood screws through these screw blocks and through three or four holes in the steel beam into the back of the 2-by to hold it in place, then the remaining holes were drilled out with an 11/16-inch-diameter bit to match the holes in the steel. Once the holes are drilled, we can then push a few bolts through some of them and thread on nuts to hold the 2-by in place while the screw blocks are removed and the remaining holes drilled out.

Most of the time, both sides of a beam needed to be packed out, and the process is basically the same—run screw blocks through to hold the new 2-by in place, then drill it out. After both sides are prepped, the through bolts can be installed and tightened as the screw blocks are removed.

Sometimes, we were able to pack out the beam with only one 2-by member on each side of the web, because the sawn or engineered joists were narrower than the distance between the upper and lower flanges. However, any time we were attaching truss joists, the beam had to be packed out flush, which required some creativity to achieve the desired thickness. We realized quickly we would need numerous sizes of CDX plywood on-site and made sure to have four or five sheets each of 1/4-inch through 3/4-inch plywood to be able to rip up what we needed.

Where the beams needed plates, we drove 1 1/2-inch-long by 1/2-inch-diameter lag screws through holes that the steel fabricator had made in the flanges into the bottom of 2-by stock sized to match the width of the flange. On vertical posts, we fastened wood members

To pack out the beams to adapt them to conventional wood framing, the framing crew drove screws through 3-inch-square blocks **(12)** and through bolt holes in the web into the back of 2-by stock sized to fit the flange **(13)**. With the beam held in place, holes for bolts and other penetrations could accurately be drilled out **(14)**, so that the wood members could be fastened to the beam **(15, 16)**. After fastening 2-by plates to the tops of the beams with structural screws driven up through holes in the flange provided by the fabricator, workers wrapped the assembly with Zip tape **(17)**.

to the steel using Reamer Tek self-tapping wood-to-steel screws.

Because this job would be exposed to weather for a long time before dry-in, we opted to wrap the tops of the packed-out beams with Zip tape to help keep water out of the assembly and prevent the lumber from swelling and thus shifting any joists around.

DETAILING THE BUILDING ENVELOPE

Because of the size of the project, we worked in sections, erecting the steel and framing in one location while ordering the materials for the next. Once the steel framing was packed out, framing and sheathing the structure was straightforward.

Going into this project, we knew getting the air-sealing right and meeting the performance standards that we like to build to was going to be a challenge. In Virginia Beach, where we work, a blower door score is not yet required for code but is in the process of being adopted. Once that's in place, we will need to hit a blower door score of 3.0 ACH50 to pass code. So from day one, even though we realized that we would not reach passive house standards, we have taken as many steps as possible to ensure good air-sealing details, with a goal of scoring below 2.0 ACH50 (as of the writing of this article, we have not tested the house.)

Starting at the sill-plate connection to the CMU foundation wall, we used two heavy beads of ProClima's Contega HF, a highly elastic adhesive caulk, below a foam sill sealer, and another two heavy beads between the sill sealer and our 2x8 mud sill (we borrowed these details from Jake Bruton, a Missouri builder who has written about air-sealing for *JLC*; see "Air Sealing That Works," Apr/18).

After our floor system box was framed, we sealed the gaps

Large gaps between the wood framing were filled with fluid-applied flashing membrane **(18)**. After the steel was packed out, the structure was framed **(19)** and sheathed conventionally. To air-seal the joint at the wall-to-roof connection, workers cut blocks of sheathing to fit snugly between the rafter tails **(20)**, installed blocking in the rafter bays, and sealed the roof sheathing to the blocking with Contega sealant **(21)**. All joints and penetrations through the sheathing of the large home were sealed with either Zip tape or liquid flashing **(22)**.

between the framing and steel columns with Zip System liquid-applied flashing. While this step is probably redundant, since the Zip R6 sheathing that we used to sheathe the house is the air-sealing layer, we figured the gaps were big enough that it couldn't hurt to take care of them while we had access to these locations.

We like to use Zip System sheathing on our projects because it offers a straightforward air-sealing approach that's easy for our trades to execute. We followed standard Zip System installation practices until we got to the roofline, where in a perfect world we would have connected the wall plywood to the roof plywood in a continuous layer. But this project featured a large overhang and built-in gutters hanging on the ends of the rafters, so it wasn't feasible or cost-effective to frame the overhang after boxing in the building envelope with sheathing. Our solution was to cut pieces of the Zip-R sheathing and a 2-by to go between each rafter bay to continue the Zip layer up to the roofline. From there we laid a bead of the Contega sealant on top of the blocking prior to the roof sheathing being installed to air-seal the wall-to-roof connection.

