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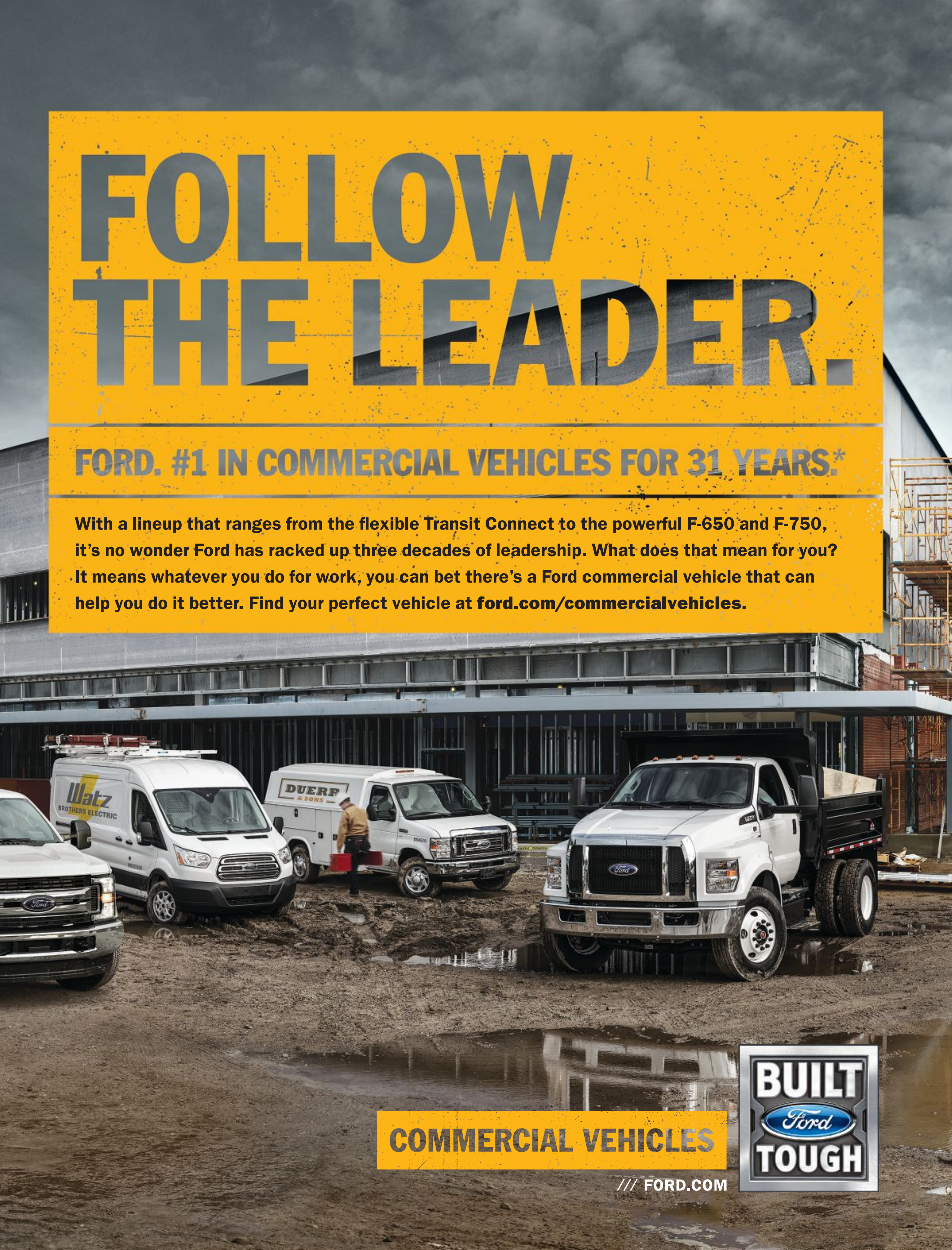
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Contents

On the cover: Carpenters install double-bulb gaskets between the structural insulated panels on a Bensonwood home built by Risinger Homes, of Austin, Texas. Photo by Matt Risinger. See the story on page 41.

FEATURES

DEPARTMENTS

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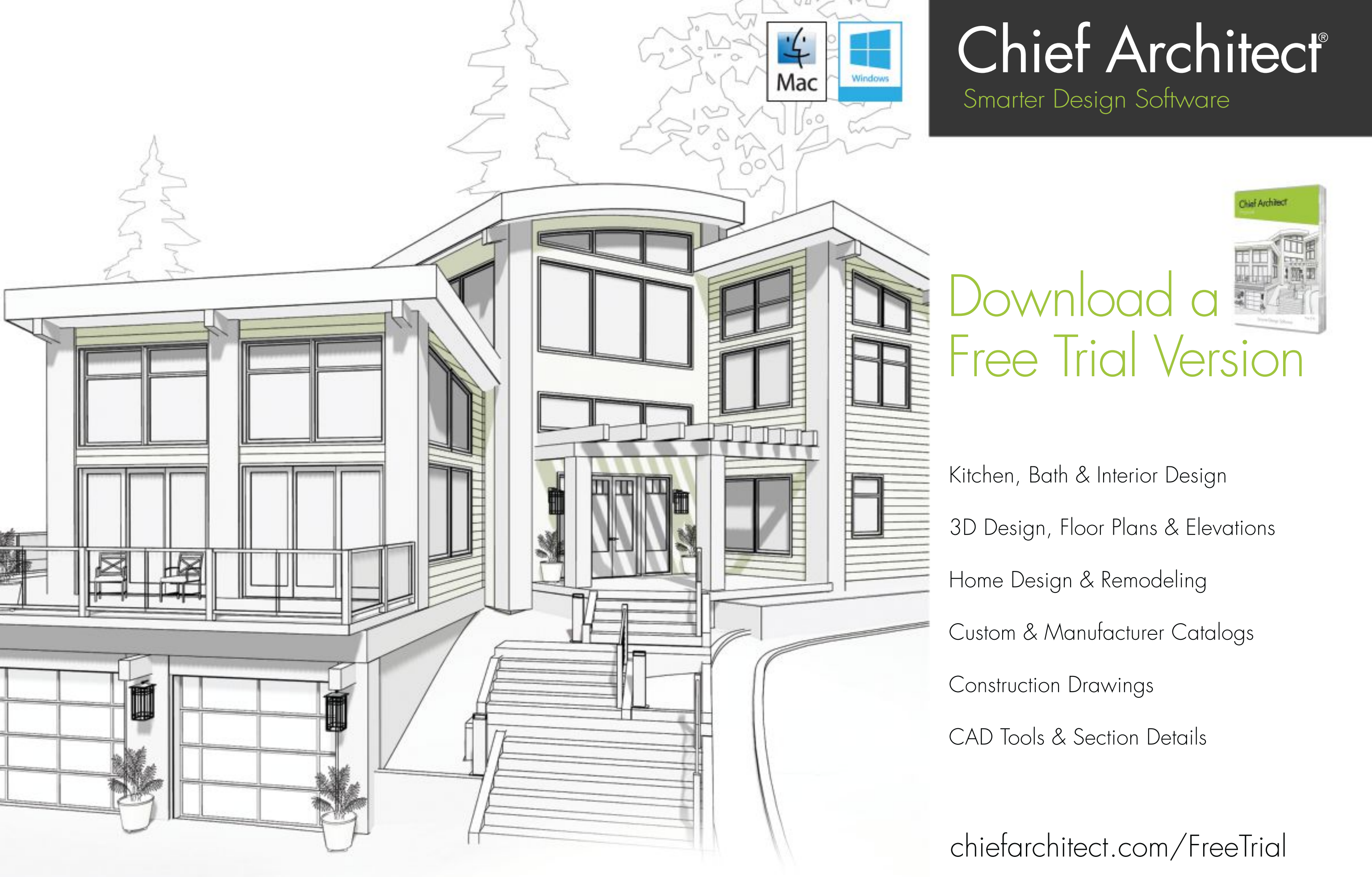

