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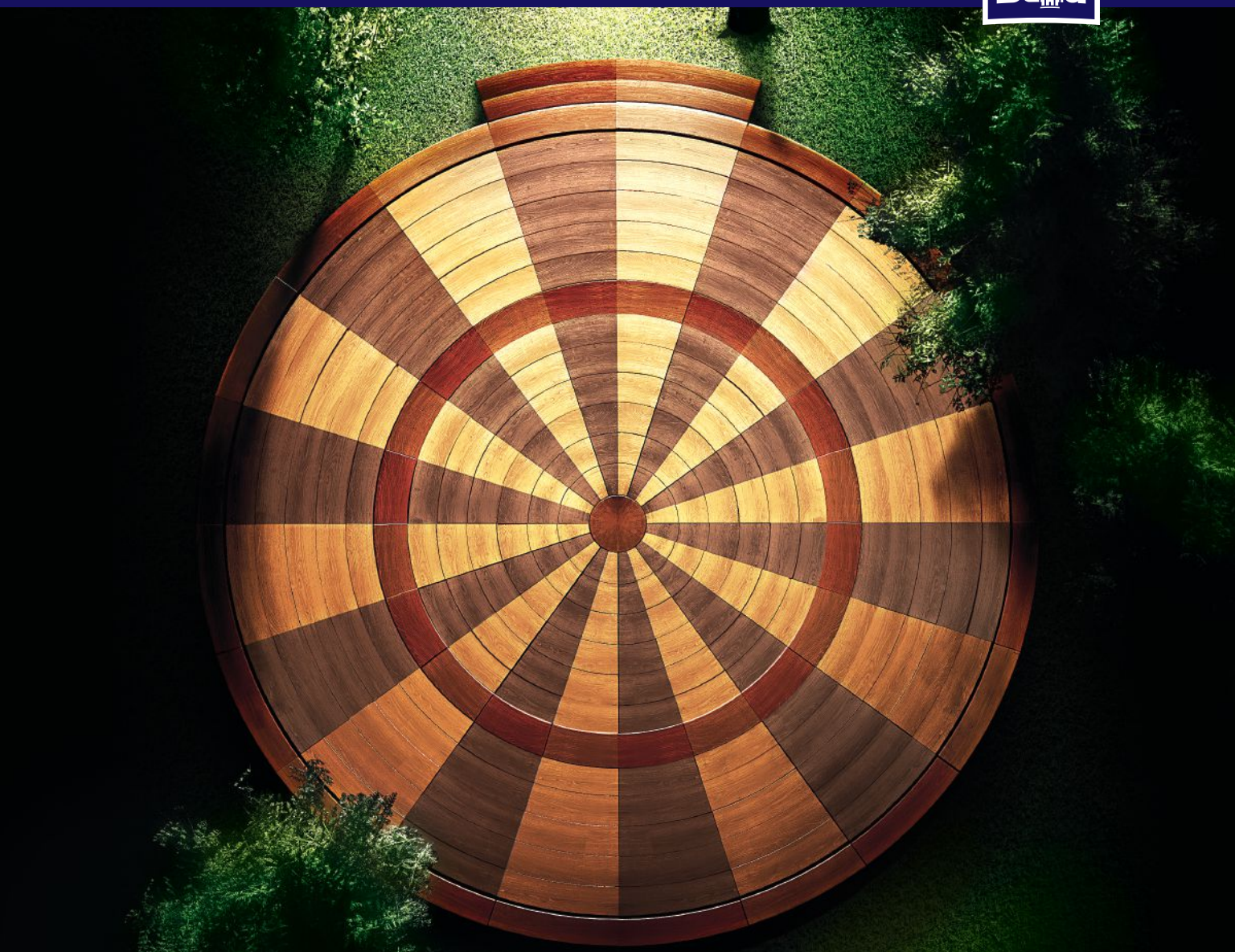

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BY ROE OSBORN

Coping Trim

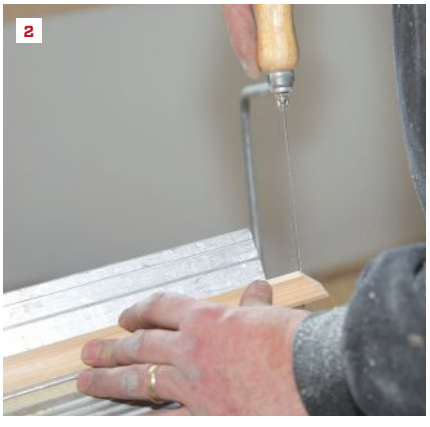
Running trim always involves joining pieces of molding at inside corners. You could just cut both sides at 45 degrees for this joint, but corners are seldom perfectly square. Additionally, wood that's cut at an angle tends to shrink differentially over time, meaning that a mitered joint can open up—even if the two cuts were perfect to begin with. The solution is coping, or cutting out the profile on one piece of trim to fit into the trim on the other side of the joint.

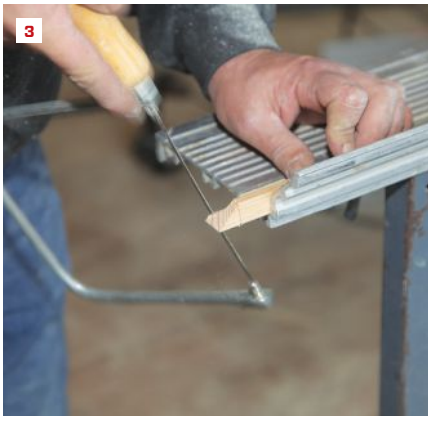
Coping saw. To cut a molding profile, you need to use a specialized tool called a coping saw, which consists of a metal hoop with a handle on one end. A thin blade stretches between turning pins on the handle and on the other end of the hoop, with the hoop keeping the blade in tension. Tightening the handle pulls on the blade to add tension. The pins rotate to allow the blade to follow a profile.

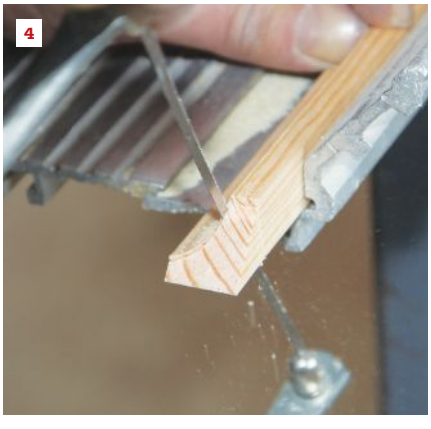
Typically, the blade on a coping saw is mounted with the teeth oriented toward the handle, which means that the saw cuts on the pull stroke instead of the push stroke. When approaching the work, some carpenters prefer to work with the handle facing up while others prefer the handle facing down. I always coped with the handle facing down so that the cutting stroke pulled against the workbench.

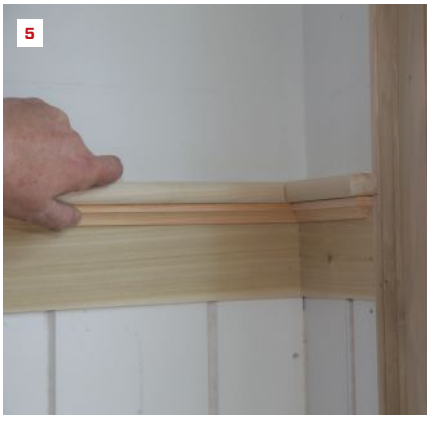
Cutting the cope. For a coped joint, one side is cut square and runs into the corner. The other side is coped, or cut to fit into the first side. The side you elect to cope is entirely up to you, but it's usually easier for right-handed carpenters to cope the right end of a board and for lefties to cope the left end. If the task at hand is running baseboard or baseboard cap (see "Running Baseboard," Nov/17), plan your cuts so that all the copes are on the preferred ends of the boards.

After cutting and installing the side of the joint with the square cut, make a 45-degree-angle cut on the end of the opposing piece **(1)**.



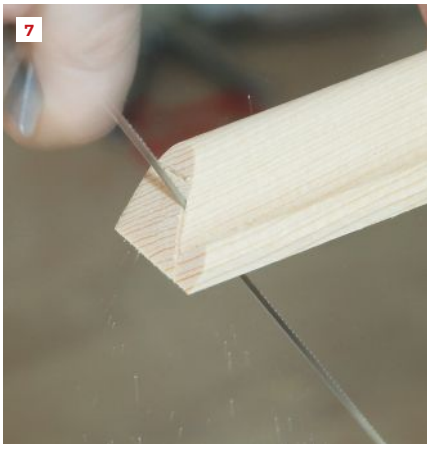


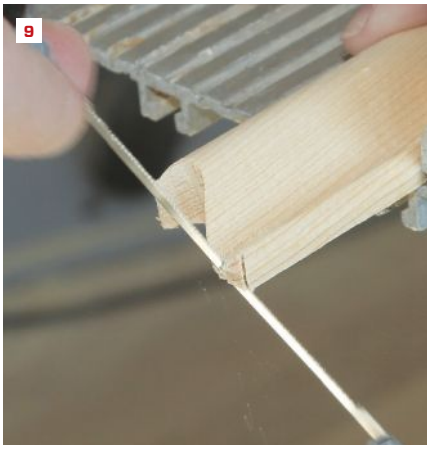




Before coping a joint, cut the molding at 45 degrees to reveal its profile **(1)**. For cove molding, first cut in from what will be the vertical face **(2)**, then cut in from the horizontal side **(3)**. Because the miter will not be readily visible, the carpenter opts for a square cut on the horizontal side. He then follows the profile until the cuts meet, keeping the saw at an angle to create a back bevel **(4)**. Giving the end of the coped trim a slight tap helps to close the joint for the final fit **(5)**.

Photos: 1–11, Roe Osborn; 12–17, Ted Cushman





For base cap molding, begin by cutting across the profile from the bottom **(6)**. After cutting in from the end **(7)**, cut the curve working side to side **(8)**, then cut the top profile **(9)**. Sanding fine-tunes the cope **(10)** for the final tight fit **(11)**.

Before coping the joint, measure the piece—by hooking a tape on the long point of the angled cut—and cut it to length. Then set it on the workbench with the angled cut extending just beyond the edge of the bench. Simply follow the profile of the trim with the blade of the coping saw, keeping the saw blade at or beyond 90 degrees to the face of the board. In other words, give the coping cut a back bevel so that only the very edge of the finished face meets the trim on the other side of the joint.

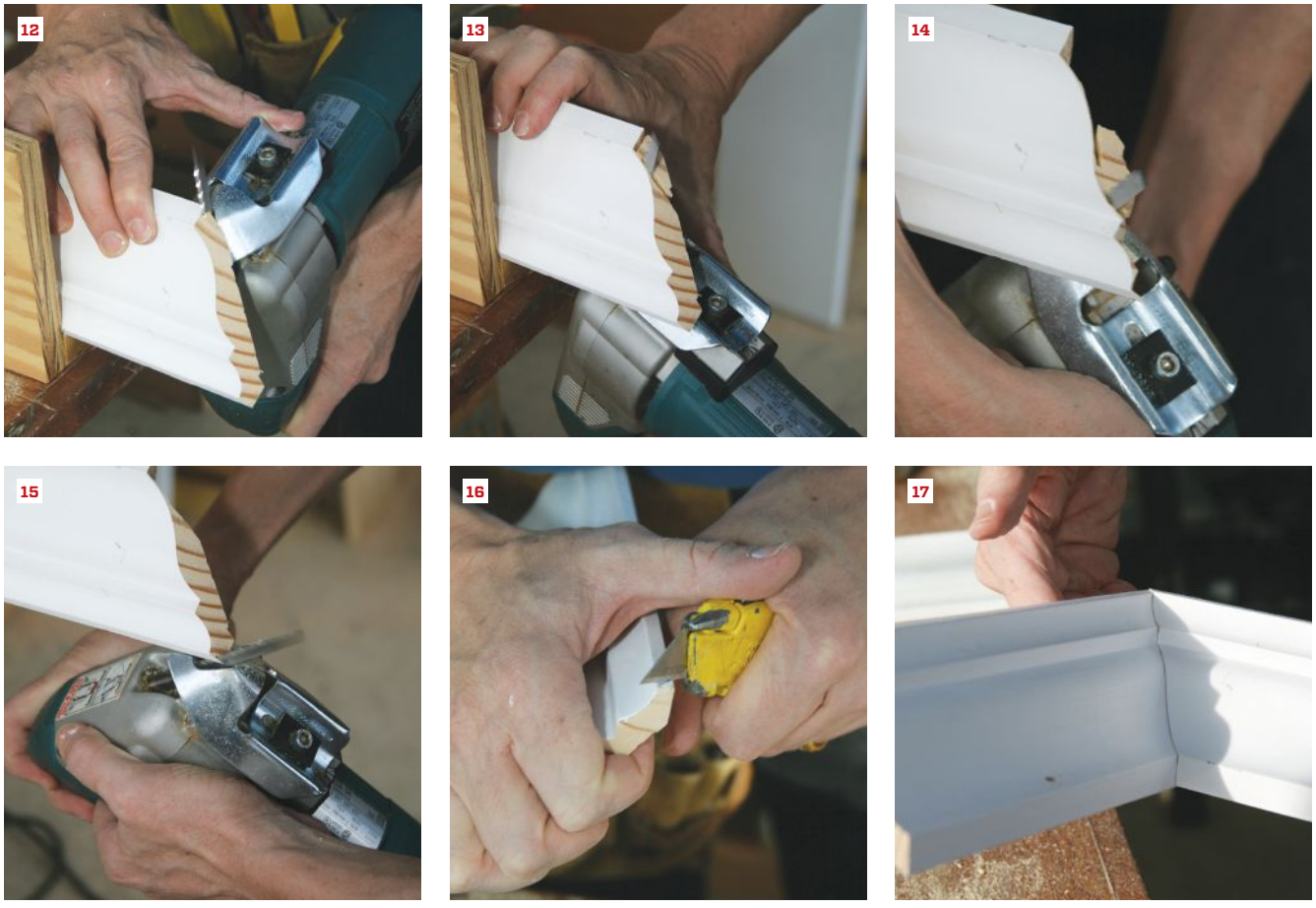
It's possible to follow the profile from one side to the other, rotating the blade of the saw as you go. But it's much easier if you make relief cuts at critical points of the profile to let the waste fall away so that you can approach different parts of the trim from different directions.

Let's look at coping a couple of common profiles, beginning with cove molding. After cutting the end at 45 degrees, use the coping saw to cut into the straight, vertical section of the molding **(2)**. Then cut in from the other side of the profile. The 45-degree-angle sliver on this side can be fragile, so carpenters often begin with a square cut **(3)**. Making short, quick strokes with the coping saw, follow the curve of the cove until the blade meets the original cut **(4)**, which lets the waste fall away. The final cut should then fit snugly into the opposing piece **(5)**.

Coping base cap molding is a bit tougher. After making the 45-degree cut, cut in straight from the bottom of the molding **(6)**. (Because the molding sits on top of the 1-by baseboard and the bottom of the profile won't be seen, cutting the fragile point isn't necessary.) Next, cut in from the end of the board and follow the profile over to the first cut **(7)**. With a large chunk of the waste removed, follow the profile from the opposite direction until the cuts meet **(8)**.

Now, cut out the small profile at the top of the molding **(9)**. To fine-tune the cope, make a tight roll of sandpaper and work the edge of the cope over to the exposed finished face of the molding **(10)**. As with the cove molding earlier, you can use a butt cut at the top of the base cap **(11)**.

Alternative coping tool. Several years ago, a very inventive craftsman, Dave Collins, developed an attachment for jigsaws called a Collins Coping Foot. The Coping



A coping foot mounts on a jigsaw in place of the footplate. The top three photos **(12–14)** show a typical sequence. For a mitered look, cut the angled sliver **(15)** and make a relief cut in the mating piece **(16)** so the two sides fit together **(17)**.

Foot replaces the footplate of a jigsaw and turns it into a coping machine. Collins says that it works best if you make a jig to hold the work—using the jig, you'll be able to make the cope cuts much more quickly and safely.