Once the roof sheathing was completed, our painting crew came in and sealed all the blocking between the rafters with Zip liquid-applied flashing. Later, they'll seal around every pipe and wire that passes through the air barrier as well. We're confident that the methods we've used will result in blower door scores that meet our goals when we are ready to test later this year.

Rick Mills is a senior project manager for Jackson Andrews Building + Design, in Virginia Beach, Va. Follow Rick and his company on Instagram: @rick.jacksonandrewsbuilding and @jacksonandrewsbuilding.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Products

BY VINCENT SALANDRO

1. Indoor/Outdoor Porcelain Tile
Rated for a variety of uses, including patios, pool decks, and interior baths, the glazed porcelain tiles in Emser Tile's Xtra line are rated 8 on the Mohs hardness scale. The 24-inch-square tiles are 2 cm thick and are available in eight color options (trav silver shown in photo) designed to imitate the look and feel of wood, concrete, or stone. The color-matched porcelain body is not UV sensitive, according to Emser Tile. Pricing starts at $9.50 per square foot. emser.com

2. Magnetic Interior Door Latch
Rather than using a strike-plate lip to latch interior doors, Inox's TL7 Magnetic Tubular Latch uses magnets. The latch keeps the bolt retracted in the door until the door is closed, when neodymium magnets in the strike latch quietly snap the bolt in place to secure the door, rendering the latch and strike invisible. A 28-degree turn of the lever then unlatches the door to open it. The latch can be specified and installed for passage, half-passage, and privacy functions. Pricing for the latch, available in more than 30 lever options and finishes, starts at $108. inoxproducts.com

3. Whole-House Ventilation Control System
Overture from Broan-NuTone is a fully integrated, smart indoor air quality system that links a home's ventilation system using a sensor, wall control, and plug. The Smart Sensor and Smart Wall Control monitor air quality in rooms where they have been installed. When the sensor detects a rise in indoor air pollution, the Smart Plug, which plugs into any 120-volt outlet, activates a home's fresh air system. Pricing for the system, which can be controlled from any mobile device, varies based on home size. broan-nutone.com

4. Self-Adhered Primerless Flashing
DuPont says its DuraGard CM Transition self-adhered flashing doesn't require priming for most construction substrates, and can be applied at temperatures as low as 25°F, withstand in-service temperatures up to 250°F, and be exposed to UV for up to six months. Available in 75-foot rolls in widths ranging from 6 to 36 inches, the flashing may be used in through-wall, base-of-wall, and roof-wall junction applications. Contact distributors for pricing. dupont.com

5. Compression-Resistive Furring Strips
Benjamin Obdyke redesigned its Batten UV furring strips with improved compression resistance for use behind open-joint cladding systems. The polypropylene strips help maintain a 3/8-inch space behind the cladding and feature notches meant to provide multidirectional airflow to help keep the wall cavity dry and allow drainage in rainscreen applications. A carton with 400 linear feet of 8-foot-long strips retails for about $450. benjaminobdyke.com

6. Crisp Window and Door Headers
Modern Craftsman Moulding window and door headers from Kuiken Brothers blend the simplicity of profiles found in Craftsman-style homes with classic scale and proportion. The Modern Craftsman profiles are milled from poplar, with deep incisions and crisp edges that create distinct shadow lines. The headers are an aesthetic fit for a modern update on classic design. Stocked as 16-foot lengths, the collection is available for shipping nationwide. Contact Kuiken Brothers for a quote. kuikenbrothers.com

7. Four-Quadrant Stainless Steel Refrigerator
Fisher & Paykel's Quad Door Refrigerator Freezer features "ActiveSmart technology," which the company says adjusts the temperature, airflow, and humidity for optimal food and energy preservation. The appliance also has two separate freezer compartments for varying degrees of preservation and storage of frozen items; according to the manufacturer, the bottom right quadrant is a "Variable Temperature Zone"—with a choice of pantry, fridge, soft freeze, or freezer mode—that allows users to create the perfect climate for different types of food. The 36-inch-wide, 18.9-cubic-foot appliance retails for approximately $3,700. fisherpaykel.com