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SkillsUSA 2016 Championships

BY GREG AND SUE BURNET

For the past several months we've talked about—and lamented—the fact that the building industry is experiencing an acute shortage of skilled workers. In particular, young workers seem to be MIA these days—or so we thought. One program working to fill the void is SkillsUSA—a partnership of students, teachers, and industry working together to develop a skilled workforce for the building trades. SkillsUSA focuses on helping students excel by providing educational programs, events, and competitions that support career and technical education (CTE) in the nation's classrooms.

Recently, we had the opportunity to attend the 2016 SkillsUSA national conference, in Louisville, Ky. We had been invited by fellow JLC Live colleague, Bill Robinson, to be judges for the TeamWorks events, and we spent a whole week there taking in the competition.

When we arrived on the show floor for orientation, we were astonished by the enormity and energy of the event. All the building trades—carpentry, masonry, sheet metal, plumbing, electrical, and cabinetry—were represented, and we witnessed 400 to 500 students excel in each of these programs. And these were only the national qualifiers. For every team we saw, there were probably an equal number of second- and third-place competitors. These numbers suggest that there are thousands of children and adults interested in building-related industries.

1

Photos by Sue Burnet

THE NATIONAL COMPETITION

Held at the Kentucky Expo Center, the entire competition covered more than a million square feet. The TeamWorks area alone was about the size of a football field. This part of the competition is a two-day build where each four-member team is required to complete the construction of a small "house." The featured areas of skill are carpentry, plumbing, electrical, and masonry. Many of these disciplines also have their own (one-day) competition as well, but TeamWorks emphasizes being part of a collective effort rather than individual achievement **(1)**.

Of the 48 teams that competed at the TeamWorks event, 34 were from high schools and 14 were post-secondary (college or tech-school). The ages of the competitors varied greatly, from 15 to over 50. There is no age limit for the competition, but each participant needs to be enrolled in a school program and be a member of a SkillsUSA chapter.

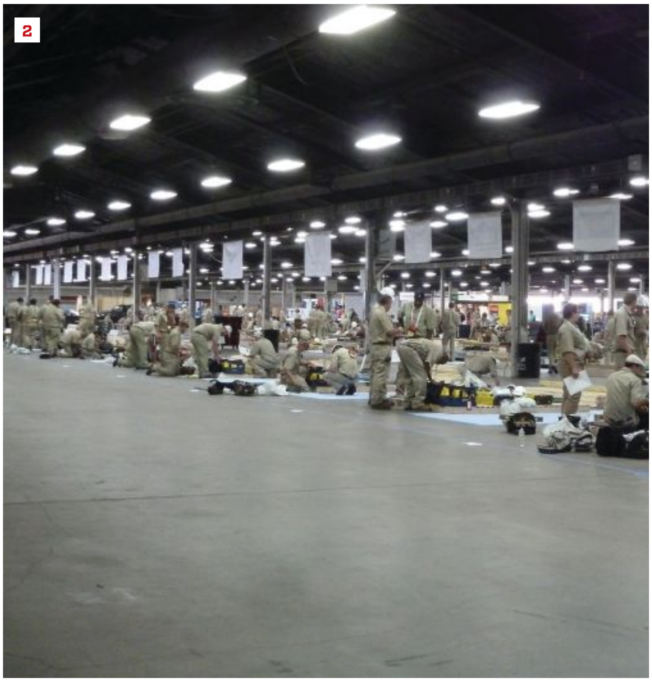
THE PREP

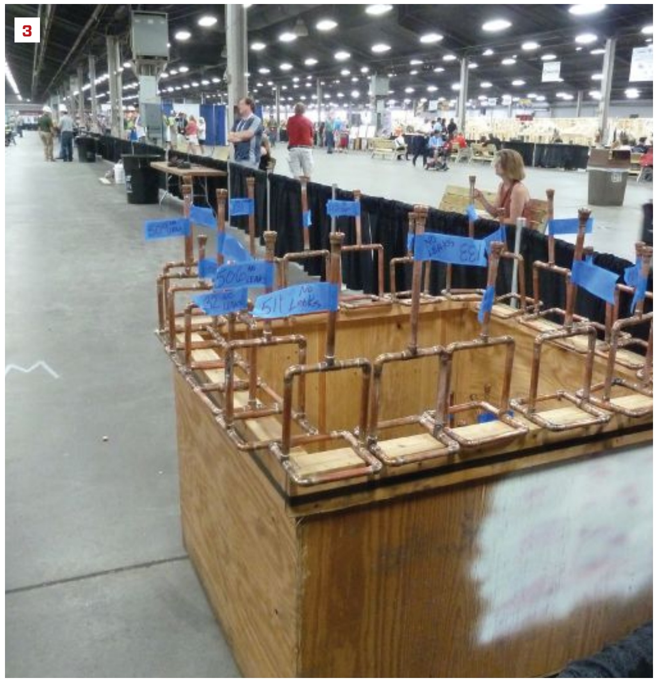
When the students arrived for the orientation, they received plans for the structure they were to build. That same day, they were required to present a 5- to 10-minute team synopsis, which they were graded on in front of the judges. At their presentation, they introduced their team, discussed their preparation and experience, and provided an outline of their plan for the build (time line, key responsibilities, and so on).

Once these initial presentations were complete, the teams were permitted to prep their tools and organize their workstations, but they were prohibited from beginning the build **(2)**. They could spend rest of the day reviewing the prints and finalizing a plan of attack.