To cut crown molding with a coping foot, the approach is essentially the same. You start with a cut at the top **(12)** and then approach from the opposite angle to meet that cut **(13)**. Continue this process back and forth until you have cut out the entire profile **(14)**. The key is to have firm control of the jigsaw at all times, with your fingers away from the blade either pushing or pulling the saw.

Creating the mitered look. If you've executed your cope accurately, the only place where the miter is visible is where the profile returns to the corner. With the base cap, the return is at the top of the profile. With crown molding, it's at the bottom. For both the cove and the base cap in the photos, the carpenters elected to butt the top of the cope. The alternative is leaving the angled cut and cutting that point to a sliver during the coping process **(15)**.

At this point, many carpenters (including myself) have made the mistake of trying to install the coped side directly over molding on the other side. But because the sliver is so delicate, it is apt to break off as the two pieces come together. Instead, use a razor knife to make a relief cut in the top end of the mating piece **(16)**. The cut needs to remove just enough material to let the sliver nest into place to complete the look of a mitered cut **(17)**.

One final word about coping: The tighter the fit, the better the coped joint looks. When cutting the coped piece to length, add a little extra to the measurement. As you install the piece, the extra length lets you spring the board into place. The extra pressure makes the coped joint tight and pretty. If the coped trim doesn't end at an opposite wall, give the free end a light tap with a block and a hammer to take any slack out of the coped joint.

Roe Osborn, author of Framing a House *and* Finishing a House*, is a senior editor at* JLC.

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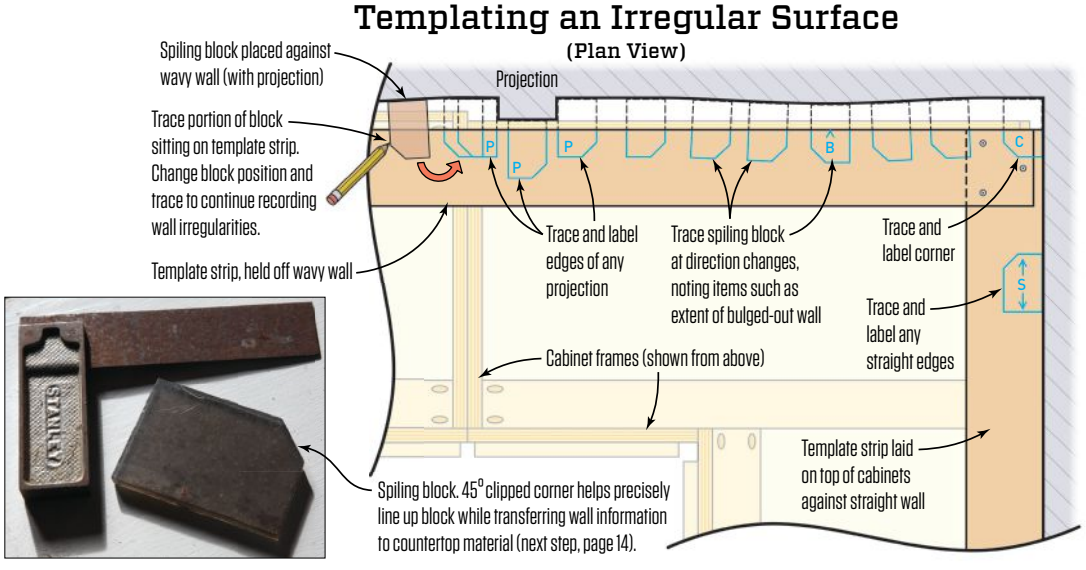
Q What is the quickest and most accurate way to template a countertop in an old house with wavy walls and odd projections?

A Roe Osborn, senior editor at *JLC*, and author of *Finishing a House*, responds: I spent quite a few years working as a joiner in a boatyard. For that job, most of the templating we were asked to do involved curves and irregular surfaces. The tool we reached for most often was called a "spiling block."

A spiling block is typically a small rectangle made of some sort of hard material. I still use a spiling block that I made back then from a 2x3-inch scrap of 1/4-inch-thick plastic sheeting (see photo, below), but I've made others from thin plywood or hard laminate. (The exact size is not important, but the block I made fits nicely in my toolbox and tool bags). To make a spiling block, cut a rectangle with square sides. Then cut an indexing corner at a 45-degree angle.

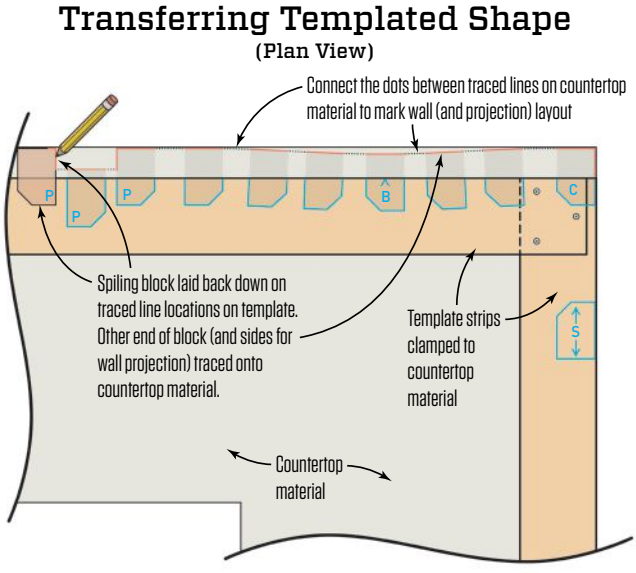
For the template itself, I cut strips of 1/4-inch plywood 3 to 4 inches wide. I start with a strip along the straightest wall and screw it to a strip that runs along the wall with the irregularities. Be sure that the template strips are well attached and stable at the corner (some folks use hot glue, 5-minute epoxy, or diagonal strips in addition to screws). Continue building the template until you have strips on all four sides. Secure the template to the cabinet or structure below that will be supporting the countertop.

Slide the square corner of the spiling block into the wall corner or at the end of the wall, and hold the block down firmly against the template strip. Using a sharp pencil, follow the entire end of the block that has the 45-degree index cut, tracing it onto the template strip (as shown in the illustration, below). Now work your way along the irregular surface, sliding the block against the wall and tracing the block onto the strip. Repeat this process at several places along the wall, particularly where the surface changes direction, flattens out, or goes from convex to concave. Write labels or make notes on the template to indicate key locations, such as a corner or a place where there is a change of direction.



To template an uneven surface with projections, make a template from plywood strips. Slide a small, solid block known as a spiling block (see photo) against multiple points along the curve and trace the end of the block onto the strip. Make notes on the strip for things such as the corner or the projection outline.

Photo by Roe Osborn; illustrations by Tim Healey



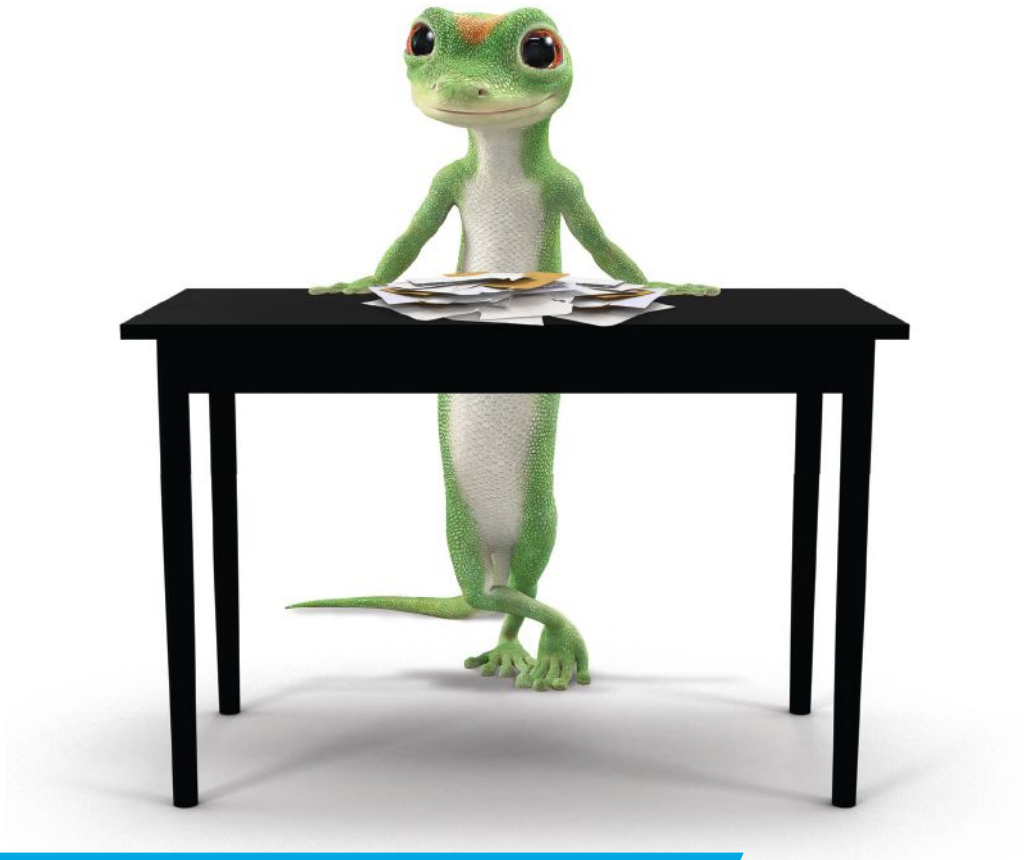
To transfer the template to the countertop, place the spiling block on the traces and mark the other end of the block.

To transfer the location of a projection such as a plumbing or electrical chase onto the template strip, use the spiling block to record all of the sides, again labeling each trace that you do. If the block can't reach all the way to a certain point (such as an acute angled corner), trace the block while holding it against the wall or surface with the long point. Then measure from the traced corner point on the template strip to the long point of the corner and write that measurement on the template. When you transfer the template to the countertop material, simply extend that line to the distance you wrote down.

When you've finished templating the entire irregular surface and have labeled any anomalous places, carefully remove the template and place it on the countertop material. If there is a finished straight edge on the material, align the straight edge of the template along that side.

Firmly but gently clamp the template to the material, taking care not to distort the template. Set the spiling block back on the template, and align it with every trace that you made (as shown in the illustration, left). At each location, trace the other end of the block onto the countertop material, continuing the process until you have transferred every position that you marked on the template.

Now connect the marks on the countertop material. If the curve is subtle, you may be able to connect them with straight lines. If the curve is more pronounced, use a flexible batten to connect the marks for a fair and even curve. When the line is complete, you're ready to cut the irregular edge of the material to the line for an exact fit.



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Airtight Attic Access

BY STEVE BACZEK

When you're sealing a residence against air leakage, some details are simple, while some require a little more attention and finesse. In a home with a vented attic, no detail can be harder to implement than the attic hatch. (Because the term "hatch" conjures up bygone images of doors that swing up or ladders that swing down, let's just call the assembly the "attic access.")

Red-line continuity. When you execute the air barrier red-line test (see "Air Barrier Basics," Jan/19), the attic access is a pretty small portion of the entire red line around a house. But it is often a major contributor to air leakage problems.

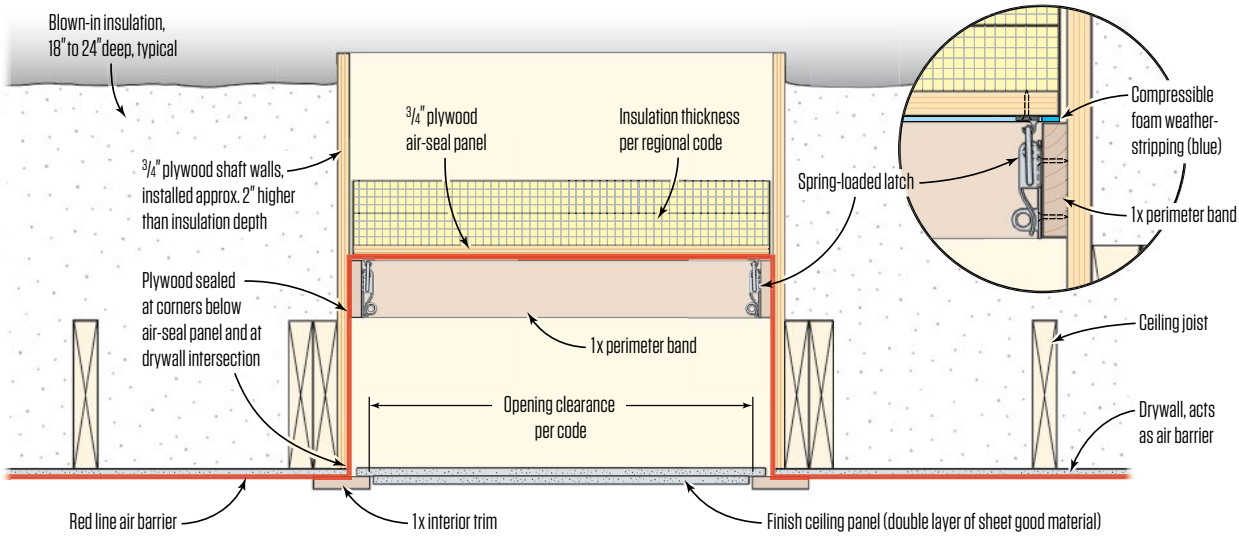
Because the access is usually located in the interior space of the house, some see it as merely a "partition" between a hallway and the attic, and they don't give it the attention it deserves. But the inside face of the access is *inside* the air barrier, and the outside face is *outside* the air barrier, making the access an integral part of the red-line continuity of the air barrier (see Airtight Attic Access, below).

Multifunction component. In addition to providing access to the attic, the assembly shown below works as an insulation dam. In many of the high-performance homes I design, it is not uncommon to have 18 to 24 inches of blown-in cellulose in the attic, so the shaft portion of the attic access is necessary to keep the insulation in place. The four walls of this shaft should always be a little higher than the depth of insulation being retained **(1)**.

Because of its height, the attic shaft lets us incorporate two removable access panels, instead of just the usual single doorway to the attic. The first is the ceiling panel that you see from the interior of the house that completes the interior ceiling finish, closing off the attic shaft from view. A second air-seal panel is farther up the shaft of the attic portal—high enough so that the ceiling panel can be lifted and removed easily **(2)**. The air-seal panel functions much the same as an exterior door on a house and should be thought of as an operable boundary element between the inside and the outside of the house. It should be fitted with rigid insulation per regional code requirements.

Building the assembly. In most houses with ventilated attics, I use the ceiling drywall below the attic as the air barrier. I think of the four walls of the shaft as simply that air barrier folded up into the attic. (As a cautionary note, be sure to consult your local building code

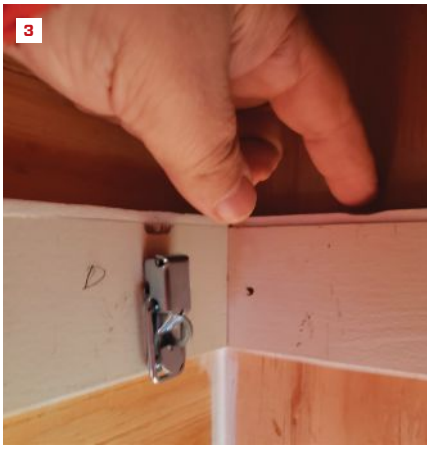
Airtight Attic Access

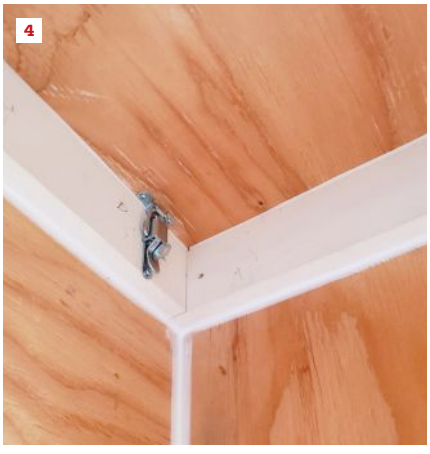


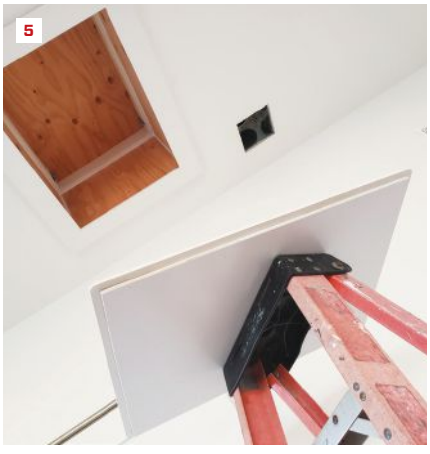
The attic access provides a portal to the attic space, while being integral to the "red line" air barrier. The walls of the assembly also act as a dam to retain blown-in insulation in the attic. The finish panel visible from below does not have to be airtight.