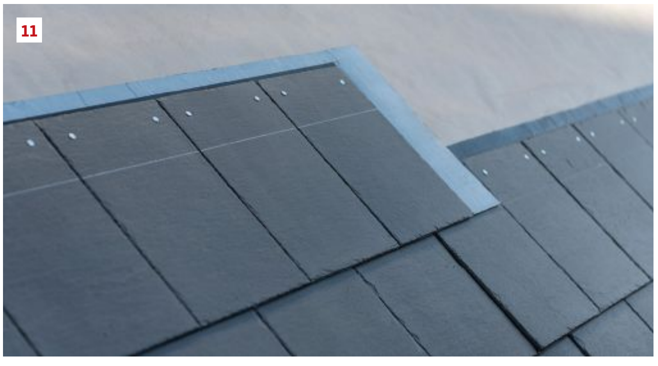
8. Smart Landscape Lighting Control
Homeowners can digitally control their outdoor landscape lighting using Kichler's Smart Control Timer and Kichler Connects app. With the app, users can create custom on/off schedules for the lights, sync multiple transformers, and use one-step, preset scheduling. The Smart Control Timer operates with Bluetooth and Wi-Fi for local or cloud-based control. The timer's external antenna allows for long-range connectivity and control by extending signal range from the transformer enclosure. The timer retails for $60. kichler.com

9. Lightweight PVC Trim

Wolf Home Products' Woodlands Collection of edge and center bead boards is available in four colors and wood-grain textures. According to the manufacturer, the 6-inch-by-18-foot tongue-and-groove planks, made from lightweight and high-cell-density PVC, are low-maintenance and will not absorb moisture or swell, rot, split, or delaminate. Each board can be cut, drilled, mitered, nailed, or glued like wood. Contact the manufacturer for pricing information. wolfhomeproducts.com

10. Wood-Look Stone Veneer

Suitable for application on interior accent walls, fireplaces, and exterior facades, Weathered Plank 4 and Weathered Plank 6 stone veneer from Dutch Quality Stone are designed to look like wood, complete with the appearance of knots, grooves, and nail holes within the grain. Both planks are 36 inches long, with plank heights of 4 inches for Plank 4, and 6 inches for Plank 6. Planks are available in two color palettes and can be used individually or together. Pricing varies. dutchqualitystone.com



11. Natural Slate Roofing System

Natural slate and a waterproofing membrane come preassembled in panels in CUPA Group's Readyslate roofing system. Modules are composed of six 12-inch-by-8-inch, 3.5 mm-thick, hand-quarried natural slates—predrilled for nailing and marked with a reference line for overlapping courses—backed by a self-adhering bituminous waterproofing membrane. According to the manufacturer, modules are lightweight and require no specialized labor for installation. Readyslate is priced at $4.40 to $5.25 per square foot. cupapizarras.com

12. Fluid-Applied Air and Water Barrier

Georgia-Pacific's DensDefy Liquid Barrier, a fluid-applied air- and water-resistive barrier, produces a seamless, vapor-permeable membrane on exterior gypsum sheathing, wood sheathing, CMU, or concrete walls. Applied via roller or spray, the single-component, elastomeric product bonds to most materials without priming. The manufacturer says it can be installed in temperatures as low as 25°F, in wet weather, and on damp substrates, and that it cures in temperatures as low as 32°F and tolerates rain immediately after application. Contact a distributor for pricing. densdefy.com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FIELD GUIDE

Efficiently Working at Height

BY TONY BLUE

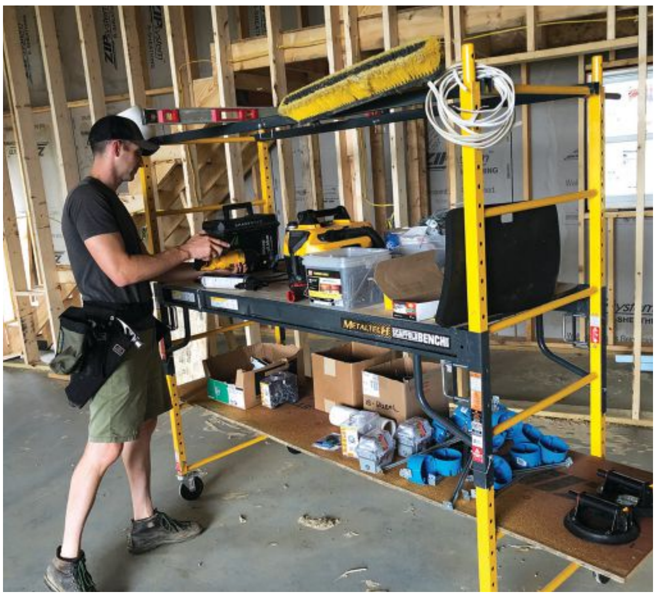
My favorite tool? Our yellow baker's scaffold because of the versatility and jobsite organization it provides. A disorganized site drives me crazy, and I have been known to show up on a jobsite and immediately start stacking tools and supplies. Our baker's scaffold helps me satisfy this obsession.