THE BUILD

When the teams arrived for the two-day build the next day at 7:30 a.m., they began with a short briefing and then were off to the races by 8. Competitors could work until 2 p.m. that day and until 5 p.m. the following day. Seven judges oversaw the completion, watching for safety, as well as evaluating each build. Proper tool and ladder use were given extra attention. Even though the participants were required to have their





OSHA certification, they sometimes forgot the basics in the heat of the competition.

During the build, each team was required to pass a plumbing skills test and another for electrical. The plumbing test was somewhat complex, with one team member required to solder together, in less than 40 minutes, an assembly of copper pipes that had to match a prototype. Each completed assembly was pressure-tested, and if it passed, it was then checked for leaks by placing it in a tub of water. This proved to be a challenge, with only about 20 teams passing both tests **(3)**.

The electrical skills test was a bit easier: Each team had 10 minutes to identify seven different wired-box assemblies. Most of the teams passed this test. As judges, we helped to monitor this station and were impressed by one particular participant who was extremely methodical, checking her work twice before completing the test correctly. Afterward, we asked her age and she replied, “Fifteen.” The knowledge and work habits she showed were remarkable for any age—we would have hired her in a second.

That ethic was typical of what we saw throughout the competition. The students had great beginning knowledge of the trades and plenty of drive and enthusiasm. Of course, they were “green,” but for younger participants who may have been involved in these programs for only a couple of years and probably for only a few hours each day, their skills and attitude were amazing.

It was not our job as judges to step in and coach the teams—we so wanted to help them succeed, but this was not allowed. It was important to remain as impartial as possible; it was a competition after all.

NOT JUST HIGH-SCHOOLERS

In the 14 post-secondary teams, there is no age limit. We talked to several of these teams after the competition and heard interesting stories. On one team, from New Mexico, all four competitors attended the Navajo Technical University. In 2013, this school’s team was the state TeamWorks gold medalist.

Another team, from Kansas, had a mother and son who had recently purchased a mountain cabin. They wanted to renovate the structure, so they both enrolled in a secondary program and are now working on the cabin together. The mom had worked for a utility company for 15 years and hadn’t really swung a hammer until last August.

MOVING FORWARD

The building-trade competitions made up just a fraction of the overall event. Every conceivable trade, from robotics and computer programming to welding and culinary skills, was represented. The common mantra we heard was: “Take your time, do your best, and have fun!”

SkillsUSA made it clear that many people—young and old—are interested in the trades. So, how do we find them, recruit them, and get them to stay in the industry? Talking with other judges, the real question was: What are *you* going to do about it?

It comes down to involvement. Whether you’re looking to change our industry, elevate skill levels, or simply find good help, you need to get involved. SkillsUSA is just one avenue. You can look for your local chapter or start your own. But there are many other things you can do as well: Contact a local Vo-tech school and see how you can help them; mentor someone from a school or someone new to the industry; and think about how you can further develop your own employees with additional skills training.

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Q When I'm installing prestained cedar sidewall shingles, what is the best method to keep the shingles aligned? Is there a way to use a ledger board without marring the surface?

A Chris Yerkes, a cedar-shingle installer certified by the Cedar Shake and Shingle Bureau (CSSB), and owner of Cedarworks, in Brewster, Mass., responds: I always use a ledger board to keep the shingles in line as they are fastened, but how you attach the ledger is critical to protecting the shingle surface. Many installers attach the ledger by simply driving nails through the board and into the face of the course below. This strategy leaves tiny, unsightly holes in each course, however, and those holes can actually cause shingles to crack. So instead of nailing through the shingles, I have worked out a different method to protect the stained surface of the shingles.

The first thing I do for each shingle course, before I attach the ledger board, is snap a chalk line in nonpermanent chalk. This line helps to ensure that the ledger stays perfectly straight.

For the ledger itself, I choose the straightest piece of 1-by lumber that I can find. Some folks just use 1x2 furring strips, but these can be a little flimsy, so I prefer to use a 1x4. The ledger should also be as long as possible for a given wall. You can always add a shorter piece at one end if needed.

Then I attach short pieces of light-gauge-aluminum flashing to the back of the ledger (the side facing the house) using the staples that I use for installing the shingles (nails also work). I space the flashing pieces

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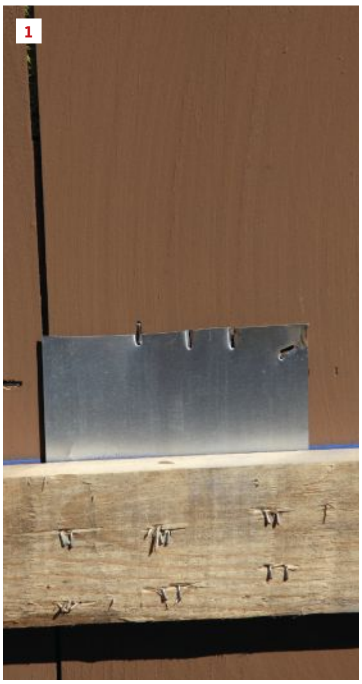


2

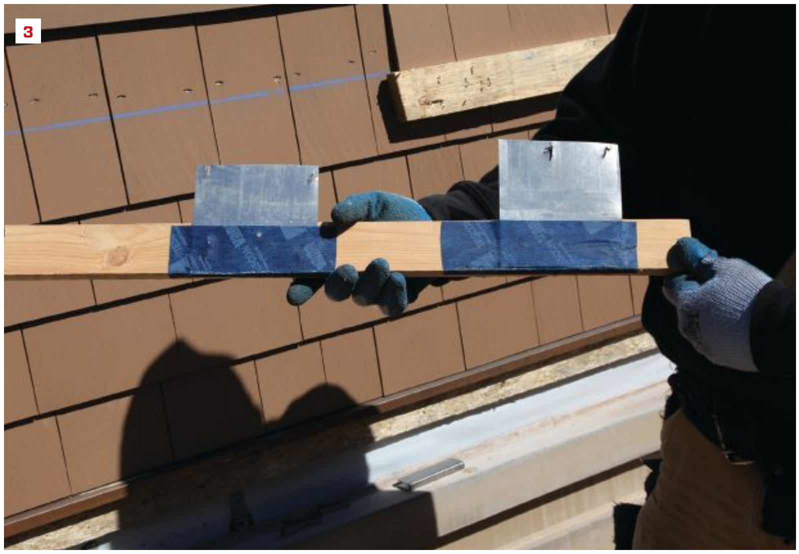

Instead of nailing the ledger board into the exposed course below, suspend the ledger from above with scraps of aluminum flashing **(1)**. A single nail or staple that bridges the top edge of the flashing tears through easily to release the ledger after the shingle course is finished **(2)**.

Photos by Roe Osborn

every 6 to 8 feet along the length of the ledger and bend over the ends of the fasteners where they come through the outer face of the board.