Photos by Steve Baczek; illustration by Tim Healey

Viewed from below with the ceiling panel removed, the walls of the access extend far enough up to retain the blown-in insulation **(1)**. With the airtight panel in place and all the corners sealed, the access completes the air barrier of the house **(2)**.







Compressible weather stripping on top of the 1-by perimeter band creates the air seal **(3)**. Spring-loaded catches hold the airtight panel in place **(4)**.

The finish panel slips into the opening and rests on top of the trim **(5)**.

for the required clearance dimensions needed for the access portal).

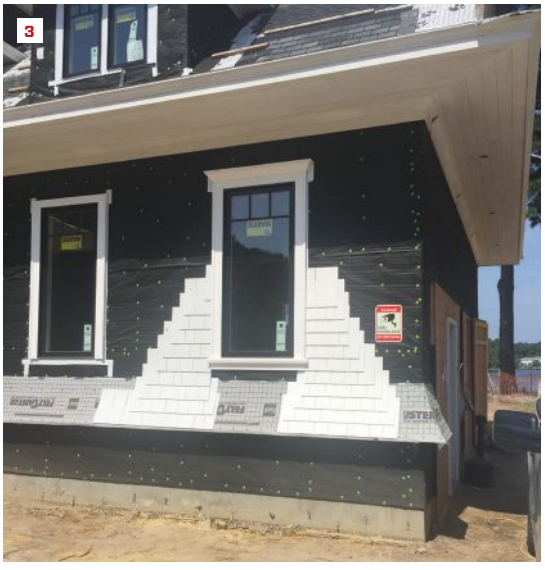
After framing the opening, we typically build the shaft out of 3/4-inch plywood. We seal the wall panels of the shaft where they interface with the ceiling drywall. In addition, we seal the corners of the shaft up to where we install a 1-by perimeter band that supports the actual air-seal panel, and we also seal the perimeter band to the walls of the shaft.

The perimeter band creates a solid shelf where the air-seal panel (also made from 3/4-inch plywood) can be pressure fitted. Typically, we install 3/4-inch-wide adhesive-backed, compressible weather stripping on top of the perimeter band **(3)**. We attach the air-seal panel to the perimeter band via four spring-loaded latches (such as National Hardware N208-587 Lockable Catches) **(4)**. The latches let the panel fully engage with the weather stripping to provide a good air seal and to maintain near-perfect continuity of the air barrier.

What you see. With the air-sealing duties taken care of, there are many ways to create the attic access's finish panel, which is visible from below. The simplest strategy starts by framing the opening in the ceiling with 1-by trim, making the inside dimensions of the frame slightly smaller than the shaft opening.

We typically make the finish panel from two layers of sheet goods, with the top layer larger than the bottom to create a rabbeted edge **(5)**. The larger layer rests on top of the lip of trim inside the perimeter of the opening, and the smaller layer sits inside the trim for the finished surface. Because this panel is just for looks, no additional sealing measures are required.

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



Photos by Rick Mills

Practice Makes Perfect

BY RICK MILLS

"Let's mock it up" is a catchphrase often used at Jackson Andrews Building + Design (JABD), where I work as a project manager. That's because we've found that it's easier for clients to understand a building detail or a final product by looking at a full-scale mock-up than by trying to decipher an architectural drawing. The problem we kept facing is that, without this visual aid, our clients often lacked confidence in their decisions and final selections.

We were first prompted to use this approach during a site meeting for one of JABD's first renovations, when a client looking at the drawings for interior columns and archways was having difficulty picturing what the architect had envisioned. This left us with two choices. The first was to explain to the client that we were at a standstill until she could decide what she wanted to do; unfortunately, if she didn't like it afterwards, we could redo it but would have to charge a fee. Our second option was to grab some scrap material and quickly assemble half of the column, which would allow us to show her what the dimensions and profile would be in full scale. We knew the costs involved to do this were minimal, while the clarity it would provide our client would potentially save more time in the end. This approach would also give the client reassurance that she wasn't committing to a building detail she might not like and potentially would have to pay an additional amount to redo.

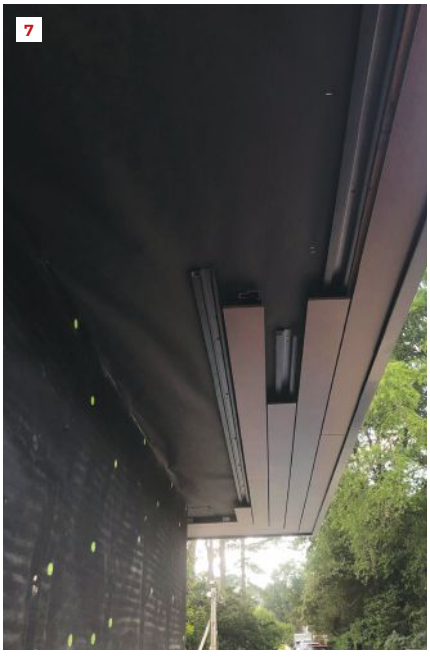
It worked like a charm. The client felt confident with the design and knew exactly what the finished product would be; the carpenter knew that—as long as he followed the mock-up—he would only have to do it once; and JABD now had a hard sample that all involved—contractor, carpenter, and client—were accountable to.

From that point on, mock-ups have become an essential part of our selections process. One simple example is the time we turned an entire wall into a paint sample, giving our client plenty of time to examine the color in different light. Another time, we installed a few square feet of a chosen tile, but with different grout colors **(1)**. We often quickly trim out a couple of windows with different interior and exterior casing details so clients can see how the profiles look in real life and compare them **(2, 3)**. We worked on a much larger scale on another project, erecting a 3,000-square-foot full-size walk-through portion of a new home that we were about to build. No matter the size, each mock-up serves the same purpose: to provide the client with enough detail to feel confident about their selection and avoid re-dos.

Recently, we discovered another benefit to our mock-ups:

It's easier to choose grout colors from a sample than from a color chart **(1)**. Before drywall installation, interior **(2)** and exterior **(3)** trim options can be mocked up. Selecting siding color is also easier when it's seen in natural light.

This small structure started out as a jobsite office **(4)** but soon became a perfect place to test different combinations of windows and claddings, including a thin adhered stone veneer in various colors and a rainscreen cladding system **(5)**.



A full-scale mockup allows clients to visualize the difference between raked and full mortar joints in the stone cladding and the mitered Parklex cladding corner detail **(6)**, and the effect of using a narrower, 4-inch version of the cladding for the soffit **(7)**.

installation verification. After evaluating the schedule for an upcoming project, we decided to build a small, on-site office. Our intent was to keep it simple and dried in, but it didn't take long to realize we had just constructed the perfect mock-up scenario: a shell that could not only receive different exterior wall claddings, windows, stone facade design, cornice details, and roofing but also serve as a testing platform for the installation of each component **(4)**.

As design and selection ideas for the project progressed, so did our mock-up, which has been crucial not only for the aesthetic evolution of the project but also for the building envelope's design. We have a platform to test the performance and integration of key components of the project, such as the Parklex rainscreen cladding system, flangeless windows, concealed gutters, metal roofing, and more.

Our mock-up also gives our team a chance to "practice" installing new materials with new methods. We've seen this lead to more productivity once we begin the actual installation, because we've had the time to work out unforeseen issues that sometimes arise with unfamiliar products. For example, we've been able to fine-tune the window positioning with the wall cladding panels, which have a double-rail mounting system that creates a nearly 3-inch gap between the face of the sheathing and the exterior face of the cladding **(5, 6, 7)**.

At this writing, the project's foundation is underway, and as we approach the framing stage, we have an architect, a designer, a builder, and—most important—a client who are all confident in the assembly, performance, and aesthetic of the design.

Is our "mini-house" overkill? We don't think so. Like the majority of our clients, the owners don't design and build residences every day, and the choices and questions we present to them can be unfamiliar and challenging. Our approach eases their stress level, and they no longer feel the pressure of "speak now or forever hold your

The roof has a wide overhang with a copper-lined hidden gutter **(8)**. The crew tested a standing-seam roof installation over sleepers, rigid foam, and sheathing **(9)**, but the panels deflected even with sleepers installed on 8-inch centers **(10)**. The final decision was to eliminate the foam and separate the panels from the sheathing with a high-temperature underlayment **(11)**.

peace" before making a commitment to any selection. And it gives our trade partners the chance to work out new details, such as the concealed-gutter design **(8–11)** that we first learned about in *JLC* ("Concealed Gutters for a Modern Lake Home," Aug/18).

Not every project warrants a "mini-house," of course. Still, we strongly believe that the only way to fully grasp the real thing is by seeing it, no matter what the appropriate scale is for the project. One of the most important responsibilities we have as a general contractor is to communicate well, both to our clients and to our trade partners. Mock-ups help prevent miscommunication with a client by taking the guesswork out of what may have been "talked about." With a trade partner, a mock-up provides a reference point that we can both look to, confirming that our subs are actually building what was approved by the client. No matter the scale of the job, mock-ups create client confidence as the project progresses, leading to a more enjoyable building experience for all involved.

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.

Water Management for a Deck Attachment

BY TED CUSHMAN

Attaching a deck to a house offers a twofold challenge. You have to make a strong, positive structural connection that resists lateral loads as well as gravity loads, and you have to detail the juncture to manage water from rain, snow, and roof runoff.

Mark Pollard and his crew from Thompson Johnson Woodworks tackled the problem recently using the Maine Deck Bracket (deckbracket.com), a standoff deck attachment component. The Maine Deck Bracket manages the structural problem handily, but it requires the builder to think through the water management details. Here's how Pollard integrated the deck brackets into a building's water control layer.

The manufacturer requires the bracket to be bolted directly to structural framing—you can't sandwich sheathing between the bracket and its attachment point. So Pollard started by protecting the home's doubled LVL band joist with pieces of self-adhered membrane (FortiFlash Butyl from Henry Co.) where the brackets would be installed. He then through-bolted the deck brackets to the band joist with 1/2-inch bolts and spaced them no more than 4 feet apart, as required by the manufacturer. (Attaching the Maine Deck Bracket with lags is approved only if the member being fastened to is 6 inches thick. In this case, the doubled LVLs added up to only 4 inches thick.)

Next, Pollard applied a thick bead of Dowsil 758 Silicone Weather Barrier Sealant to the LVL, going up the sides and over the top of the deck brackets. Then he sheathed over the framing with 1/2-inch plywood, cutting holes in the sheathing to leave about 3/4 inch of room around the brackets.

Below the brackets, Pollard applied small patches of Henry Blueskin VP100 self-adhered air barrier membrane to the plywood. Next, he applied a coating of vapor-permeable Henry Air-Bloc LF Liquid Flashing to the plywood edges, lapping onto the base of the deck brackets and covering the bolt heads. Then he applied Henry

Deck brackets are bolted to the floor frame **(1)** through protective patches of FortiFlash Butyl membrane **(2)**. The brackets and sheathing edges are sealed with Henry Air-Bloc LF **(3, 4)**. The bracket faces are isolated from treated framing with FortiFlash **(5)**.

Photos by Mark Pollard

Blueskin to the entire wall, slitting the Blueskin to fit around the webs of the deck brackets.

Where the bracket webs project through the Blueskin, Pollard sealed the Blueskin to the metal webs using Henry Crystal Clear Sealant. That's the same sealant Henry specifies for situations such as reverse laps over window heads.

Next, Pollard applied FortiFlash Butyl to the faces of the deck brackets. "I used the FortiFlash to act as an isolation membrane between the aluminum bracket and the copper-treated wood," Pollard explains. "We're using MCA (micronized copper azole) treated lumber, and it's got low reactivity. But it couldn't hurt to protect the aluminum. It's good practice."

Finally, the crew attached the doubled 2x12 PT ledger beams and continued on with framing the deck. The deck framing will make the wall a little difficult to access for installing the siding system (a rainscreen with cross-strapping behind 1x5 tongue-and-groove white cedar, run vertically). Pollard's plan was to fasten the ends of the siding boards from below using stainless steel trim-head screws, driven in at an angle.

After working with the Maine Deck Bracket a number of times, Pollard is a fan. "One of the reasons I like them so much is that you're not interrupting the water flow," he says. "When water hits the siding, it continues right down to the bottom of the siding and drops out. It's not coming over the top of a deck ledger flashing, and running down the face of a deck ledger."

Installing the deck brackets takes more time than a traditional ledger, says Pollard, "but I feel that it's a safer, more durable connection. And it also satisfies the lateral load provisions in the code, so you don't have to put on those extra deck tension ties. I think it would be a pretty rare case where I wouldn't want to use these things."

Ted Cushman is a senior editor at JLC.

After bolting the double 2x12 standoff deck ledger beam to the deck brackets with hot-dipped galvanized bolts **(6)**, the crew installed galvanized joist hangers **(7)** and hung the deck joists **(8)**. Deck framing continues down the side of the building and around the corner to the rear, facing the ocean **(9)**.

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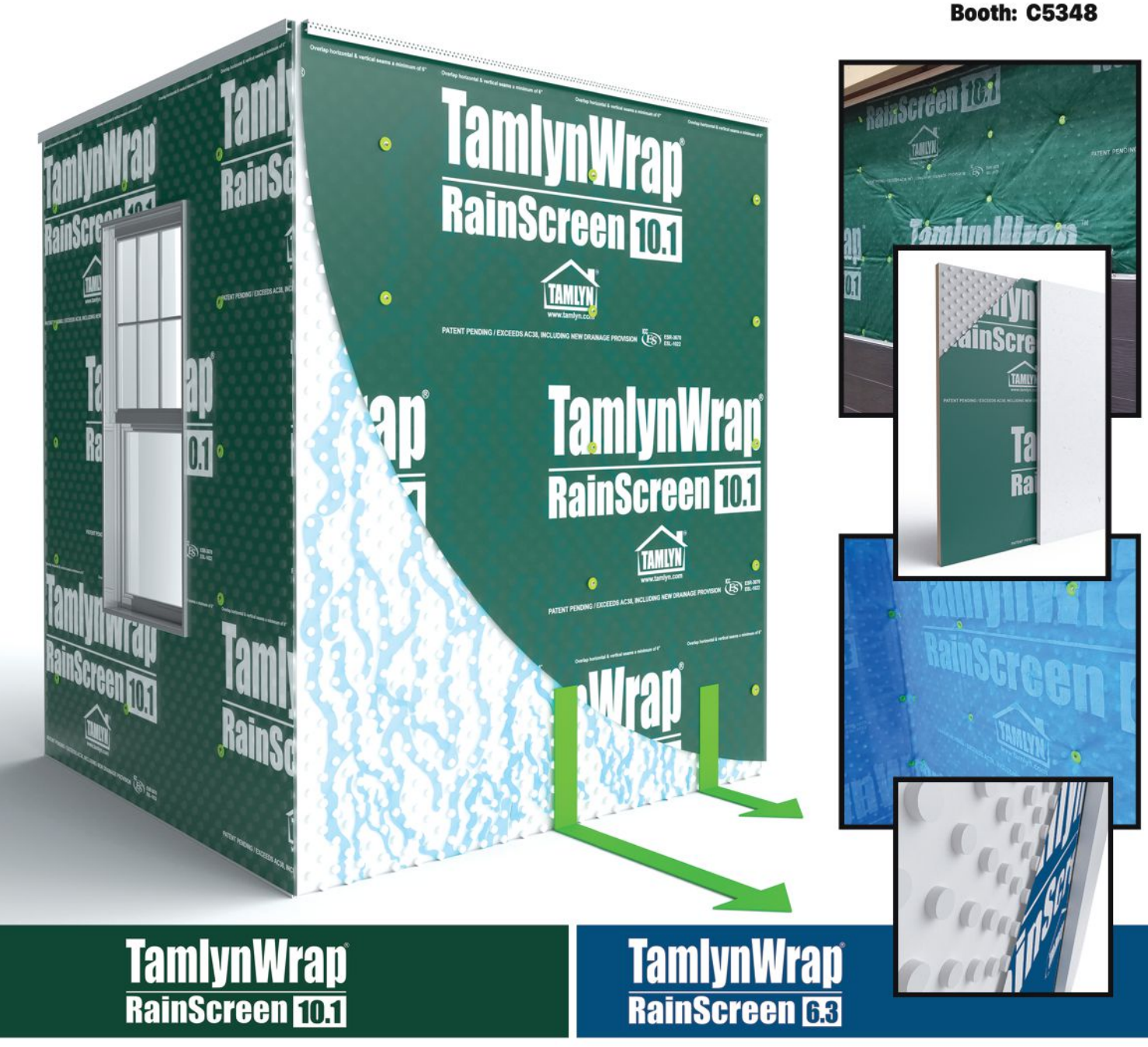

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BY IAN SCHWANDT

Building a Worker-Centered Crew

Part 3: Rough-In

The previous articles in this series laid out the foundation for creating a worker-centered company—a company that provides the structure for the full development of its workers and their neck-up and neck-down skills—and the framework (based on an understanding of how the inexperienced worker learns) for how to teach workers the essential skills to be productive tradespeople. These skills, once learned, exist inside the mind and body of the tradesperson in the same way the rough mechanicals of a home exist under the drywall: largely out of view but crucially important. Defining these "rough-in" skills is the focus of this article and the key for unlocking the potential of the "crew member" point of the company structure triangle.