Metaltech ScaffoldBench. Of course, we also use our yellow scaffolding when working at height, such as when we need to rough-in ceiling boxes or tape drywall. Earlier this year, when working in the high-end home of one of our frequent customers, who wanted more lighting, we needed to hide some new wiring in a soffit box about 14 feet above the floor. This was a bit out of reach from our single section of scaffold, so one of our crew members checked his Home Depot app and found a Metaltech 4-in-1 ScaffoldBench in stock at a nearby store. Although made by a different manufacturer, the Metaltech scaffold was sized to fit on our Werner scaffolding and could be broken in half to give the crew the additional height they needed.

The ScaffoldBench has a 1,100-pound capacity and can be used in the traditional 6-foot-high configuration, with the ability to be stacked up to three levels high. But what makes it different from standard scaffolding is its ability to become a miter saw station. Just flip the platform over (with the plywood facing down) to reveal rails that accommodate a set of four universal brackets (also included). These brackets fit different manufacturers' saws and come with uprights to help support the material that's being cut. To clear the space needed to bring long material in to your saw, simply remove the top half of the frame on the bench.

The scaffold also comes with a set of 200-pound-capacity rails that span the width of the frame, and a wire mesh platform that sits on the rails to provide another shelf. The rails are light and fold in half for easy transportation. Unfortunately, we found the mounting hooks for the wire mesh were not very sturdy, nor was it practical to cart the mesh around from job to job. So we tossed the mesh but still use the rails for a work shelf, placing long-handled items or sheet goods on it. There's nothing wrong with our ordinary baker's scaffold, but this Metaltech scaffold has been a good addition to our jobsites, giving us a little more height while having a couple of features the standard yellow frames don't have. It costs $350. metaltech.co.com

Gorilla multi-position ladder. I can't discuss working at height without mentioning my ladder of choice, a Gorilla GLMPX-22



Photos: Tony Blue

Metaltech's 4-in-1 ScaffoldBench doubles as a miter saw stand and has lockable wheels that allow it to be easily moved around the jobsite (above left). Gorilla's multi-position ladder can be used as both a stepladder and an extension ladder (above right).

multi-position ladder that I always have with me in my truck bed, tucked safely underneath my cap. As I'm the business owner, my job typically involves doing whatever is needed to get the job done. I may need a ladder to complete a punch list task, or look at a customer's roof, or help the guys set a window. I like the versatility of having a single ladder that can do most of these tasks, by functioning either as a stepladder with a 13-foot reach or as an extension ladder with about a 22-foot reach. I also like that it weighs only about 40 pounds, even though it's a type IAA ladder with a 375-pound capacity.

All of my employees have their own multi-position ladder with them on-site, and 90% of the time, that is sufficient. Working with the ladder they have with them is more efficient than having them drive back to the shop to pick up one of our specific A-frame or extension ladders. Made of aluminum, the Gorilla GLMPX-22 is slightly lighter than any of the equivalent multi-position ladders I've tried from other manufacturers, and it also has the most ergonomic locking handles. I've been using mine for the past couple of years, and it has proved to be durable and reliable. That's why it has become my go-to ladder. It costs $250. gorillaladders.com

Tony Blue owns @SquaredAwayContracting in Greenwich, N.Y. He is a general contractor who enjoys nerdy energy efficiency and moisture management details.

ToughBuilt TB-S550 Miter Saw Stand

BY MARK CLEMENT

The more work I can do at my miter saw, the better my life is. Sure, I can make cuts hunched over a lumber pile stacked on the floor, but standing up is better. So what I call a "cut station" is a full-on hub of how I cut. Hence my interest in miter-saw stands. I've seen enough of them to know that the ToughBuilt TB-S550 is the best one to come down the pike in a long time.

Length. Among its many attributes, this stand is long enough to support 124-inch-long stock. To support that stretched-out length, the stand comes with four work supports, not just two stuck at either end. What this means is that I can support—on either side of the saw—both smaller pieces and the 16-footers whose very ends I need to be able to clip a miter off of. And this unit does that without me having to do anything to jury-rig the system.