Now I line up the ledger on the chalk line and drive a nail or a staple that bridges the top of each flashing piece **(1)**. One nail or a single leg of a staple is enough to hold the ledger while I fasten the shingles, and it easily tears through the light-gauge aluminum when I tap down on the ledger to remove it after the course is installed **(2)**.

This method leaves no unsightly holes, but the metal flashing can leave "pot marks" on the shingles. I solve that problem by covering the aluminum flashing with thin flashing tape **(3)**. I keep a roll of flashing tape on hand, but the stuff seems to be on every jobsite these days anyway. The tape covers the flashing below the top edge of the ledger. Then I let it wrap around the bottom of the flashing and onto the lower edge of the ledger. Just be sure to replace the tape when it begins to wear through.



Metal flashing can leave marks as it rubs against the shingles during installation. Short pieces of flashing tape cover the flashing to prevent those marks **(3)**. Keep an eye on the taped flashing and replace the tape as soon as it starts to wear out.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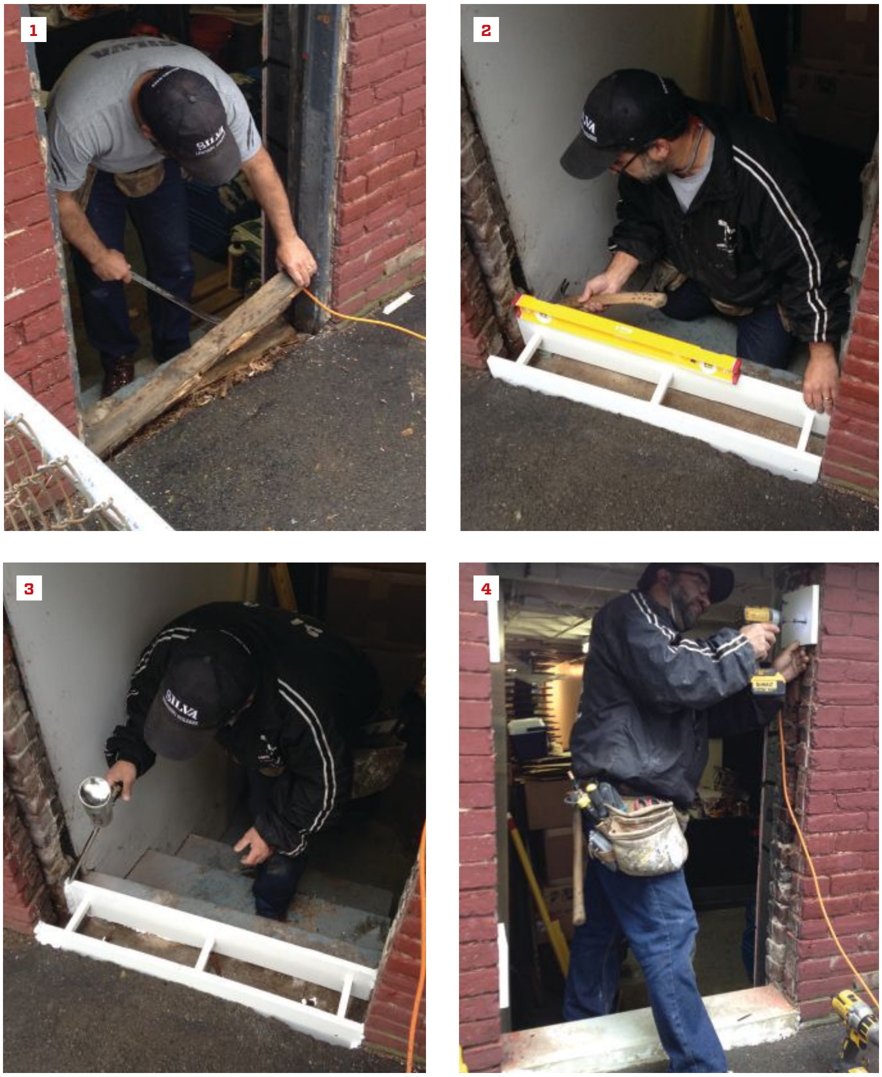
New Access Door for an Old Basement

BY EMANUEL SILVA



Photos by Emanuel Silva

As is typical of original basement-access doors in older homes in the Northeast, this one had rotted out. The first task is tearing out the old door and cleaning up the opening **(1)**. A PVC form will be filled with concrete to bring the new threshold above grade **(2)**. Expanding foam will keep the form in place while it's filled; note the rebar that has been inserted into holes drilled in the existing concrete **(3)**. The author screws PVC blocks to the brick foundation for attaching the pre-hung door **(4)**.

Homes that are more than 100 years old are the norm in the part of the country where I work, and many of them have very small basement-access doors that were made to fit the height of the exposed foundation. These undersized openings were built primarily for moving things in and out of the basement, but they don't work well for large items such as appliances, and they certainly don't make good entrances for a finished basement.

The doors were often cobbled together from construction scraps such as beadboard or 1-by stock left over when the original house was built. And occasionally builders simply used an interior door and modified it to fit the foundation opening.

I recently was asked to replace one of these access doors in a client's home. The grade outside the door was too high relative to the wooden threshold, and the wood had rotted. The interior door that had been used was not insulated, nor was the opening sealed, which made for a cold basement. My plan was to install an insulated fiberglass door with a composite jamb that would offer energy savings and rot resistance. Additionally, I would trim the outside of the door assembly with low-maintenance PVC material.

RAISING THE THRESHOLD

I started by removing the existing door, jambs, and threshold **(1)** and thoroughly vacuuming the entire opening. The foundation of the home consisted of two layers of brick with an air space between the layers. The bottom of the door opening—which was also the top step of concrete stairs that led down to the basement floor—sat about 4 inches below grade, probably because the grade around these old houses tends to fill in and build up over the years.

I wanted the new door to sit above the

The author slides the door unit into place **(5)** and attaches the hinge jamb to his PVC blocks **(6)**. Flashing tape seals the jambs to the foundation **(7)**. An extension screws to the back of the exterior trim to accommodate the out-of-plumb foundation **(8)**.

grade, so I custom-ordered a new door from my local lumberyard that was slightly shorter than the original door to allow for raising the threshold. The new door was also a little narrower than the original to provide space for insulation and for better attachment along the side jambs.

So that the new door sill would be above grade, I formed and poured a small concrete curb on top of the existing concrete step. I made the form for the curb out of 1-by PVC stock, with spacers between the two sides to strengthen the form.