WHAT'S ALREADY ROUGHED-IN?

Anyone who has ever hired a "greenhorn" for construction site labor has a method for determining if the potential hire is worth putting effort into. Very early in my career, I was given an opportunity solely based on having matched the foreman stride for stride as he quickly walked me around a job. I soon realized this was his technique for quickly determining what skills I already had roughed-in.

When I meet a potential hire, I look for signs of rough-in skills that show me an ability to work hard, work safe, stay busy, and stay organized. Being on time for an interview and showing up dressed for and ready to work are good indicators of roughed-in skills. My personal favorite is watching where potential hires park their vehicle when they come to the jobsite for the first time. Most residential jobsites are tight on space, and a good lead always has an efficiency hierarchy in mind when it comes to the jobsite parking lot. Any of these examples will exhibit a level of pre-roughed-in skill that increases the likelihood of the candidate being successful in the long term.

ACTIVE ROUGH-IN

The important rough-in skills that I look to impart onto a new tradesperson fall into both the neck-up and neck-down categories. In Part 2 ("The Framework") of this series, I discussed how critical these initial skills are in moving new workers past day zero and setting them up to gain confidence. Since we rarely arm a novice immediately with power tools, I will start with a rundown of the neck-up skills that I have found to be the most beneficial to the worker, the job, and the company.

Measuring. The humble tape measure is a tool that is of such importance to the building trades that many of us own dozens of them that we favor for specific uses. But this tool also confounds and confuses even the most experienced tradesperson from time to time. In terms of general use, I have found a common roadblock is around understanding fractions and what they mean. Learning that $^1/_2 = {}^2/_4 = {}^4/_8 = {}^8/_{16}$ goes a long way toward making sense of "the little lines" and, most importantly, illustrates the basics of performing math with fractions.

It's also important to understand that a measuring device, be it tape, stick, wheel, or laser, is only a reference. The measured length of something is directly proportional to the tool used to take the measurement. Measure a stud with two tapes and depending on your tolerance, you will likely get two different measurements.

Being on time for an interview and showing up dressed for and ready to work are good indicators of roughed-in skills. My personal favorite is watching where potential hires park their vehicle when they come to the jobsite for the first time.

Seeing. The ability to quantify something through measurement is enhanced by learning how to see. The majority of the work we do in residential construction can be broken down into a series of squares and triangles. Once a young tradesperson can see both a stair stringer and a common rafter as the hypotenuse of a triangle, they can use their measuring skills to apply the simple geometry needed to think through simple layout tasks.

From the all-important 3-4-5 triangle to bisecting angles and lines to finding the center of a circle, the ability to see the underlying geometry of our work as builders is a fundamental skill that can unlock high-level skills early in a novice's career when it is mated with working knowledge of measuring tools and the ability to draw.

Drawing. In the field, we rely on drawings to inform us and

interpret the intent of the designer or architect. Drawing at full scale on the jobsite, usually on a plywood cutoff, is an important skill that is the bridge between seeing and measuring and producing work. Many talented craftspeople believe that they lack the artistic talent to draw. But drawing a detail on the job is less about art and more about harnessing an ability to see and measure. Understanding how to draw at full scale is key to executing complex details. Everything is complex to the beginner. Drawing at full scale works to remove that complexity and sets a novice up to understand a set of plans.

Tool use. As we move to neck-down skills, I want to highlight the principle of "the tool is an extension of you," as it is one of the most important concepts that I have learned in my career as a tradesman. Neurologists studying tool use in primates and humans have found that, even after short periods of tool use, the tool is incorporated into the brain's representation of the body (body schema) in the surrounding space (peripersonal space). The ability to swing a hammer and strike your target is possible because of the connection between hand-eye coordination and body schema.

Many of the tools that we use every day can be confusing and dangerous to a novice. Knowing that the majority of tools we use are designed to work within our body's natural range of motion informs every step taken to execute a task with the tool by the user—if using the tool is physically uncomfortable, you are probably using it wrong. As a novice builds experience in using hand and power tools correctly, the brain begins to add the tool to the body schema.

Tolerances. One of the most challenging things to convey to a novice tradesperson about the carpentry trade is what level of tolerance is appropriate for the task at hand. There are a number of ways to do this, but I begin with how to strike a line by pencil or knife, emphasizing that this line, be it on wood, concrete, or drywall, sets a foundation for tolerance and provides a basis for communication. Lines have width and depth in addition to length. Something as simple as striking a line is an important skill of its own, but it has a more important role: It sets a standard of tolerance.

Building is challenging, but motivating and engaging individuals with a foundation of basic roughed-in skills needed for building is even more challenging. This is a primary goal for a successful building company. In the next article, I will speak to the requirements of the other points of the triangle: the company and the crew members themselves.

Ian Schwandt is a lead carpenter from central Wisconsin with experience leading commercial and residential projects in the Midwest and Northeast.

Review: 'Nail Your Numbers: A Path to Skilled Construction Estimating and Bidding'

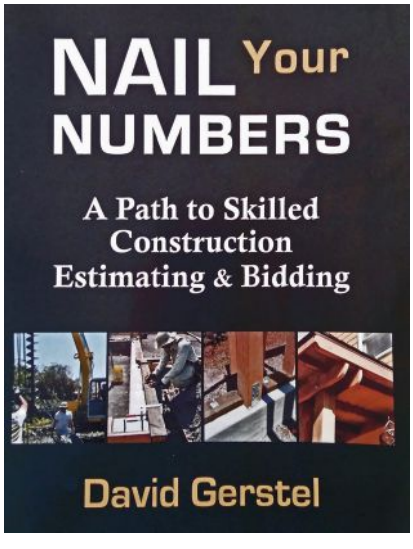
BY DAN KOLBERT

The typical progression of a building contractor is this: You work as a carpenter, start doing work on your own, hire a helper, hire an experienced carpenter, start doing more complicated work, and, before you know it, you're doing a half million in volume and realize you don't actually know if you're making any money or not. At that point, you start looking for resources that can help you move from busy to profitable.

For more than a generation, one of the first books people turned to was David Gerstel's classic, *Running a Successful Construction Company*. It helped countless contractors navigate the perilous path, and we were lucky that Gerstel was not only so well organized but such a good writer.

Now, Gerstel has come out with a book that, I think, will prove even more essential. In *Nail Your Numbers: A Path to Skilled Construction Estimating and Bidding*, Gerstel has put together a book that is as well-organized and comprehensive as his estimating system. Getting through its almost 400 pages is a serious undertaking, but contractors at any phase of their careers can profit from the book.

The book is divided into five parts comprising 19 chapters. Chapter 1 is titled, appropriately, "The Heart of Our Business" and is a full-throated defense of why estimating is where a company is made or broken. Gerstel has been a careful student of the subject and is



In this review of David Gerstel's latest book, the author predicts that *Nail Your Numbers* will become "even more essential" to building and renovation contractors than Gerstel's first book, *Running a Successful Construction Company*, which is widely considered an industry classic.

generous in acknowledging all the other contractors and writers whose work has helped him along the way.

After this, he dives into the nitty gritty. Each chapter is a deep dive into a subject, starting with such easy-to-overlook issues as where are you actually working? Is it comfortable? Quiet? He also takes the time to make sure the reader understands what a complete set of plans includes, points out some common mistakes, danger signs, or complications in plans, and even goes over some basic math estimators need. In fact, he spends the first three chapters solely on making sure the reader is ready to dive into an estimate.

Part 2 is really the heart of the book—creating your estimating system. Over the course of five chapters and almost 100 pages, Gerstel goes through, literally, the nuts and bolts of creating an efficient but comprehensive estimating system—"if you have 100' of foundation and are spacing bolts every two feet, you will need 50 AB's (100÷2=50), plus one more for the end of the run."

In addition to valuable discussions on things like how to do a comprehensive site visit, how to develop waste factors, and how to create clear and well-organized take-off forms, there are innumerable sidebars in which Gerstel illustrates his points with stories drawn from his own or others' careers. Topics range from how to say no to a job and knowing the level of risk you are comfortable with to various pitfalls he and others have encountered along the way.

As someone who is in mid-career, I found his chapter on General Requirements particularly valuable. He argues convincingly that this phase—comprising all the things that are part of, but don't become a permanent part of, a job—is where many contractors lose untold thousands. Gerstel himself says he found that "General Requirements consistently amounted to close to 10% of direct construction costs."

What is included in this mysterious category? The book includes a selected list with more than 100 items—everything from preconstruction costs like permitting and plan check, to construction costs like cleaning, getting materials, scaffolding, and snow removal, through post-construction service calls and project management during the job. His compelling argument for why all these costs belong together convinced me to adjust my own bid spreadsheet and move where I entered certain costs. At a minimum, these adjustments will allow me to track all these somewhat amorphous costs as a percentage of job total with more accuracy in the future.

The rest of Part 2 consists of deep dives into various facets of a successful estimate—specific phases like interior and exterior finishes, how to get good estimates from subcontractors, how to write scopes that accurately reflect the work proposed (and, just as important, what is not included), and more. The sections can be dauntingly detailed—this is a book that will require focus and return trips to benefit from it. But anyone wanting to benefit from the accumulated knowledge of a successful and systematic contractor will be well advised to put in the time.

While many people have put together good estimating systems, where Gerstel stands out is in the subject of Part 3—"Capture Your Costs." His focus is, rightly, on the area most of us struggle the hardest with—our internal labor productivity rates. He takes us through his steps for setting up, tracking, and using a well-organized, clear set of assemblies based on carefully collected historical data. He also gives examples of adjusting data to account for different conditions (access, first vs. upper floors, fussy details, difficult client, and so forth). His recommendations are a challenge to implement, but will yield a treasure trove of essential information for the remainder of any building contractor's career.

This is a book that will require focus and return trips to benefit from it. But anyone wanting to benefit from the accumulated knowledge of a successful and systematic contractor will be well advised to put in the time.

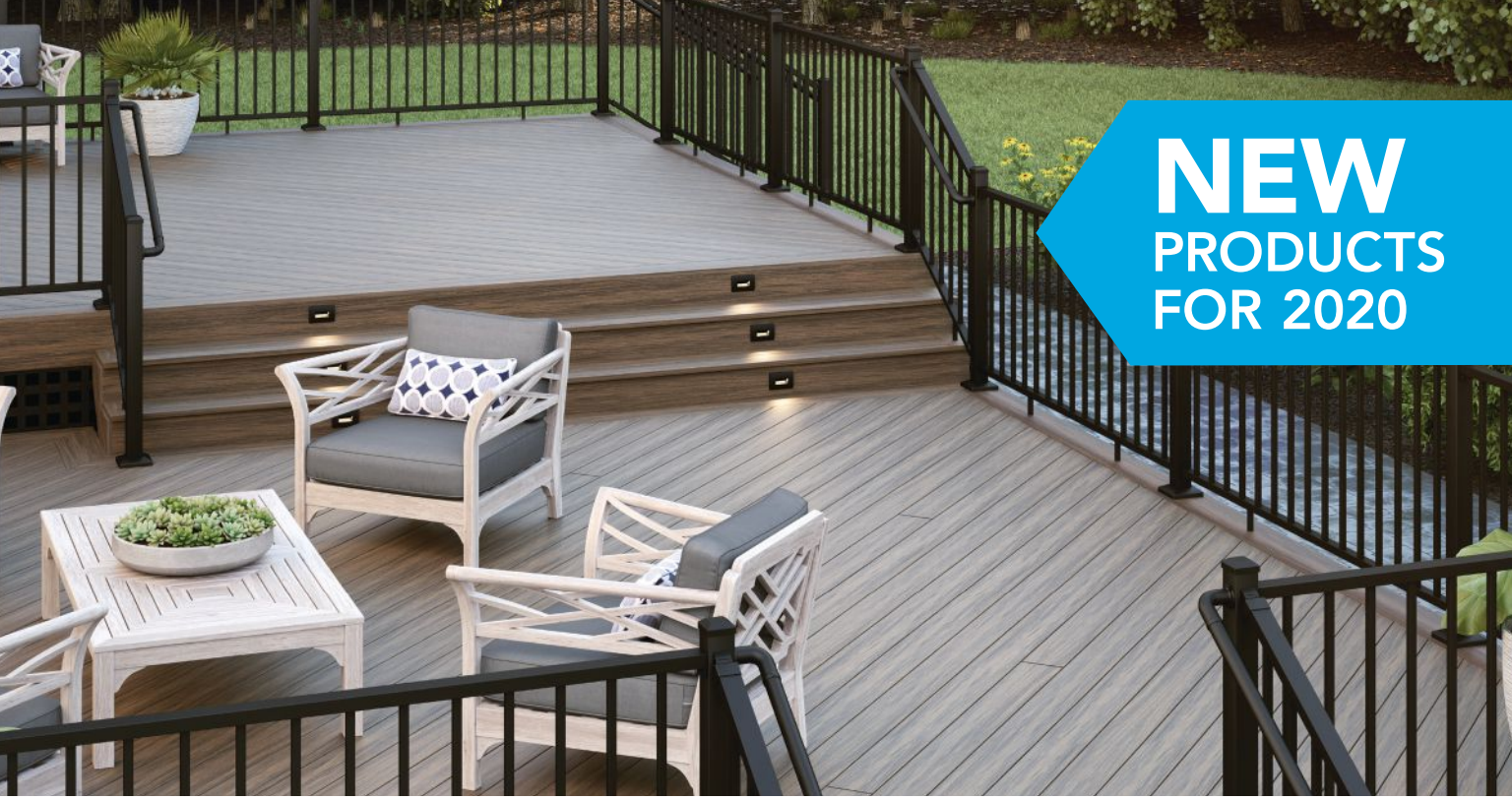
Several times in the book, Gerstel makes the important point that estimating is an administrative function, while pricing the job is a management function. It is the job of the estimator to figure, as accurately as possible, what it will cost to produce the job. What to actually charge the client, however, is a different question and should be considered separately. This is largely the subject of Part 4, "Take Command." This section of the book helps you consider questions like how to recoup overhead and make a profit, then moves on to other nettlesome issues like change orders, contract writing, and charging for estimates.

He also returns to a related subject he discussed in *Running a Successful Construction Company*—Capacity Based Markup. He argues that, since total volume may fluctuate significantly from year to year based on how much material we use or how many subs we hire, we should base our markup (and thus our coverage of overhead and profit) on the constants—either the number of project leads we have or the total number of billable hours we expect our crew to produce annually. I have long found this argument compelling and find that the approach helps provide a more accurate sense of risk and reward on both labor-light and labor-heavy jobs. His treatment of the subject is, not surprisingly, thorough and well-reasoned.