Out of the box. Assembly is easy. My 12-year-old son and I had it unpacked and up and running in less than an hour. While assembling it, I could immediately tell that the 2 1/2-inch square tube frame would give this unit the core strength needed to support the arms when extended—and allow it to collapse into a sensibly transportable cube, both on the jobsite and in the back of my truck.

What was also immediately apparent was that the quick release/ball catch/lever locks on the legs to splay them would require no fussing with; there'd be no issue with dirt getting in them or a slight bend crippling the ball-catch catching. Or un-catching. The legs deployed and collapsed nicely on setup and have not failed since. After several months of use, a couple of the ball-catch retainer clips have released, and I've found springs and parts rolling around in the back of my truck. Fortunately, they are easily reassembled if you can find the parts; if not, the legs seem to function fine without them.

The legs themselves are beefy, consisting of 2-inch tube steel with round, plastic bases that set up easily whether on a basement remodel or on a paver patio. There's no "adjustment" leg either, which I like; if you need to set it up on grass or dirt that is out of level, just hack a hole out and go to town.

ToughBuilt's TB-S550 miter-saw stand's work supports extend to 124 inches. The stand includes two quick-release universal tool mounts and a pair of rubber wheels for easy portability (above left). The stand doubles as a workstation (above right).

Photos: Mark Clement

Material supports. The stand is equipped with enough supports to make most cuts without reconfiguring them. But more importantly, the supports are round, so that when you're sliding long stock into the saw fence for positioning and it sags a bit between supports, it doesn't catch as it reaches the farthest outrigger.

The unit also comes with stops. Obviously, ToughBuilt sees a reason for this feature, but I don't. And that's me, not ToughBuilt. The twist lock that secures them doesn't secure them quite square (it holds them still; I'm not saying it doesn't work), which bugs me. But, again, it's me, not the tool.

Limitations. The legs have fold-down holders for materials, and while they definitely work, I found them to be a bit awkward. I'm not sure if there's an engineering reason—top-heaviness for example, or to allow the legs to fold—but when there's a stack of lumber resting on the stand, it feels like I'm standing at a cabinet whose toe-kick is not quite deep enough. I'm aware there is a barrier at my shins.

There's a bit of a barrier at my stomach too, because of the knobs that lock the saw mount to the stand. It's not a deal-killer, and the knobs work well to lock everything in place, but I like to stand *at* the saw, not away from it. The knobs seem to stick out a bit too far for comfort, and I've also found myself snagging my nail bags on them.

And despite the stand's generous wingspan, long stock that extends much past the end of the outboard support still sags. A recent project, for which I had to trim to length and square up the ends of lots of cedar 4x4x10s, probably pushed up against the stand's maximum load capacity. And I've found that I have to make sure all the adjustments are tight, even when cutting lighter trim stock.

The ToughBuilt weighs 55 pounds (without a saw), and while it comes with wheels, I usually just fold it up and carry it when I have to move it to another jobsite. On the other hand, if you move around all the time (I don't), the wheels work great and will never go flat. If you're a "wheel it in, extend the arms" carpenter, I'm not sure there is a better alternative. It sells online for $176. toughbuilt.com

Mark Clement is a member of the JLC Live Demonstration team, author of The Carpenter's Notebook, A Novel*, and a deck builder/remodeler in Ambler, Pa.*

Photo: Tim Uhler

Max HN120 PowerLite High Pressure Concrete Pinner

BY TIM UHLER

The older I get, the more I realize just how much tunnel vision I have. For many years, we fastened wood to concrete using a Hilti powder-actuated gun, but I got sick of cleaning it and worrying about the potential fines for consumables being left out. Plus, the need for safety training for our crew and the potential for injury turned me away from that gun. Instead, we resorted to drilling and using split-drive anchors when we needed to fasten treated wood to concrete—a slow method to be sure, but safe and strong.

This is where Instagram opened my eyes. A couple of framers I follow (@morton.ben and @shevcon_custom_homes) had recently invested in the Max High Pressure system and kept telling me to look into the Max concrete pinner. Having already invested in the Max system compressor and framing nailers in 2008, it made a lot of sense for us to buy the gun if it worked as well as advertised.

I've written about 500-psi high-pressure systems from Max and Makita in the past but had used the system only for framing and siding. I had even tried out an earlier version of Max's concrete pinner in 2012, but we never adopted it for use by our crew. See what I mean about tunnel vision?