After setting the form into the opening, I lined it up with the exterior foundation walls and leveled it in both directions **(2)**. To anchor the curb to the original concrete, I located holes for three lengths of 1/2-inch rebar where they wouldn't interfere with form spacers and then removed the form to drill the holes. After inserting the rebar, I reinstalled the form in the opening. To seal around the form and to help keep it in place during the pour, I sprayed foam insulation around the edges **(3)**.

Before pouring the concrete, I applied a coat of Quikrete bonding adhesive inside the form to help bond the new concrete to the old. After pouring quick-setting concrete into the form and letting it set for a while, I screeded the top with a board for a smooth finish. The rot-proof PVC form stayed in place after the pour.

PREPPING THE OPENING

Although the bricks and the mortar in the old foundation of this home were in good shape, I did not want to attach the door jambs directly to the brick. To create more-reliable attachment points and to address the space between the inside and outside layers of brick, I installed spacer blocks made from scraps of 1-by PVC stock—two on the hinge side of the opening and three on the latch side **(4)**. The blocks bridged the gap between the brick layers and acted to stabilize them.

For the strongest connection, I had to make sure that the fasteners for attaching the blocks went into the brick, not into the mortar joints. After drilling the appropriate size holes in the brick with a hammer drill, I drove Tapcon masonry anchors to secure the blocks to the brick.

INSTALLING THE DOOR UNIT

Before setting the door in the opening, I screwed a metal security plate to the back of the latch jamb. This plate has openings for both the deadbolt and the latch and will help to keep the jamb from splitting in case someone tries to break open the door.

When I dry-fit the door in the opening, the first thing I noticed was that the foundation was out of plumb—the outer layer of brick leaned in quite a bit at the top—a problem I decided to take care of with the installation of the exterior trim. The only good news was that the bricks leaned in about the same amount on both sides of the opening.

I took the door back out of the opening and applied a generous bead of Geocel sealant to the interior edge of the curb where the back of the aluminum door sill would sit. I then set the door in place, keeping it centered side-to-side in the opening **(5)**. To deal with the out-of-plumb foundation, I kept the tops of the jambs flush with the brick

After screwing the exterior trim to the jamb **(9)**, the author uses backer rod and caulk to seal behind the trim **(10)**. On the inside, he air-seals the space between the jamb and the foundation with foam **(11)** before installing the interior trim **(12)**.

and let the jambs sit just inside the opening at the bottom.

I checked to be sure that the sill was level sitting on the new curb. Then starting on the hinge side, I shimmed and plumbed that jamb in both directions, driving screws through the side jamb and into the block to secure it in place **(6)**. I attached the latch jamb the same way, making sure the door opened and closed evenly. Before moving on to the next step, I cut PVC plugs and tapped them into the screw holes in the jambs and then cut the plugs flush with a handsaw.

FLASHING AND TRIMMING THE DOOR

To keep air and moisture from entering around the jamb, I applied a layer of 4-inch Vicor self-adhering flashing around the opening **(7)**. The pieces were wide enough to bridge from the edge of the jambs to the brick foundation. I applied the membrane to the sides first and the top last to create the proper drainage plane.

It was pretty easy to attach the tape to the smooth flat surface of the jamb edge. But making sure that there was good contact over the uneven surface of the brick foundation wall—especially in the mortar joints between the brick courses—required more care.

I preassembled trim kits for the interior and exterior on my workbench. I used 1x4 PVC stock for the exterior and wood for the interior. The exterior trim was made in two layers. To adjust for the out-of-plumb foundation, I glued and screwed a jamb extension onto the back of the trim **(8)**. I made the extension slightly thicker than the distance that I had stepped back the bottom of the door to make it plumb, which gave me room to seal the trim to the brick.

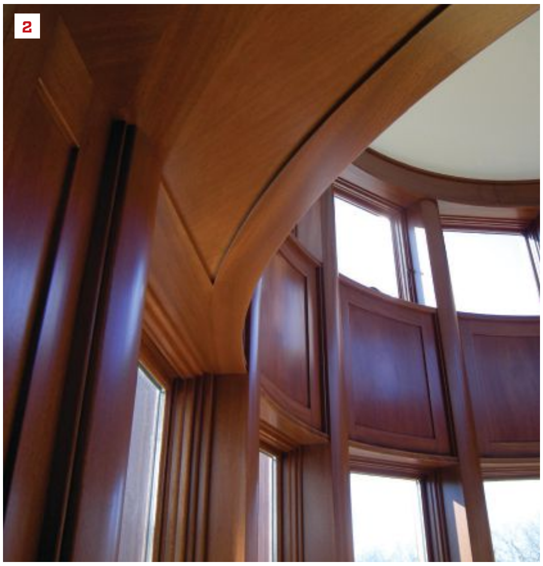
I secured the exterior trim kit to the jamb using Cortex screws **(9)** and filled the screw holes with PVC plugs. That still left a gap between the brick and the back of the trim from the leaning foundation. I filled that gap with foam backer rod **(10)** and then applied OSI Quad sealant to weather-seal the opening.

On the inside of the door, I first sprayed low-expansion foam insulation around the door between the jamb and the brick to help air-seal the opening **(11)**. With two layers of brick and a 1-inch space between them, the foundation was more than 8 inches thick. The prefabricated door jambs were sized for a 2x6 wall, which meant that I either had to build extension jambs for the inside trim, or just scribe the trim to fit inside the brick. Because the inside was an unfinished basement, I opted for the second choice.

With the interior trim preassembled and ready to go, I slipped the kit into place and fastened it to the jambs before the foam insulation had a chance to cure, which helped to keep the foam from expanding out past the jamb **(12)**. I finished with a bead of caulk to seal the spaces between the brick and interior trim.

In the end, my clients had a new access door for getting in and out of their basement that should last as long as the house. But more importantly, this door is much more secure than the old one, and with the drafts sealed out, their basement should be a lot warmer this coming winter.

A frequent contributor to JLC, *Emanuel Silva owns Silva Lightning Builders, in North Andover, Mass.*



The paint-grade paneling on the first floor **(1)** and the mahogany paneling on the second floor **(2)** of this two-story tower **(3)** on Long Island, N.Y., were made with laminated stiles and rails and 1/4-inch plywood, using the same basic techniques. The plywood fits into a rabbet formed between the laminations in the stiles and rails.

Curved Paneling for a Circular Room

BY MARK LUZIO

One of the more interesting trim jobs I've done was on a two-story tower attached to a Shingle-style beach house on the eastern end of Long Island, N.Y. **(1)**. I came on the job after the tower had been framed. It wasn't a perfect cylinder, like a grain silo, but had a conical shape. The frame had 12 glulam columns laid out in a spoke pattern and tilted inward at roughly 3 degrees. Between the columns were curved wall panels interspersed with trapezoid windows that were wider at the base than at the head.