The final section is a brief discussion of the pros and cons of various software solutions. Not surprisingly for someone who clearly excels (foreshadowing alert!) at creating his own systems, Gerstel comes down firmly on the side of creating custom spreadsheets that meet your needs, rather than signing up for integrated packages.

Fortunately for us business-challenged contractors, there are an increasing number of valuable books to help with what is, ultimately, a challenging way to make a living. *Nail Your Numbers* is, I'm confident, destined to be a central work for contractors and is one of a small number of those books that I would say are essential.

Dan Kolbert is the owner of Kolbert Building, based in Portland, Maine.



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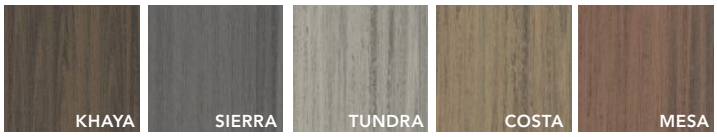

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Architectural Compactness and Hot-Water Delivery

To satisfy homeowners, cluster water heaters and fixtures

BY GARY KLEIN

Photo: Ted Cushman/JLC; illustrations by Tim Healey

Over the past three decades, I've canvassed thousands of people and asked them what they expect from their hot-water delivery system. The results are virtually unanimous: First, almost without exception, people want hot water to come out of their tap within a few seconds of turning the faucet. Second, people don't want to run out of hot water, ever.

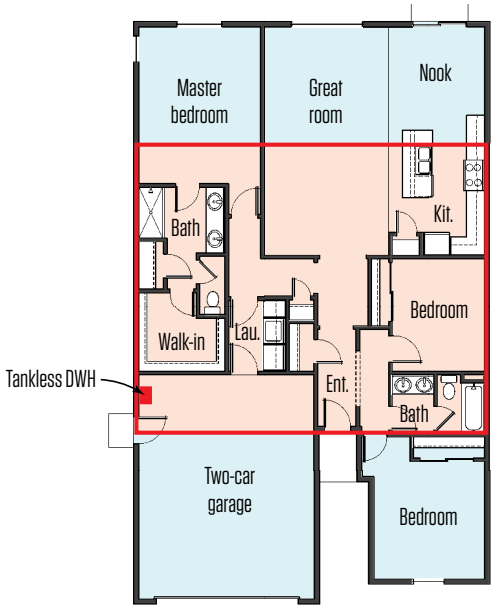
The second demand is satisfied easily enough by providing a water heater that has the capacity to supply the expected use, either through a large storage tank or through a burner (or electric element) large enough to keep up with the instantaneous hot-water demand. But the first requirement—practically instant hot water—turns out to be very difficult to achieve.

And it has only gotten harder to achieve over the past 50 years. That's because of two trends in the building industry. On the one hand, houses keep getting bigger. That means that bathrooms and kitchens are spread out over a larger and larger area. Moving hot water from the water heater to the bath or kitchen fixtures requires longer and longer runs of pipe.

At the same time, flows at fixtures have continued to be constrained by federal and state water-conservation standards. In 1980, a residential bathroom lavatory faucet had a flow rate of 3.5 gallons per minute (gpm) or more. Under current plumbing codes, that fixture can draw only 2.2 gpm. And under some stricter state codes, those faucets can draw only 1.2 gpm—a reduction of 66% since 1980.

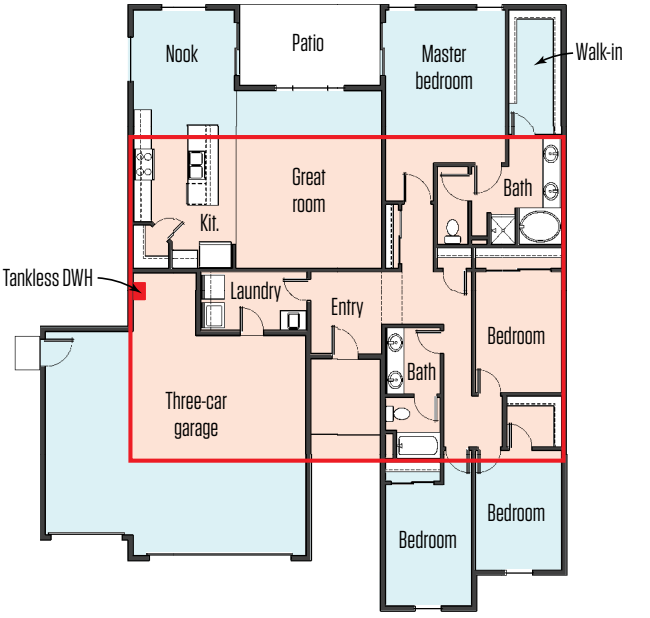
The Hot Water System Rectangle

One Story (3 Bedrooms, 2 Baths)



Hot Water System Rectangle ~67% (1,137 sq. ft.)
of total square footage (1,697 sq. ft.)

One Story (4 Bedrooms, 2 Baths)



Hot Water System Rectangle ~81% (1,628 sq. ft.)
of total square footage (2,010 sq. ft.)

The author calculates the area of the hot water system rectangle by drawing a bounding box around the water heater and hot-water-using fixtures and dividing the occupied floor area of the home by the area of the bounding box. The result can exceed 100% because the bounding box includes unoccupied areas such as the garage.

What about showerheads? In 1980, a flow rate of 3.5 gpm or more was typical. Today, mainstream codes limit showerhead water consumption to 2.5 gpm, and advanced green codes limit the flow to 1.8 gpm, a reduction of 49%.

It's a pattern. Commercial lavatory faucets used to draw 3.5 gpm; now, they can draw no more than 0.5 gpm. Residential clothes washers used to use 51 gallons per load; now, an Energy Star-rated washer uses only 12.6 gallons. Dishwashers used to use 14 gallons per cycle; today's Energy Star appliances use only 3.5 gallons.

Have pipe diameters decreased to match these changes in draw? No, they have not. Pipe sizing rules have not been revisited since they were first written down in the 1940s. So we have pipes that are sized by 1940s standards serving fixtures and appliances with radically reduced flow and fill rates. And because the houses are larger, those pipes are longer than ever before.

When you turn on a hot-water tap, all the standing water in the pipe serving the tap has to flow out before you see hot water at the tap. In fact, it's even worse than that: It turns out that because of mixing in the pipe, you actually have to flush double the volume of the standing water out of the pipe before fully heated water reaches the tap. In a modern house, that wait is often two minutes or more.

In practice, that adds up to a waste of water, energy, and of course, time. If the person using the tap actually decides to wait for the hot water, then several gallons of water can go down the drain before hot water arrives. If they don't wait, but instead go ahead and wash or rinse using cold water from the hot-water pipe, then there's a waste of energy: Water from the water heater ends up stranded in the pipe where it cools down, letting the energy dissipate without being used. In either case, there's a dissatisfied customer.

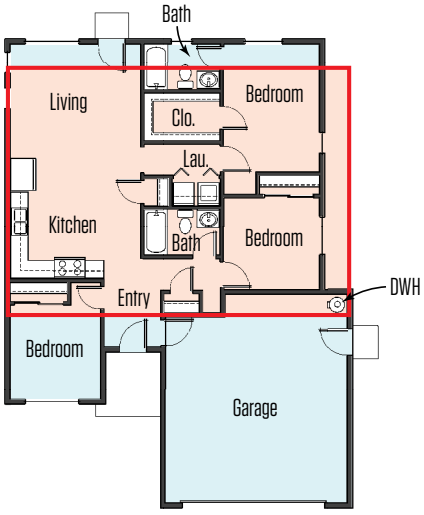
What can be done about it? That question is at the heart of a research program I was involved in for the California Energy Commission. We looked for ways to significantly increase efficiency of hot-water distribution systems. We examined many aspects of the problem, but the one I want to focus on here is architectural compactness: What happens if you cluster wet rooms closer to each other and locate the water heater close to (or inside) the cluster?

THE HOT WATER RECTANGLE

To start with, we looked at the existing layout of floor plans in the industry. We collected a sample of floor plans from the internet and

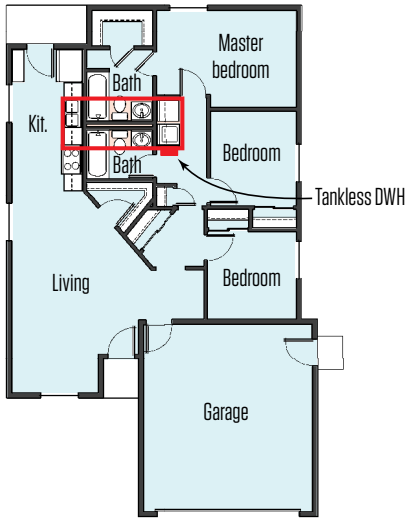
Success Story (Habitat for Humanity House)

Initial Design:
One Story (3 Bedrooms, 2 Baths)



Hot Water System Rectangle ~79% (1,279 sq. ft.)
of total square footage (1,619 sq. ft.)

Revised Plan:
One Story (3 Bedrooms, 2 Baths)



Hot Water System Rectangle ~2.5% (30 sq. ft.)
of total square footage (1,223 sq. ft.)

As a cost-saving measure, Habitat for Humanity construction manager George Koertzen was able to shrink the footprint of the hot water system in his home designs to a tiny fraction of the building floor area. Koertzen achieved this by placing bathrooms back to back and locating the washer and the kitchen sink at opposite ends of his main plumbing chase.

looked at how spread out their wet rooms were within the home's footprint. Over the existing plan, we superimposed a rectangle that bounded all the fixtures in all the wet rooms. This we called the "wet room rectangle." We also drew a rectangle that included the water heater as well as the hot-water fixtures; this we called the "hot water system rectangle." (In many cases, the two rectangles were the same.) Then we calculated the ratio of each rectangle to the total floor area in each of the houses, expressed as a percentage. The larger the percentage of the total floor area taken up by the hot water system rectangle, the more lineal feet of plumbing pipe required to reach the fixtures from the water heater. In the logical worst-case scenario, the water heater is at one corner of the house and the kitchen, laundry room, and baths are at opposite corners. It turns out that you can do worse than this!

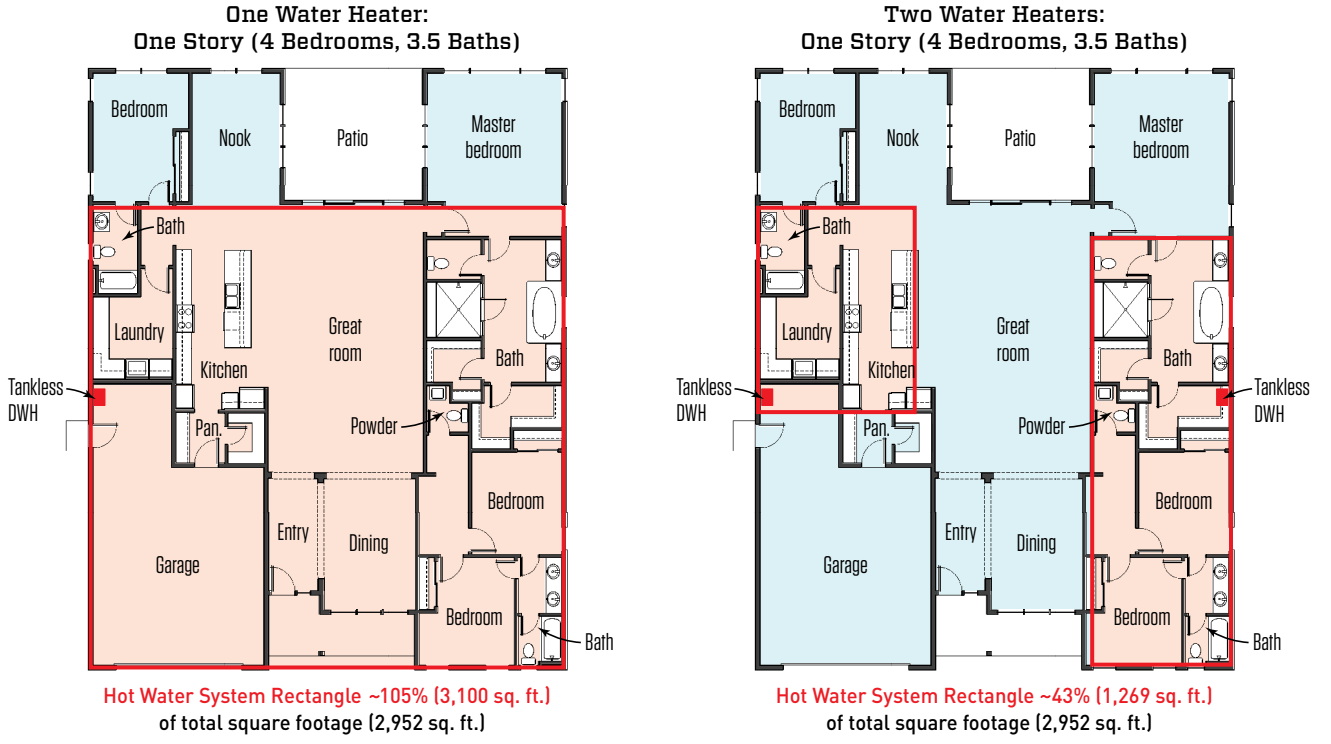
Shown here are a few examples. In all these cases, the water heater is within the wet room rectangle. The ratios range from a low of 67% to a high of 155% (the ratio can exceed 100% when the rectangle encompasses some garage and patio areas that are outside the occupied floor area of the house). The numbers show that house designers rarely design compact plumbing layouts. There's a range, but generally speaking, wet room rectangles and hot water system rectangles take up a large fraction of the floor area of houses.

SUCCESS STORY

It doesn't have to be that way. Proof of this comes from the Habitat for Humanity affiliate in San Joaquin County, Calif. George Koertzen, the construction manager for the affiliate, came to hear one of my presentations at a building industry conference. We had a short conversation that evening, and he went away and redrew the plans for his Habitat houses. Over several years, Koertzen was able to shrink the hot water system rectangle for these affordable houses from about 79% of the total footprint down to 15%, then 4%, then 2.5%, and finally down to 0.8% of the floor area.

Koertzen achieves these small rectangles by placing two bathrooms back to back, separated by a double-wall plumbing chase. At one end of the chase is the kitchen sink, and at the other end is the laundry room. The plumbing system is a ManaBloc manifold serving PEX hot and cold water lines, with a separate line for each fixture's hot and cold supply. Originally, Koertzen put the on-demand water heater for the house in one of the bathrooms,

Locating Water Heaters Closer to Fixtures



One effective way to reduce the building area required by the plumbing system is to add a second or third water heater to the plan. In this example, adding a second water heater would shrink the hot water system rectangle by more than half, reducing the required piping by a comparable amount.

but that choice proved unpopular, so he moved the water heater to the laundry room.

According to Koertzen, the wait time for hot water in the kitchen is 12 seconds—not quite instant, but a far sight better than the several-minute wait time experienced in some large houses. And after one of the fixtures has been used, the manifold is charged with hot water, so that any subsequent draw on other fixtures in the array results in hot water delivery within five seconds—the target time of thousands of consumers.

THE COST OF CONSTRUCTION

Koertzen's Habitat houses rely on volunteer labor, so he has no information on the labor cost savings to be gained by using so much less pipe and fewer hangers. But there's no doubt that the construction cost involved in a compact layout is less than in a widely distributed layout. Our research team analyzed that comparison for a typical mid-market house.

Our analysis is based on the California Energy Commission's Title 24 prototype house for energy mathematics and modeling, a 2,100-square-foot single-story slab-on-grade home. We used this house for several modeling efforts. One thing we did was compare two wet-room layouts: one where the baths and kitchen were spread around the building, and one in which they were clustered together.