The Max HN120 will shoot nails into both concrete and steel, no powder charges needed. All that's needed is the Max 500-psi compressor. The gun comes with the different tips needed to fasten metal track to both concrete and steel and to fasten wood to concrete and steel I-beams with fasteners up to $2\frac{1}{2}$ inches long. It's a coil nailer—the magazine holds up to 50 nails—and it features the standard Max swivel fitting and air filter.

I'll be honest—I was a little nervous at first about using the gun, even though it doesn't require a license or powder loads to operate it. Max claims that the 6.4-pound gun shoots with 2,231 inch-pounds of driving force, so I was expecting a lot of recoil. After getting a little more familiar with its operation, I felt more comfortable using it and found that it was easier on my wrist than a powder-actuated gun. When shooting into concrete less than a year old (our typical job), I found no difference in fastener performance between this gun and our old Hilti.

This gun isn't cheap at $991, but then again, the Max 500-psi system isn't cheap either. A Hilti DX 460-MX gas-actuated fastening tool, which works with either single fasteners or collated strips of 10 fasteners, costs about $1,380. Since we're already invested in the Max system, the HN120 gun is a no brainer for us. The fasteners we use with this gun cost about $0.10 each, while the Hilti runs $0.14 per fastener and $0.41 per powder cartridge. maxusacorp.com

Tim Uhler is a lead carpenter for Pioneer Builders in Port Orchard, Wash., and a contributing editor to JLC. *Follow him on Instagram at @awesomeframers, subscribe to his YouTube channel, or visit his website at awesomeframers.com.*

Designed for use with the Max 500-psi compressor, the Max HN120 PowerLite nailer shoots fasteners up to 2 1/2 inches long into both concrete and steel. The gun comes with different tips for different materials and has a coil magazine that holds up to 50 fasteners.

Photo: Tim Uhler

Advertising Index

*Advertising appears in regional editions

Classifieds

BY CLAYTON DEKORNE

Old-School Newel

Last September, my family and I were part of that large American demographic fleeing big cities during the pandemic. In our case, with two small children and no outdoor space attached to our sixth-floor, Brooklyn, N.Y., apartment, we mostly wanted a yard, and the closest place of any size we could afford was three hours away in the Catskills. The yard came with an elegant Italianate home built in 1855, which we fell in love with instantly. The walls had never been painted, only wallpapered; the woodwork and doors—unpainted clear chestnut—are intact; the original oak and fir floors are water-stained in places and reveal the placement of old rugs but show almost no wear; even the porcelain-knobbed window latches remain and are operable. With all this charm, however, comes a serious lack of modern performance, and as elegant and intact as it may be, this home hadn't been occupied since the 1990s and nearly every square inch needs love. That is, all but the stairs.

Arguably the most charming woodwork in the home is the stair to the second floor, and never have I walked on a set of wood stairs as old that didn't creak and have a wobbly handrail. This stair is silent and immovable, and the newel, a single piece of turned oak with carved flutes and an integral pedestal set into the first step, feels as rigid as a tree trunk. When I looked to find out how it was secured, I found something I'd never seen: The bottom end (below the pedestal block) is cut into two opposing tenons that are mortised through the subfloor (see photo 3). Each tenon has a slot cut into it at subfloor level, and an oak wedge was driven into each of these slots to draw the post straight down, snug to the floor. To complete the connection, the pedestal is braced by the stringer and the first tread and riser and locked in by finish flooring.

As for squeaks, there is no substructure, no glue and screws, just good wood and not as much of it as I'd expect—one set of 1-by oak treads and risers supported by 1-by oak stringers. (Granted, all these pieces are a full inch thick and cut from tight-grained, rift and quarter-sawn oak, which probably best accounts for their resilience.) On the closed side of the stairs, the stringer is nailed to a 1-by oak apron nailed to the wall. On the open side, the finish stringer, which is also the carriage, is supported by a flat-framed wall tied together with oak laths and plastered on both sides.

I'm not advocating that this method is best for a new set of stairs today, but I am full of admiration for a long-gone carpenter's skill and chosen materials. Only time can prove good practice.

Photos by Clayton DeKorne

The newel gets a lot of action these days but remains immovable **(1)**. The integral block **(2)** at the base (about 6 1/2 inches square) has two tenons cut on its bottom end that project through the floor and are drawn tight to the subfloor by wedges driven into slots in the tenons **(3)**.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