The first floor was a circular breakfast room connected to the kitchen, and I trimmed it out in curved painted panels and mahogany HVAC grills **(2)**. The room on the second floor was an extension of the master bedroom and was trimmed out with solid mahogany column covers and mahogany stiles and rails with flitch-matched veneered panels **(3)**. In this article, I'll focus on the method I used to make the curved stile-and-rail paneling, which I developed with Jed Dixon, a master stair builder and frequent presenter at JLC Live. Drinking coffee and sketching at his kitchen table, we applied our shared experiences of dealing with curved millwork to design an efficient fabrication system.

LAYOUT

The first step for any large-scale curved trim work is to make a full-size plan and section drawing. Jed and I drew the plans on CAD to work out the geometry and printed a few full-size templates. I cut

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1/4-inch plywood sheets to fit each floor and screwed them to the subfloor. I found my center point and drew the position of each glulam column. Then I measured the diameter from post to post and drew all the radii using a trammel point. (The best trammel points I have used are General 523 adjustable ones, which allow you to make the beam that fits between the trammels as stout as you need to; you can also switch out one of the steel points for a pencil.)

Because the tower walls tilted inward **(4)**, I had to measure the room diameter at each "level"—that is, at the floor; at the sill height and head height for the main windows; at the sill height and head height for the transom windows; and at the very top of the paneling where it joined the base of the domed ceiling. At each of these levels, the diameter grows increasing smaller, but because the change is gradual, we did not have to change the radius of all top and bottom rails for each panel section. The larger, upper finish panels are actually trapezoid in elevation, like the windows. But the smaller panels below the windows were left square. Over 18 inches, the difference in the panel width is less than 1/16 inch.

I transferred each diameter to my plywood templates (we had one template for each floor). My finished plan was a series of smaller diameters, with copious notes written on the plywood about all observed site details. I brought the templates back to my shop and screwed them to the floor. During each step of construction, I could refer to these full-scale drawings to retrieve any measurements I needed. The templates also served as a helpful build pattern.

FABRICATION

With flat trim work, you can often jump right in, but with curved millwork, you need to take time to make accurate patterns first. I use 3/8-inch MDF for my pattern stock. I cut the MDF with a shop-made trammel jig attached to a router fitted with a 1/4-inch straight cutter **(5)**. A CNC machine, if you have access to one, is even faster and more precise. There are companies that will make up a series of templates in a matter of minutes. Once you have all the correct patterns, then you can lay up the blanks, flush-trim them, and make any molding detail with a ball-bearing guide on the shaper.

All the curved sills were cut 1/16 inch fat, flush-trimmed, and profile-molded on the shaper with a ball-bearing guide.

Column covers. The 12 column covers were made from three pieces of solid mahogany and a back plate (see again photo 4). The front piece was milled before assembly with a custom-made knife for a Williams & Hussey molder. The sides and back plate were ripped at 15 degrees. This allowed each window sill to be cut at 90 degrees on site and fitted to each bay.

Curved rails. There are two difficult problems to overcome in making a curved stile and rail panel system: making a curved rail with a rabbet and making a curved panel.

The fabrication of a curved rail with a rabbet that will accept the panel is the first hurdle. I make curved rails with a bent lamination of five pieces of solid wood **(6)**. The strips are 4 inches wide and 1/16 inch thick. I rip the laminations oversized on a table saw and run them through a planer.

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The tower walls tilted inward about 3 degrees, a detail that was largely unnoticeable in each room, except in the taper of jamb panels for the doorway leading into the main house **(4)**. To create a curved form, the author uses a trammel jig for his router to cut MDF at the radius of each rail **(5)**.

Each curved rail is formed from five laminations **(6)**. The center lamination is ripped narrower than the others to create a rabbet to receive 1/4-inch plywood. The laminations are bent around an MDF form. Using clamps **(7)** can work, but the best way to create a smooth curve is to glue up the lamination in a vacuum press **(8)**.

To form the rails, I use 3/4-inch MDF to make clamping forms to match the finish radius, screwing multiple laminations together into a stack. The best way is to use both an inside and an outside radius, squeezing the rail between the two forms. This allows you to use fewer clamps and get even pressure. But a single outside radius form with multiple clamps works, too **(7)**.

Another method is to use a vacuum bag to press the blanks **(8)**. Vacuum pressure is absolutely even and produces a truly fair curve. (Clamps can leave slight undulations in the rail that can sometimes be visible in flat light.)

A bent lamination's radius is retained by the glue line; overnight cure is critical. There are rigid-set glues (like resorcinol) available that are traditionally favored by boat builders for curved laminations, but Titebond 3 will work fine for a large radius. Because the glue is slightly flexible, there will be some "spring back"—about 3/8 inch on each end for the radii on this project. When it's critical to hit an exact radius, do a test run and adjust your mold as necessary.

The center strip in the lamination is exactly the thickness of the 1/4-inch birch plywood—a bit thinner than the back and front strips. After overnight clamping, this center lamination in the curved rail creates a perfect panel rabbet. I think everyone reading this can appreciate how difficult and painstakingly slow it would be to manually cut a rabbet into a curved rail instead of forming it.

Stiles and rails. When the radii are longer than 50 inches, the edges of the stiles can be milled with square edges. Each end cut on the rails needs a slight bevel cut (less than 90 degrees). Do a test cut.

To fasten the rails to the stiles, the joint can be made with a double biscuit or a Festool Domino. Kreg system pocket screws will also work. I think the Domino creates the strongest joint.

Panels. I would never use 1/4-inch plywood for ordinary flat panels; it is too thin and has too much flex for quality work. But for a curved panel, 1/4-inch ply works great. Most of the 1/4-inch hardwood veneered plywood I've seen has three plies that bend easily into a 50-inch or larger radius when the face grain is oriented vertically. Bending the panel and working it into the curved rabbet creates a drum effect that keeps it rigid. The panel is taut and feels as rigid as 1/2-inch or thicker plywood. This solves the second major problem referred to earlier—having to make up curved panels.

All panels are cut from flat stock. For paint-grade work, standard hardwood-veneered ply would work, but to get the finished look required for this job, I custom-veneered the panels with flitch-matched mahogany.

Note: There was no panel molding on the tower project. For a project that requires paint-grade panel molding, some type of flex product would be the quickest option. I use Duraflex moldings from ResinArt East (resinart.com).

Curved paneling makes for a unique detail in a custom house. And even if the budget doesn't allow for full-wall paneling, these methods can easily be adapted for any curved trim, such as a curved wainscot or baseboard.

Mark Luzio owns Post Pattern Woodworking, based in Brooklyn, Conn.

BY MELANIE HODGDON

Creating Coherent Company Policy

I often hear the phrase, "It depends." Whether I'm working with a company's owner or the bookkeeper, these two little words always signal the absence of a coherent company policy. Other key indicators of a company's need for policy are words such as "if," "sometimes," and "usually."