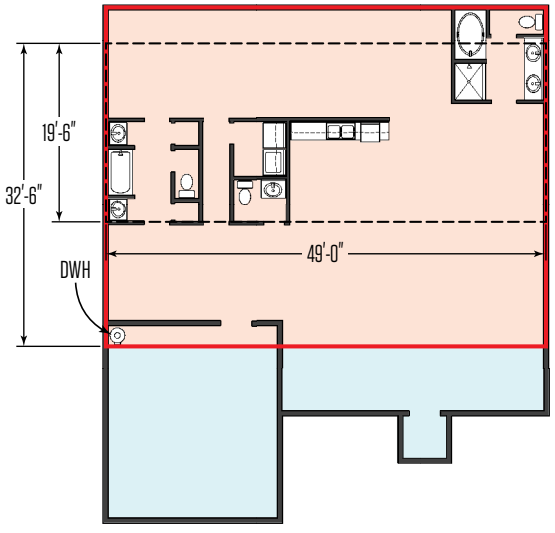
We asked one of California's largest plumbing contractors to estimate the cost of the supply, waste, and vent piping in the two scenarios. The result (see tables, facing page) indicates that clustering the wet rooms together and placing the water heater in close proximity to the cluster results in a savings of more than $2,000 in the cost of the plumbing system. Most of this cost savings is the result of labor savings. By reducing the amount of pipe and fittings to be installed in only the horizontal portions of the hot, cold, drain, and vent piping, the compact layout saves a week of labor hours.

MOVING THE WATER HEATER

Without radically rearranging the locations of the wet rooms, some house plans can be improved simply by moving the water heater or by adding a second or even a third water heater. When you add water heaters, you can break the hot water system rectangle up into two or more separate rectangles. This cuts down on the pipe lengths between the water heaters and the fixtures, reducing the time to

Compact Core

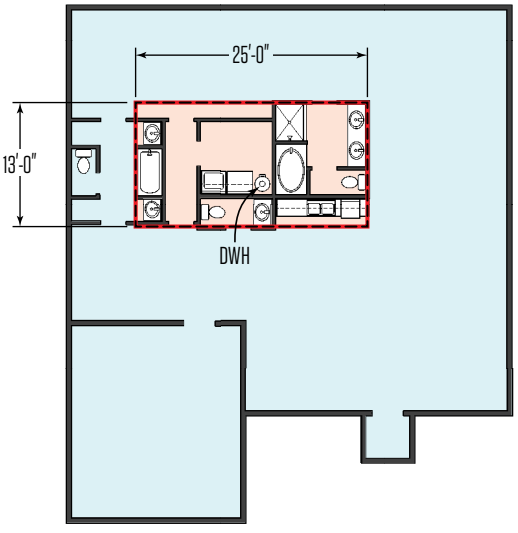
Baseline Case



Wet Room Rectangle:
- 19.5 feet x 49 feet
- 956 square feet
- 45.5% of floor area

Hot Water System Rectangle:
- 32.5 feet x 49 feet
- 1,592 square feet
- 76% of floor area

Compact Core



Wet Room Rectangle:
- 13 feet x 25 feet
- 325 square feet
- 15.5% of floor area

Hot Water System Rectangle:
- 13 feet x 25 feet
- 325 square feet
- 15.5% of floor area

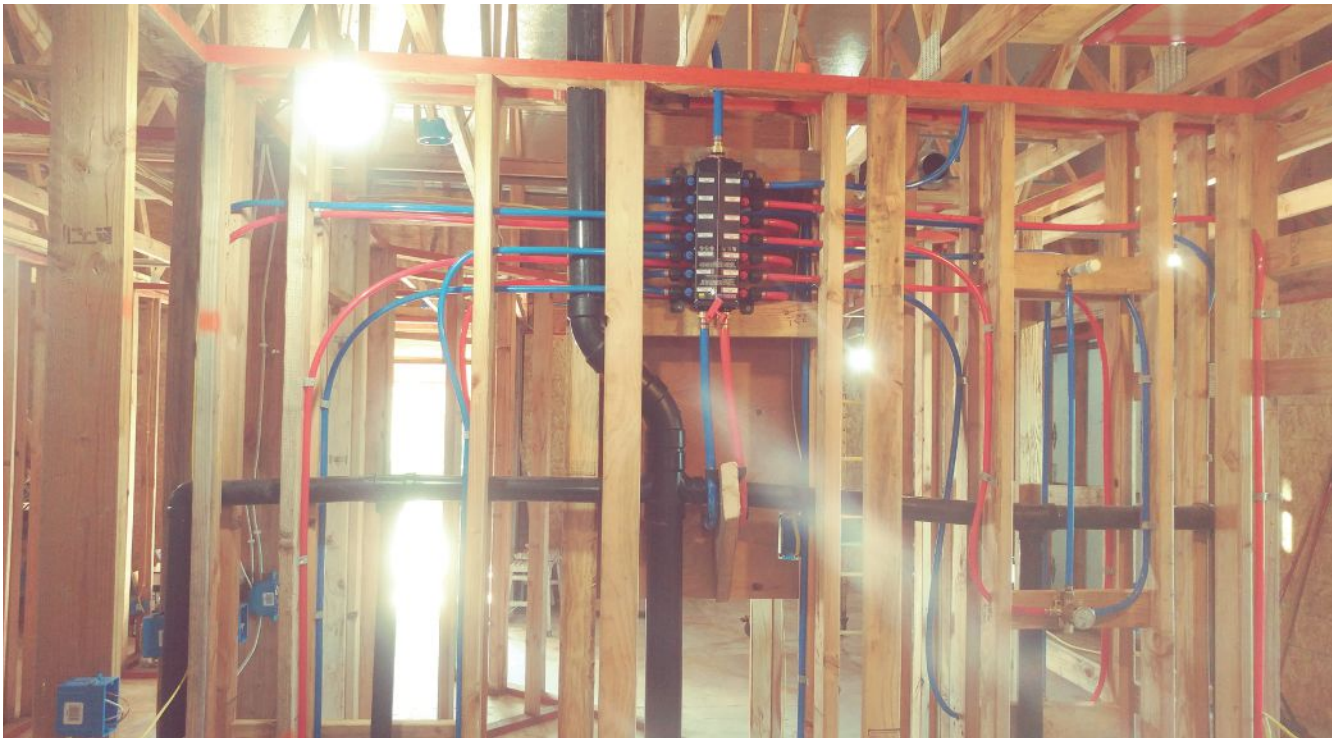
The two plans above represent two hypothetical cases that formed the basis for the construction cost comparison below. The more compact plan saves more than $2,000 in estimated construction cost, mostly by saving labor.

Cost Savings Breakdown for Baseline Case

	Materials		Labor		
Item	**Quantity**	**Cost**	**Rate**	**Hours**	**Total**
Supply Piping (PEX)	297	$180.91	$43.45	15	$653.49
Supply Fittings (PEX)	28	$162.45	$43.45	15.5	$672.17
Supply Joints (PEX)	60	$25	$43.45	0	$0.00
Supply Hangers (PEX)	137	$16.14	$43.45	35.6	$1,547.69
Drain Piping (ABS)	182	$201.34	$43.45	19.5	$849.01
Drain Fittings (ABS)	40	$120.05	$43.45	17.4	$756.46
Steel Pipe	132	$146.08	$43.45	7.9	$341.95
Steel Fittings	14	$31.16	$43.45	8.9	$385.84
Miscellaneous Joints	122	$27.08	$43.45	0	$0.00
Pipe Insulation	111	$135.70	$43.45	3.2	$139.00
Subtotal		$1,046		123	$5,346
Materials + Labor					$6,392
Sales Tax					$65
					$6,457
Overhead			10%		$645.74
Profit			10%		$710
Total					$7,813

Cost Savings Breakdown for Compact Core

	Materials		Labor		
Item	**Quantity**	**Cost**	**Rate**	**Hours**	**Total**
Supply Piping (PEX)	170	$118.04	$43.45	8.8	$381.93
Supply Fittings (PEX)	27	$171.55	$43.45	15	$652.18
Supply Joints (PEX)	57	$25.00	$43.45	0	$0.00
Supply Hangers (PEX)	46	$5.36	$43.45	12	$519.66
Drain Piping (ABS)	150	$147.11	$43.45	15.1	$656.10
Drain Fittings (ABS)	40	$119.42	$43.45	17.4	$756.46
Steel Pipe	118	$152.15	$43.45	7.4	$321.53
Steel Fittings	16	$34.56	$43.45	8.9	$385.84
Miscellaneous Joints	128	$28.13	$43.45	0	$0.00
Pipe Insulation	56	$64.30	$43.45	1.6	$70.50
Subtotal		$866		86	$3,744
Materials + Labor					$4,610
Sales Tax					$54
					$4,664
Overhead			10%		$466
Profit			10%		$513
Total					$5,643



A view of the rough plumbing in a house under construction by the Habitat for Humanity affiliate in San Joaquin County, Calif. A short plumbing chase located in the double-wall partition between back-to-back bathrooms serves baths, toilets, and sinks in both bathrooms, as well as a kitchen sink at one end and a laundry at the other. Hot water is delivered to fixtures in seconds.

tap of the fixtures. This would be a strain on the budget for a small house, but in large houses, where the strategy is most effective, adding a second or third water heater isn't going to break the bank.

The challenge lies in locating the water heater close enough to the fixtures. Six feet of pipe holds about one cup of water. In simple terms, one strategy is to locate the water heater within 6 feet of the fixture—that is, no more than one cup away.

That is very hard to do. In a bathroom, it might mean putting the water heater over a toilet between the sink and the shower. If you're lucky, you would have two bathrooms back to back and you could serve them both with one water heater. In practice, two cups away turns out to be much more buildable than one cup. That is, locating the water heater 12 feet from a fixture is more practical than putting it just 6 feet away.

Interestingly, if we allow 3/8-inch tubing instead of 1/2-inch tubing, 12 feet of pipe would hold one cup of water. So reducing the allowable tubing diameter would help solve the problem. Plumbing codes generally don't allow this without an engineered design. But in reality, physics tells us that dropping down to 3/8-inch pipe with modern fixtures does not impact the performance of the fixture—at least, not for showers and sinks (filling a large tub still works better with 1/2-inch or 3/4-inch pipe). So, a long-term solution to the hot-water problem may have to wait on a revision of the plumbing code to bring it into conformance with the physics of the situation.

COLD-START FUNCTION FAUCETS

Our research indicates that a lot of energy is wasted by short-duration draws at sinks. What happens is that the user turns on the hot water, but doesn't wait for hot water to arrive. Instead, they rinse or wash with cold water from the pipe and turn the tap off. There is a hardware fix that will help reduce the energy waste associated with those short draws: We call it a cold-start function faucet.

These faucets take advantage of the fact that people tend to center the lever on the faucet and keep it centered. With cold-start function faucets, the center position is cold water; you have to pull the lever to the far left to draw hot water. If you lift the lever straight up, only cold water is released. In essence, the faucet defaults to cold instead of to a mix of hot and cold. With this faucet, we avoid wasting hot-water energy for those events where hot water isn't going to arrive at the tap anyway.

Gary Klein is the president of Gary Klein & Associates. The author wishes to acknowledge the California Energy Commission for support of the research that led to this article.

Photo: George Koertzen

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Photos by Bill Robinson

New Windows for Old Brick Veneer Walls

Sealing off the windows when there's no WRB

BY BILL ROBINSON

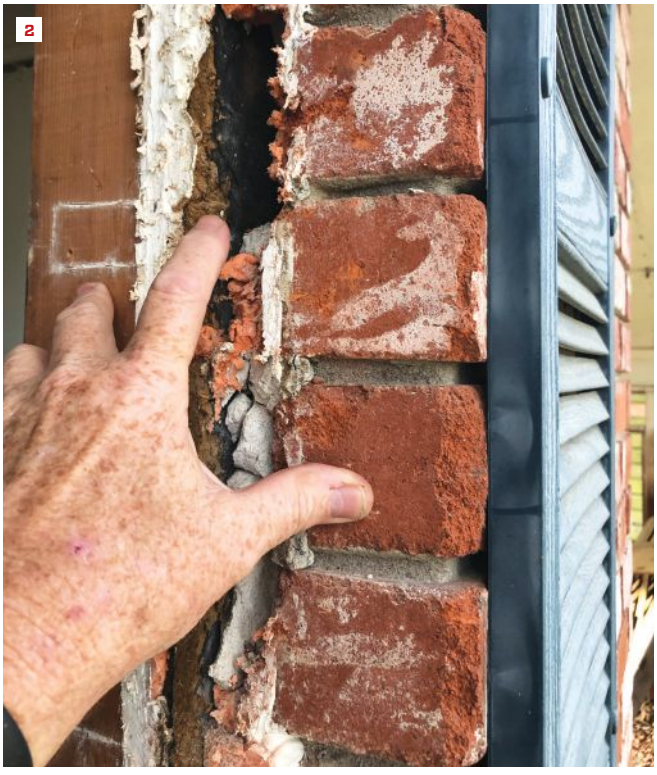
I've been in the construction industry for more than 30 years, much of that time as a licensed contractor. Over the years, I have learned about window installation on the job. More recently, I took the Installation Masters Certification course from the American Architectural Manufacturers Association, which gave me a stronger technical background and the confidence to install windows in a variety of situations.

In my view, the same basic principles that apply generally to exteriors also apply to window installations:

- Install materials "shingle style" (what is below is covered by what is above).
- Avoid creating horizontal surfaces that could limit drainage.
- Ensure that materials used are compatible.
- Realize that air-sealing is key.
- Modify installation details to fit the climate and exposure.

This year, I've been helping an industry committee of the Fenestration Manufacturers Association, the American Architectural Manufacturers Association, and the Window and Door Manufacturers Association develop a standard of practice for installing replacement windows in existing brick veneer–clad residential buildings, without removing the brick cladding. Once completed, the document will be used for the training and education of field crews and supervisors.

The FMA/AAMA/WDMA Installation Committee has created a



The author identified several existing homes that were gutted and standing empty. The crew pulled existing single-glazed windows from the openings **(1)**. Inspection revealed that, in general, there was no intact drainage plane to be identified behind the existing brick **(2)**, so the decision was made to isolate the replacement windows from the walls.

number of similar documents pertaining to new construction. In those cases, the methods were tested and proven using mocked-up walls built in a laboratory setting. But this time, the idea was to demonstrate and test a method of installing replacement windows in a realistic setting.

I located several buildings in Louisiana that had been damaged in the 2016 floods and were gutted and standing empty. With help from committee members, industry representatives, and a local contractor, we installed two windows in each of three houses using various materials and methods and then tested the installations for water leakage using the standard test method ASTM E 1105. In the next few pages, I'll describe how we installed and tested the windows and what we learned from the process.

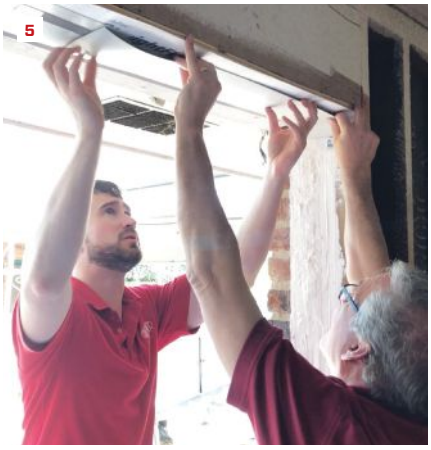
JLC has covered the installation of replacement windows in brick veneer walls before ("Replacing Windows in Brick Veneer Homes," *Coastal Contractor*, May/07; "Installing Full-Frame Replacement Windows," *JLC*, Oct/13). In those stories, the authors describe attempting to integrate the window flashings into the existing weather-resistive barrier behind the brick. The houses we worked with in Louisiana, however, were built in the 1950s through the 1980s (when there was no statewide building code), and they all lacked functioning WRBs behind the brick.

Because field conditions varied so widely, the committee decided to treat the surrounding wall system in each of the three homes as an unknown factor that could not be relied upon for robust integration from an air- and water-management standpoint. The principle of membrane drainage behind the wall façade simply did not apply. Instead, the decision was made to isolate the windows from the brick wall and the wood frame behind it. With the opening isolated, water would not be able to enter the wall through the window and the window opening; any water entering the opening would be directed to the exterior.

MEASURING THE OPENINGS

Once the homes were identified, I set out to take measurements. Because we would not be removing the exterior cladding, it was important to take measurements inside and outside and identify the limiting dimension.

The standard is to take six measurements: bottom, middle, and top on the sides of the opening, and left, middle, and right on the head and sill. For sizing windows, the smallest measurement is selected. In this case, we measured the rough wall framing as well



Some openings were prepped by filling the gap between the brick and the wall framing with gun foam **(3)**, and caulking over the rough jambs **(4)**. Site-bent coil stock was used at the head and sill of the openings **(5)** to direct water out to the face of the exterior.

as the brick-veneer opening, for a total of 12 measurements.

To determine the actual window dimensions to order, a deduction is made from the exact rough opening size. The amount subtracted depends on the window manufacturer's specifications. I prefer to make a note of the exact measurement of the opening on site and calculate the deductions later at the office, or at least somewhere there are no distractions.

Since these homes had been flooded and gutted, the interior finish had been removed and the wall cavities were open, so we took the measurements from framing rather than from finishes. In most situations, however, there would be some material—drywall or wood, for example—in the returns, which would need to be accounted for. In that case, it would be necessary to think about whether to size the window to fit inside the existing jamb return finishes, or to remove the jamb return finishes and go to the framing.

Another decision to be made is about fastening the windows. These windows were block frame—that is, with no mounting flange—and so we could either fasten the windows through the jamb or secure them using masonry clips.

We also had to make a decision about the placement of the replacement windows: whether the exterior face of the window would be flush with the framing or extend past it partway so the jambs overlapped the brick on the sides of the opening. Because there was no intention to add brickmold to the installation, we decided to extend the outer face of the window beyond the framing, covering the gap between the sheathing and the interior face of the brick. As it turned out, that space between the brick and the sheathing meant that we needed to use clips to install the windows, because not enough of the window jambs overlapped the framing to fasten the jambs directly to the framing.

PREPARING THE OPENINGS

Three manufacturers (Pella, Jeld-Wen, and Milgard) provided windows for this exercise.

On one install, the window arrived at the site too large to fit in the rough opening, which fortunately was smaller to the interior. A crew member used a chain saw to rip a half inch from a jack stud to enlarge the framing rough opening.

There were two basic steps involved once the conditions were identified. We needed to fill the gap between the interior face of the brick and the exterior face of the sheathing, then we needed to seal up the opening against water intrusion. We filled the gaps using gun foam or backer rod, then covered the rough-opening jamb area with liquid-applied flashing to create a moisture-resistant cavity to keep water from entering the wall and to isolate the opening. On these perimeter gap details, some form of gap filler (such as backer rod) is necessary to create an effective caulk joint. This prevents three-sided adhesion and creates an hourglass-shaped caulk bead. It's important to have a sealant with high solids content and with good adhesion (meaning it sticks to the substrate) and good cohesion (meaning it sticks to itself).


6


7


8


9

For some windows **(6, 7)**, gun foam, Tyvek sealant, and vinyl coil stock were used to isolate the windows from the opening. In other cases **(8, 9)**, backer rod and Prosoco sealant were applied. Good quality control proved critical in both applications.

We employed a combination of materials on each window. On some windows, the installers placed backer rod in the gap between the brick and the sheathing, then applied Prosoco R-Guard FastFlash to the jambs. In other cases, they filled the gap using gun foam and completed the seal using DuPont Tyvek Fluid-Applied Flashing and Joint Compound. The DuPont and Prosoco products are both high-solids Silyl Terminated Polyether (STPE) formulas able to be gun-applied and troweled. (In other window replacement projects where brick left a rough, irregular opening, we have found these liquid-applied flashing products to be by far the simplest way to isolate the opening and especially to create a panning system at the sill.)

In addition to using liquid-applied sealants, we fabricated head and sill flashings. Vinyl coil stock was used at the head and sill to deflect water in the wall out over the head and to direct water that might leak through windows out over the brick at the sill. At the head, we tried two different ways of attaching the flashing. In one case, we stuck the flashing onto the framing using Echo double-sided tape, but in most cases, we simply wedged the bent flashing up between the sheathing and the framing so that friction could hold it in place until the window was installed.

Once the windows were installed and the masonry clips were secured, the perimeter joint around the new windows was addressed. From the exterior, sealant was installed around the head and the side jambs and at the sill. A couple of gaps were left at the bottom to allow any incidental water to drain. Remember, we are using a drainage system where any water from the window or other sources is not trapped in the cavity defined by the window jamb thickness. This also requires that the window be spaced a little off the sill to allow water to drain.

On the interior, the joint between the window and the framing was fully caulked (with no drainage gap at the bottom), using the same materials and methods as on the exterior. Before testing, all the caulk was allowed to cure according to manufacturer's instructions.

TESTING THE ASSEMBLIES

Window testing was done by Intertek to the ASTM E 1105 standard. This test looks at the install only, so the window was taped off from the exterior to exclude any flaws in the window itself.

A calibrated spray rack was set up on the exterior, and to the interior, a chamber was established to allow a negative pressure to the test area. The spray rack is calibrated to deliver five gallons per hour of water per square foot of window opening, to simulate a heavy rain. (In passing, the test rack on the exterior did not look like it was putting out the torrential summer rains we get here on the Gulf Coast, although it might represent heavy rain somewhere else.) The variable was the negative pressure on the interior; there were three timed cycles using increasing negative pressure to determine how well the install would withstand defined wind and rain exposures. The test pressures were marked on the interior test film to keep track.

The results? On one home, the installation passed all three cycles. On one window in another home, the interior caulk bead had been overlooked, but after the coil-stock head flashing was removed and the caulk applied, the installation passed the test. On another window, there was a holiday in the caulk bead on the interior, allowing a leak into the sill. Once that was fixed, the window passed.

The final takeaway is that isolating the windows from the opening worked well, given careful site craftsmanship. My "Aha moment" relates to the interior caulk bead: When the install is used as a drainage system and there is a functioning sill pan, the back caulk is the key that will save you from callbacks. This assumes that the rough opening is fully sealed and flashed into the opening to a depth deeper than the window jamb depth, preferably with a liquid-applied flashing, and the interior back seal is done with backer rod and a high-solids content STPE sealant.

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A standard ASTM test rig was set up to apply a constant spray of water to the window opening **(10–12)**. The windows were taped off so that the test would concentrate on the installation method, not on possible leaks in the windows themselves.

2019 Index

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The 2019 *JLC* Editorial Index contains listings for feature articles, selected departments, product reviews, tool reviews, and letters. References are listed by topic rather than by article title. The following codes are used to help you find information:

***— In-depth coverage**
Q — Question and answer
P — Product information

Note: This year's index also contains entries for the articles from the Professional Deck Builder *sections in the March, May, July, September, and October 2019 issues of* JLC. *Those articles are indexed separately at the end of this* JLC *Index, and those page numbers refer to the page numbers within the* PDB *sections. The codes used are the same as those listed above.*

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BY SYMONE GARVETT

1. Durable Quartz Surfaces
Each of four new surface profiles—Tartarus, Moreno, Chacra, and Savoie—in Daltile's Natural Quartzite collection is available as a countertop or as an extra-large stone slab surface. According to the manufacturer, the Natural Quartzite surfaces are harder than granite, offer a long usable life, and resist heat, stains, scratching, and etching. Tartarus (pictured, left) is dark with subtle veins, Moreno features a gray stone pattern, Savoie is a "griege" color with a terrazzo look, and Chacra is light gray with dark veins. Contact a local distributor for pricing. daltile.com

2. Metal-Roof Snow Guard
National Nail's Stinger Mini SnowGuard is designed to stop ice and snow from sliding off metal roofs. The Mini SnowGuard features a self-sealing gasket system that requires no silicone, eliminating the mess associated with sealants. Additionally, the SnowGuard's patented weathertight gasket system allows for installation at any temperature, according to the manufacturer. The product is available in 12 colors and a clear finish. Each box includes 50 Mini SnowGuards, 50 weathertight gaskets, and 150 all-weather coated screws. Pricing starts at $120. stingerworld.com

3. On-Trend Shiplap Wainscoting
Royal Building Products' 6-inch and 8-inch cellular PVC Nickel Gap Shiplap can be installed vertically or horizontally in exterior as well as interior trim applications. Both sizes are available in 9-foot, 12-foot, and 16-foot lengths, with white as the standard color. Contact a local distributor for pricing. royalbuildingproducts.com

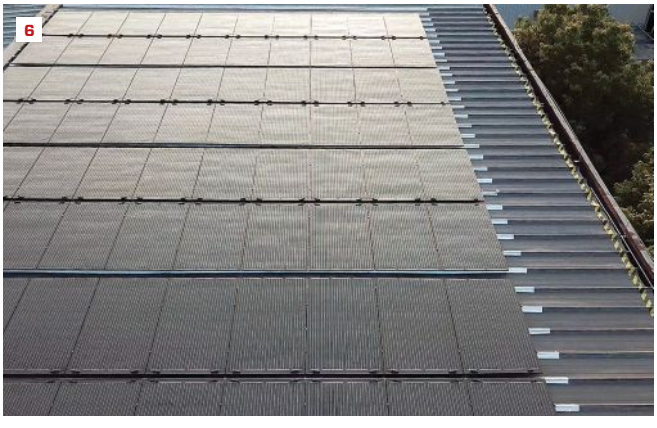
4. Innovative Shower Base
The MTSB-6036SOHD shower base by MTI Baths is designed to conceal the position of an existing tub drain behind a wider top drain cover. The shower base measures 60 by 36 inches and is crafted from Lucite, a durable cross-linked cast acrylic, layered with fiberglass, resin, titanium, and wood to help prevent flexing. It may be specified with a left- or right-side drain, and either a stainless steel or white powder-coated hidden drain cover. The full base is available in white, bone, or biscuit, with either a glossy or white matte finish. Pricing starts at $1,460. mtibaths.com

5. Mixed-Frame Window Finishes

The Marvin Elevate Collection, previously known as Integrity Wood-Ultrex, now offers separate finish options for the frame and sash of each window. Customers can select from four available finishes—bare pine, clear coat, designer black, and prefinished white—with a total of 16 combinations possible. Styles include awning windows, casement, double-hung, glider, picture, round top, and specialty window frames. The windows have a wood interior and fiberglass exterior and arrive prefinished or painted and ready to install. Contact a local distributor for pricing. marvin.com

6. Light Solar Modules

Sunflare's new solar energy offering, the LiteMount series of rackless solar modules, is an alternative to traditional silicon solar racks for metal roofs. The modules integrate seamlessly with metal-roof attaching systems and weigh less than 1 pound per square foot installed. They are rated to handle a wind load of up to 42 pounds per square foot and are shatterproof, as they have no glass coating. A bypass diode is included at every cell, which keeps the panel active in any level of sunlight. Contact a local distributor for pricing. sunflaresolar.com



7. Contemporary Cabinetry

MasterBrand Cabinets has added three new curated door styles to its Omega Cabinetry brand. The Kali and Kadey door styles both feature a shallow center panel with a wide perimeter, mixing modern and classic aesthetics. Jax (pictured, right) has a slim-line, mitered door and drawer front with flat center panels. In addition, the brand launched four new textured laminate finishes and two cool-toned color selections. Contact a local distributor for pricing. omegacabinetry.com

8. Re-engineered Subfloor Screws

Simpson Strong-Tie Strong-Drive WSV Subfloor screws were re-engineered from head to point to reduce driving torque, speed installation, and help eradicate the squeaking caused by poorly fastened subfloor sheathing. They feature a ribbed head design to countersink easily and a variable thread to ease driving torque and speed fastening when used with the Quik Drive auto-feed screw driving system. The screws are available in 1 3/4-, 2-, 2 1/2-, and 3-inch lengths and have a yellow zinc coating for interior applications. We found a box of 2,000 #9 1 3/4-inch WSV screws online for about $80. strongtie.com

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9. Liquid Roof Flashing Resin

CertainTeed's new SmartFlash One roof flashing resin is a one-component, UV-stable, fluid-applied solution for both steep- and low-slope-roof flashing details and repairs. The resin may be applied without a primer, and it can be resealed for future use. It comes in a five-gallon pail (covers 125 square feet) or a one-gallon pail (covers 25 square feet). The one-gallon pail is available on its own or as part of a Flash Pack, which includes resin, fleece, and application accessories. Contact a local distributor for pricing. certainteed.com

10. Laminated Timber Columns

Culpeper Wood Preservers manufactures laminated timber columns that offer an alternative to solid timber, fiberglass, and aluminum structural columns. The columns are made from treated southern-pine components joined with waterproof resorcinol adhesive. According to Culpeper, the columns are lighter and easier to handle than solid PT posts and are less likely to twist. They are available in cross sections from 4x4 to 12x12 and in two styles of turned post in 5- and 6-inch sizes. Contact a local distributor for pricing. culpeperwood.com

11. Capped Wood-Composite Decking

MoistureShield's new line of capped wood-composite decking, called Elevate, is targeted to the entry-level market. The wood composite is manufactured from 95% recycled content, and a protective cap shields the boards from impact, corrosion, and harsh weather. Elevate's 5/4 deck boards are available in 12- and 16-foot lengths in grooved profiles for hidden fasteners and in 20-foot lengths with a solid edge. Fascia boards come in 12-foot lengths. Customers can choose between two colors: Lake Fog (gray) and Canoe (brown). Pricing information will be available soon. moistureshield.com

12. Wood Siding Clips

Nova USA Wood Products developed its Exo-Clad Rainscreen QuickClips to accommodate natural swelling and shrinking of wood siding, regardless of the amount of moisture. Made from marine-grade extruded aluminum and fastened with #10 pan-head screws, the QuickClips work with hardwood siding, such as batu, ipe, and cumaru, as well as softwoods like cedar, redwood, and Douglas fir. Clips also provide a 3/4-inch stand-off from the structure and can be screwed right into the studs over housewrap. We found them online for $1.90 each. novausawood.com

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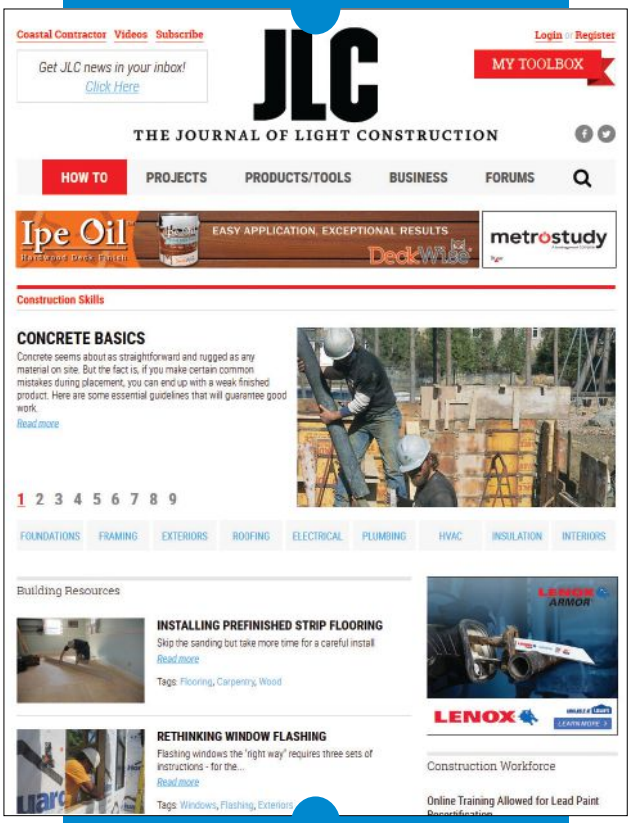

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hanleywood

12-Inch Sliding Compound Miter Saw Roundup

BY TIM BURCH JR.

Last fall, the team at BOWA Builders received a sampling of brand-new 12-inch sliding compound miter saws. After unpacking them, one of our lead carpenters and I spent a couple of weeks testing them against pressure-treated pine framing material, standard and engineered lumber framing material, 1-by trim material, large and small crown molding, and small picture-frame and cove detail molding materials. We wanted to get an understanding of how the saws performed in a variety of work environments.

We found that all the saws performed well in different applications, with the top two or three extremely close in rating. In fact, we liked them all and felt that professionals in the field would be happy with the performance of any of them. Here's a summary of what we discovered in our testing.