Here's an example based on one of my recent conversations with a bookkeeper.

Bookkeeper: "Can you show me how to enter this customer payment we just got?"

Me: "Sure. What is the payment for?"

Bookkeeper: "It's a deposit from the customer for some initial design work."

Me: "Is this non-refundable?"

Bookkeeper: "Well, it depends."

Me: "What is the purpose of the payment? What does it secure for the customer?"

Bookkeeper: "It's sort of a sales incentive. It's supposed to hold the customer's place in the schedule, and it is also for some initial design work; but if the project is sold, the payment can be credited back to the job price. And if the project doesn't sell, then we usually keep it. But sometimes we give it back."

PROBLEMS CAUSED BY MISSING POLICY

When there's no policy, the company is often stuck with many unprofitable repercussions, not the least of which is that the decision-maker (owner, salesperson, or estimator) becomes a kink in the hose; everything "downstream" comes to a halt until that person makes a decision.

Sales, too, is affected: Without a policy, the sales process is more complicated because the same service or payment request may be altered according to gut feelings about the prospective customer, current cash-flow realities, or even whimsy.

And as for the bookkeeper, he or she is stuck with three less-than-effective methods to choose from. There's the "crystal ball" approach: He or she can try to guess which way the decision-maker will land in this instance. Or the bookkeeper can simply "wait and see," in which case the payment won't be processed pending a decision—resulting in decreased cash flow. The third approach is to process the payment, but file it in some type of "pending" account and make any required revisions when a decision is finally made—which obviously leads to duplication of effort.

Not having a policy may also cause the financials to fluctuate. For example, if a payment is received on May 27 and classified as income, the Profit and Loss for the month of May will include that money as income. But if in June the "income" is reclassified as an A/R credit, then the income reported in May will suddenly disappear.

> Key indicators that a company needs a policy are the words "it depends," "if," "sometimes," and "usually." When there's no policy, the decision-maker becomes a kink in the hose; everything "downstream" comes to a halt until he or she makes a decision.

INTRODUCING CONSISTENCY

The first step to turning this scenario around is to identify your purpose. What are you trying to achieve? Next, what strategy will you use to achieve it? What policy must be in place to implement the strategy? What procedure must be created to implement the policy? When there's policy and procedure, there's no need for language such as "it depends."

Here's how the scenario above could be represented to reflect a coherent company policy.

Purpose: Increase close ratio (primary purpose). Get paid for initial concept design (secondary purpose).

Strategy: Use initial customer payment as a sales tool to encourage customer buy-in.

Policy: Customer deposits will be treated as credits to the project sale price if the project is sold; they are nonrefundable if the project isn't sold.

Procedure: Classify all customer deposits as liabilities (reported on the Balance Sheet), not income (reported on the Profit and Loss). If the job is sold, convert to a credit against the project. If the job is not sold, convert to income.

Establishing policy and supporting procedures relieves decision-makers from making inconsistent "seat-of-the-pants" decisions. Policy-based procedures permit bookkeepers to follow a consistent process, promoting efficiency. Finally, you can save money by making it unnecessary for your bookkeeper to call me for advice.

Melanie Hodgdon, owner of Business Systems Management, works with clients to generate realistic solutions that reflect the resources and style of their companies. She co-authored A Simple Guide to Turning a Profit as a Contractor, *with Leslie Shiner.*

BY KYLE DIAMOND

Premature Trim Failure

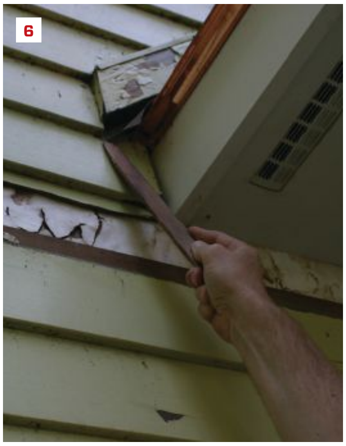
Photos: 1, 5, Kyle Diamond; 2, 3, 4, Tim Healey

Last year my company, New Dimension Construction, began restoring the exterior envelope of a neo-colonial home, in Millbrook, N.Y. The scope of work included tearing off an existing wood-shingle roof, replacing windows, and upgrading the siding and trim with more-durable materials **(1)**. The house was only 28 years old, but poor trim detailing had caused the exterior cladding and windows to prematurely fail on many parts of the home. For this story, I'm going to focus on a few of the trouble spots I encountered on this project—and continue to encounter on similar projects built around the same time period.

TROUBLE SPOTS

To begin with, on the windows, the metal cap flashing at the head was not sloped properly and the wood cap trim was not kerf cut **(2)**. This caused water to pond, then run off the ends of metal flashing and behind the siding **(3)**. The siding was scribed around decorative head trim and no thought was given to directing water outwards from the WRB, so it ran down the factory-applied pine trim, collecting at the sills. Roughly half of the home's 30 windows exhibited the level of sill rot shown in photo **(4)**.

Also, the cedar water table trim was rotted throughout the house **(5)**. Traditionally, water table was topped off with a wood drip cap, which makes it prone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to rotting if regular maintenance painting is not kept up. And if, as was the case here, it has no metal flashing installed over the wood drip cap, it's doomed to failure.

Another problem was at the entry portico, where kickout flashing had not been installed. Here, trim was placed over the step flashing, but no attempt was made to direct water running down the step flashing outward at the bottom **(6)**—water was allowed to flow behind the siding. This problematic detail also occurred in a couple of other locations, higher up on the roof.

Finally, at the rake returns, the aluminum cap flashing sloped the wrong way, which caused water to pond against the trim and siding **(7)**. The returns were probably built with too little slope to begin with, and over the years, settling caused them to reverse slope. Eventually, the silicone caulk sealing the aluminum cap flashing failed. When we started our repairs, we found the underlying rake-return boxes, adjacent trim, and framing had turned into compost **(8)**.

MIXING NEW PRODUCTS WITH TIME-TESTED METHODS

Working one facade at a time, we removed the existing siding and trim and replaced any rotted sheathing we came across. For the new weather-resistant barrier (WRB), we opted to use a drainable housewrap manufactured by Benjamin Obdyke called "HydroGap." It comes with raised dots placed in serpentine pattern that provide a capillary break between the WRB and new siding, while also offering some ventilation. For the new siding, we installed HardiPlank lap siding, which we had pre-primed and painted. All the replacement trim was cellular PVC manufactured by Koma and the metal flashing was 16-ounce copper—we like copper because it's long lasting and aesthetically pleasing and because you can solder the seam-work rather than relying on sealants to make watertight joints.