DELTA 26-2250 CRUZER

Out of the box: Out of all the saws, the Delta (see photo, right) was the one that we had heard the most buzz about from industry friends and peers. It's an impressive-looking tool with its retractable sliding arms (like something out of a Transformers movie), and it made perfect miter and bevel cuts right out of the box.

Power: The Delta's belt-driven 15-amp motor cranked through all the wood we could throw at it. When switching the saw on, we could feel the power of the belt drive. This saw seemed to offer the best combination of power and accuracy for those who need a saw for both framing and trim work.

Accuracy: The laser guide worked perfectly and was accurate on all cuts. The bevel cuts were effortless to set up, as all the bevel controls are in the front of the saw. The sliding arms worked great, but we found that we had to be careful not to pull on the handle grip to the right or to the left when cutting, as there seemed to be a small amount of play when even pressure wasn't applied to the saw arm.

Mobility: The space-age sliding arms are great for cramped jobsites and tight shop environments. You can back the saw right up to a wall, and it still operates correctly. At 60 pounds, it would be manageable for someone who frequently moves a saw around.

Features: Delta boasts that this saw has patented military-grade aluminum sliding arms. The saw has 50-degree-left/60-degree-right miter cutting capacity and an impressive 18-inch crosscutting capacity, thanks to an adjustable flip-down fence design. It also features one-hand front miter controls, a flip-down side lock for accurate plunge cuts, and a five-year warranty. While the performance of the dust collection bag system was only average, we particularly liked the adjustable sliding tension, which allowed us to personalize the saw for our cutting styles.

Cons: The throat plate is very open and wide. That allowed a lot of small pieces to fall into the saw when I was cutting detailed trim pieces, so I had to keep cleaning out the saw trim debris.

Price: The Delta lists for $650, which is at the high end of the saws we tested. It is probably best suited for professionals who need a single saw that will stand up to everyday use while staying accurate.

Delta's versatile new Cruzer 26-2250 has power for framing cuts and accuracy for trim work.

METABO HPT C12RSH2

Out of the box: When I removed the Metabo HPT (see photo, next page) from its box, I noticed that the miter slide handle had broken during shipping, but I was able to super-glue it back together for the testing. The first cut was accurate, but the bevel cut was a little off and needed to be adjusted.

Power: This saw seemed to have average power. It had no problems cutting through any of our trim materials but struggled a bit through the larger (4x4 and 4x6) deck framing materials.

Accuracy: As mentioned, the bevel cut had to be adjusted; however, the adjustable laser light worked well and was a nice feature. The cuts aligned perfectly with the laser line on all materials.

Mobility: Weighing in at 59 pounds, this saw wouldn't be difficult to move from one jobsite to another. Its compact sliding system allows it to be backed up to a wall or structure while in use—which is good for working in tight spaces or close quarters.

Features: The Metabo HPT has a 15-amp motor, large sliding fences for cutting substantial trim materials, 0–45-degree-left

Photos by Tim Burch

and 0–57-degree-right miter cut capability, quick stops for miter and bevel cuts, a five-year warranty, and—most important to this reviewer—a light weight.

Cons: The electric brake was slow to respond, and there seemed to be some blade wobble after a day of testing. The miter sweep was not super smooth and slowed us down a bit when we were cutting tediously detailed trim pieces.

Price: We found the Metabo HPT listed for $413, which makes it the least expensive of the bunch.

RIDGID R4221

Out of the box: Weighing 64 pounds, the Ridgid (see photo, facing page) is massive; it took us 15 to 20 minutes to unpack it and put the pieces together. After the first few cuts, we noticed a slight blade wobble that required adjustment to fix the problem. The slide was also not particularly smooth, something we were not able to fix.

Power: The Ridgid's 15-amp motor didn't have any problems cutting any of the materials we ran the saw through.

Accuracy: The blade light on this saw worked well and was accurate on all cuts once we corrected the blade wobble. All the bevel and miter cuts seemed to be true as well.

Mobility: Because this saw is huge, I wouldn't recommend it to someone who is setting up and breaking down every day. It's more suitable for a shop-type setup.

Features: The Ridgid has an LED cut indicator, 15-amp motor, dust collector vacuum adapter, 0–67-degree miter capability left and right, a lifetime service agreement, and a three-year limited warranty. Dust collection using the dust bag is average.

Cons: The blade wobble out of the box was annoying, as I expect a new saw not to have that problem. The slide not being smooth was also a disappointment. The Ridgid's overwhelming size is too large for me but is probably suitable for a DIY-er or a home-shop woodworker.

The least expensive saw in the group, Metabo HPT's C12RSH2 has a compact footprint and offers good dust collection.

CORDLESS OPTIONS

In our field-testing, we also tried out a hybrid saw—the DeWalt DHS790—which can be plugged into an outlet or run off a pair of FlexVolt batteries—and a cordless saw, the Makita XSL08. Both proved capable of competing with their corded cousins; in fact, we consider the DeWalt to be the best saw of the seven that we tested, with the Makita close behind. We liked having the cordless and corded options on the DeWalt, and its manageable weight made it easy to set up and tear down. We consistently got repeatable, accurate cuts (after making a slight bevel adjustment) and found ourselves reaching for the DeWalt more than the others once we were on the jobsite. We also liked the accuracy and options on the Makita, but the saw's overall size was too large for us to move it into the top-dog status.

MAKITA XSL08

Out of the box: Right out of the box, I noticed that the Makita was a monster. In fact, it took me close to 30 minutes to remove the saw from the box, organize the parts and pieces, and attach the blade. Because of the cordless option, I was expecting a more compact, lighter saw. It is not. It was tough to carry and set up. Once I set it up, however, all the fencing and other pieces were tight and true.

Power: The Makita seemed to have excellent power, and the two 18-volt lithium-ion batteries lasted for more than a day of heavy use. It performed well with both framing lumber and trim pieces.

Accuracy: The miter and bevel cuts were incredibly accurate. The trim cuts were the cleanest we had seen, and this beast handled all the 2-by framing lumber we ran through it just as accurately. The laser light worked perfectly.

Mobility: Did I mention that this saw is huge? It weighs 69.1 pounds with batteries, and moving it from the truck to setup is a workout. It does boast a single-slide operating system that allows it to back up against a wall or structure in use.

Features: The Makita includes almost too many features to list here, including a Makita build brushless motor, an Auto-Start Wireless System (AWS) that uses Bluetooth technology to operate your dust collector, a front-lock bevel adjustment system, and

Ridgid's value-priced R4221 is capable of cutting 67-degree miters both to the right and to the left—best in class.

Price: We found the Ridgid listed for $500, which grouped it in the less expensive category of similar saws.

BOSCH GCM12SD

Out of the box: I have used previous versions of Bosch's 12-inch SCMS, which has earned a reputation as "the professionals' saw" in the trades. Out of the box, I was struck by the many new adjustment features, which felt almost overwhelming, on the latest version of this saw (see photo, next page). Our first test cuts proved the Bosch very accurate. We also noticed the fencing detail was much more robust than on previous versions, with measurement and benchmarks right on the fences themselves. We also liked the retractable extended base support that comes with this saw. It came in handy.

Power: The Bosch is cranked by a 15-amp motor, with power that was repeatable through most cuts. However, we had trouble when cutting bevels on 2-by framing material. The saw seemed to be bogging down before powering through the lumber. Thinking it was a fluke, we tried several more times, but got the same result. We also tried changing the blade, to no avail.

Accuracy: As we expected, this saw was very accurate. The new fencing details were a bonus that made accuracy of squaring easy when we were making precision cuts, such as when cutting crown molding.

Mobility: The saw's axial glide system makes it easy to use in tight spaces, even though it is a big saw. Weighing in at 65 pounds, it can be a leg banger when you move it. It would be perfect for a large trim-job setup, where the saw is staying put for a week or two.

Features: The Bosch features a prealigned square lock fence system, integrated expanding base extensions, 52-degree-left/60-degree-right miter capacity, 47-degree-right and -left bevel angle with marked rafter detents (we love this feature), and an ergonomic trigger. The bag dust collection was dual dust-port locations. We found that dust collection with the bag that comes with the saw was above average.

Cons: The heavy weight of this unit even though it's cordless is something we have a hard time understanding. The saw is also a bit expensive, but as the saying goes, "you get what you pay for."

Price: The Makita lists for about $600. Be careful to check if the batteries are included or not; we found it both ways at different suppliers and home stores.

DEWALT DHS790

Out of the box: Like the Makita, this saw seemed like it had many parts when we first opened the box. Again, that was due to the cordless features, which included a dual charger, batteries, and a corded power supply unit.

Power: The DeWalt powered through everything we had "like butter." There was no difference in power between using the supplied batteries (as long as they were charged) and using the corded power supply. When the batteries run low, the saw light blinks, a helpful feature.

Accuracy: We loved the LED shadow light system. It was super accurate except in direct sunlight. The extra-tall saw fences were "right on" square. All miter cuts were very accurate, but we had to adjust the bevel because the bevel cuts were a few degrees off when we first tried a bevel cut.

Mobility: The saw is compact, and we used it on multiple jobs throughout the week. It weighs in at 56 pounds, so it is manageable to lug around.

Features: The DeWalt comes with two 20V/60V Max batteries, a dual battery charger, a DCA120 corded power supply adapter, an extra 12-inch blade, and a dust bag. The saw has a three-year limited warranty. We were able to work all day with the batteries on one charging cycle (approximately 200 cuts). We tried the backfin fence stops to cut 16-inch material, and they worked well. Dust collection was above average using the dust bag.

Cons: The only drawback we could find (besides the price) was the bevel cut being out a degree or two, but this was easily fixed with a quick adjustment.

Price: This saw lists for about $800, the priciest in the group.

Accurate right out of the box, Bosch's GCM12SD has a beefy, well-designed fence system and efficient dust collection.

Skilsaw's powerful SPT88 wormdrive dual-bevel 12-inch SCMS has a big footprint, yet weighs in at only 51 pounds.

superior with this unit, and as on most of the other saws, it can be hooked up to a vacuum system for even better performance. It comes with a one-year warranty.

Cons: We did not like the three-step-plus operation to cut right-side bevels. We found ourselves flipping over boards and cutting with the left-side bevel to save time. The lack of power cutting through 2x10 material on a bevel was also a bit of a disappointment.

Price: The Bosch lists for about $600, which places it in our higher-priced saw bucket. I would recommend it for professional carpenters or woodworkers rather than the average garage-shop DIY-er.

SKILSAW SPT88

Out of the box: The first saw my father bought for me when I was a kid was a Skilsaw circular saw, which I used to build tree forts, planters, and my first projects in high school, so I was rooting for this saw (see photo, above right). My first impression out of the box was that it was big but extremely light and easy to pick up. We tested the fence accuracy to 9 degrees and found quite a bit of play. The fences also seemed to be loose, regardless of where we adjusted them or how tightly we tried to lock them down.

Power: This wormdrive Skilsaw sounds like a top fuel dragster starting up when engaging the blade. It is powerful and had no problem cutting through all the test material. The saw literally almost jumped off the saw stand. You can feel the power of this saw; there is no doubting it.

Accuracy: The miter and bevel cuts were accurate, and the lock for the bevel, even though it was in the back of the saw, was easy to use. The shadow line worked great and accurately. We found we had to pay close attention to the fence movement when cutting detailed crown molding. Because of the play in the fence system, I feel more comfortable recommending the Skilsaw for framing use than for detailed trim projects.

Mobility: This is a big saw, but it's easy to move due to its light, 51-pound weight. I think it could be moved from job to job without too much of a problem.

Features: The Skilsaw has a 15-amp dual-field motor with the company's famous wormdrive power, crown stops, sliding base extensions, 4x14-inch crosscut capacity, 50-degree-left/60-degree-right miter cutting capacity, and 45-degree bevel cutting capacity. The dust bag provided average dust collection. It comes with a one-year limited warranty.

Cons: The base extensions moved a bit and did not sit level with the table. The fencing was the biggest disappointment, as we had to keep checking when cutting trim that we had a true 90 degrees set.

Price: The Skilsaw lists for $650—close to the top of all the tested saw prices.

CONCLUSIONS

All the saws performed well in our testing, and the top four—the corded models from Delta and Bosch and the cordless models from DeWalt and Makita (see sidebar, pages 52 and 53) were all extremely close in rating. We liked the power of the Skilsaw but feel the manufacturer needs to refine the components a bit more to make it a great saw. The offerings from Ridgid and Metabo are at great price points and are good options for someone willing to accept slightly less performance in exchange for a lower price.

Tim Burch Jr., CR, is a vice president and owner at BOWA Builders, with offices in McLean and Middleburg, Va.

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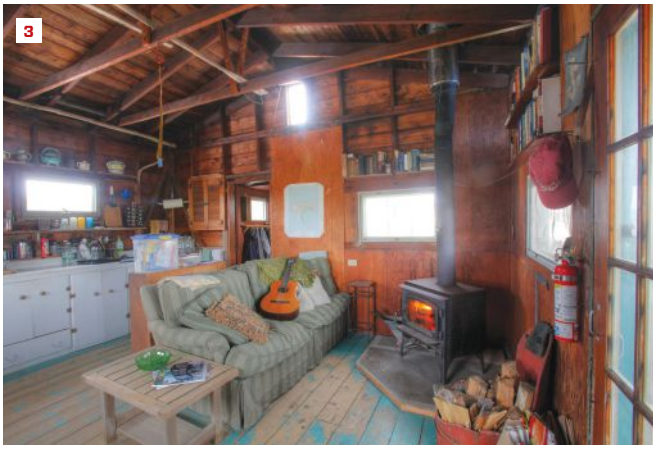
BY ROE OSBORN

The Fowler Dune Shack is one of 19 shacks that sit nestled in the dunes of the National Seashore in Provincetown, Mass. **(1)**. As the shack is completely off the grid, all water has to be pumped by hand and carried to the shack **(2)**. The shack is uninsulated and the framing and sheathing serve as interior finishes. A wood stove in the main volume of the dune shack is the only source of heat for its occupants **(3)**.



A Week in the Dunes

The National Seashore in Provincetown, Mass., is home to a collection of tiny shacks—small, seasonal cottages built decades ago by artists and their families wishing to get away from the bustle of town life or looking for inspiration in remote rolling dunes. These so-called Dune Shacks, most now owned by the National Seashore, have stood against massive storms with fierce, wind-driven salty rain and sand.

A couple of the shacks are open to the public on a lottery basis, and this year I won that lottery for a week's stay in the Fowler Dune Shack **(1)**. After gathering up the appropriate gear as well as a week's worth of food, my wife and I met a gentleman in a 4WD pickup to take us to the shack. After a 20-minute ride through the dunes, we unloaded our gear, and our guide gave us a quick rundown on the place. He showed us how to pump water **(2)** and operate the composting toilet, offered a few tips on life in the shack, and then he was off.

The Fowler Dune Shack is totally off the grid—no electricity or plumbing, and spotty cellphone reception at best. It has a propane-powered fridge and a gas stove **(3)**. My wife and I quickly fell into the rhythm of the place—sunrise, sunset, the tides, and the weather. The ocean is not visible from the shack, but the sound of the waves was a constant reminder that the Atlantic and the pristine beaches of the National Seashore were just a few yards beyond the dune to the north.

My wife was only able to spend the first three days at the shack, and on the fourth day, we made the 45-minute hike back to her truck and civilization. I made a quick grocery run for items we'd forgotten and was back at the shack by noon that same day. The rest of my stay at the shack was nothing short of magical, despite changeable weather and brisk fall winds. I hiked the dunes and the beach and did a ton of writing. At one point, I went almost 36 hours without encountering another human, and then it was just catching sight of a couple walking the beach about a mile away. The solitude was absolutely cleansing.

At the end of my stay, I returned home refreshed and renewed. I wrote two blogs for JLConline.com. The first, "A Week Off the Grid," is a general account of the time I spent there. The second, "A Close Look at a Mighty Little Shack," is a photographic and written chronicle of the shack itself. The shack is maintained by volunteer work, and I have already signed up for the work party next spring. I'll be looking forward to seeing this old friend who sheltered me well for my week in the dunes.

Roe Osborn is a senior editor at JLC.

Photos by Roe Osborn

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