A better head detail. We joined the Koma head, jamb, and sill stock on the ground and fastened the resulting trim surrounds in place using the Cortex hidden fastening system. Out of Koma, we milled cap trim with a slope for drainage and a continuous kerf cut, and decorative molding. With our Tapco Pro-III metal brake and metal cut-off wheel, we fabricated the copper cap flashings on site.

After installing the PVC head cap trim, we slit the HydroGap

Photos: 6, Tim Healey; 7, 8, 9, 10, Kyle Diamond

WRB and slid the vertical leg of the cap flashing into the cut opening **(9)**. To direct water outward from the head flashing, we slipped square copper flashing under the cap flashing on both sides of the head trim; the bottom of square flashing was lapped onto the fiber-cement siding. The slit in the WRB was sealed with 3M all-weather flashing tape **(10)**.

Later on, the siding was butted to the head trim and then the decorative trim (with mitered returns glued up) was installed. This avoided the need to scribe the fiber-cement siding around a decorative molding, eliminating a potential water entry point, as was the case with previous head flashing.

Rot-proof water table. We replaced the existing rotted cedar water table, base, and corner board trim with Koma; the home's upper trim (fascia, frieze, rake, and soffit) was in good shape. For the water table, we purchased new Azek PVC drip cap; its trim profile was sloped for drainage and had a continuous kerf on the bottom edge. We fastened off the 12-inch-wide water table with Cortex screws and then installed the PVC drip cap with white aluminum L-flashing on top (lapped under the WRB) to prevent water from getting behind it.

Photos: Kyle Diamond

In the rear of house, the existing water table trim transitioned into base trim, which butted stone pavers on a raised patio area. The existing rotted patio-to-wall base trim was too close to the ground and was not flashed properly. Here, we fit copper Z-flashing between the pavers and the rigid foundation insulation **(11)**; PVC base trim would be added later on. Stone entry steps at the rear patio and front portico were rebuilt and pitched away from the house **(12)**. The PVC corner boards were built to match the existing; the mitered drip cap was milled with a slope for drainage and a continuous kerf.

Portico roof. For aesthetic reasons, we doubled up on the new kickout flashing; the larger, upper kickout sheds most of the water, allowing the lower one to be more subdued **(13)**. We salvaged as much as we could of the portico roof. We rebuilt rake-return boxes to slope, trimming them out with Koma. The rake-return cap flashing was made with three pieces of copper, its seams soldered to act as one piece **(14)**.

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

BY TED CUSHMAN

Plug-and-Play ERV for Retrofit Work

Tight buildings need fresh air. But mechanical systems that supply fresh air come at a cost that can put a strain on budgets—especially in remodels, where you might have to demo existing ceilings and walls to install the supply and return ductwork for a high-performance energy recovery ventilator (ERV). That's the problem the German firm Zehnder is trying to solve with its latest U.S. introduction, the ComfoAir 70.

Unlike Zehnder's full-size, whole-house ERV models (the ComfoAir 550, 350, 200, and 160), which have large central air handlers installed in a mechanical room and require the design and installation of extensive ductwork in floor and wall cavities, the new ComfoAir 70 is a simple one-piece unit that mounts through a side wall in the living space and needs no ducts. Each unit exhausts stale room air and supplies fresh outdoor air through small openings on the sides of the appliance.

Priced at $1,250 and sized to provide fresh air for about 600 square feet of living space, the ComfoAir is a good match for small spaces—and of course, the more units you install around the building, the more space they can serve.

The ComfoAir 70 enters the U.S. market on the heels of another European-made compact wall-mounted air exchanger, the Lunos e2, which—along with a smaller companion device, the Lunos eGO—is available in the U.S. from the New York firm 475 High Performance Building Supply. The Zehnder and Lunos systems both mount quickly through a simple hole in a side wall, both offer balanced ventilation, and both have heat recovery. But they operate differently: The Lunos e2 system uses a matched pair of through-wall units with heat-storage cores, set up to operate in tandem on a 70-second cycle, so that one unit exhausts stale air while the other unit draws in fresh air. A thermal-mass core in each member of the Lunos tag-team stores heat from the outgoing warm air, then returns the heat to the incoming fresh air when the fan reverses. The ComfoAir 70, by contrast, does continuous intake and exhaust through just one unit, exchanging heat directly from the outgoing airstream to the incoming airstream through an "enthalpy" core, just like the larger central ComfoAir systems (and like most other ERV systems on the market).

Although both systems are compact and easy to install, the internal transfer core gives the Zehnder ComfoAir an advantage over the Lunos. Like its larger cousins, the ComfoAir transfers humidity as well as heat—that's why it's an "energy recovery ventilator" (ERV), not just a "heat recovery ventilator" (HRV). The ComfoAir also filters the incoming fresh air, and the enthalpy core can be removed and washed (in fact, the core must be cleaned on a regular basis for the unit to perform properly).

Photos by Daniel Bradley

Guided by a template supplied with the ComfoAir 70, carpenter Matt Burstein drills a pilot hole through a home's superinsulated wall. He uses a bit long enough to pass through the 11½-inch wall and keeps the bit level with the help of a torpedo level **(1)**.

INSTALLATION

In June, *JLC* went on site with remodeler and home-performance contractor Jim Bradley, of Caleb Contracting, in Cambridge, Vt., to see two ComfoAir 70 units installed for a deep energy retrofit on a country house. These are the first two ComfoAir 70 units sold in the U.S., so Zehnder's U.S. rep, Norbert Wesely, was on the job to help out.

Jim Bradley's crew had already carried out an extensive reconstruction of the home's wall system, turning the existing underperforming fiberglass-insulated 2x6 stud wall into an airtight superinsulated double wall assembly with an intelligent vapor barrier on the inside face, a plywood air control layer in the wall center, and a vapor-open exterior drainage-plane membrane.

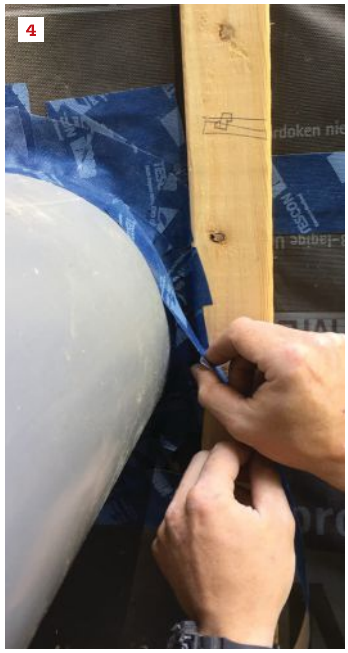
To install the ComfoAir 70, the crew had to bore a cylindrical hole through this multilayer assembly, then install a plastic through-wall protective pipe for the unit's polypropylene-insulated intake and exhaust vent duct, sealing the pipe to the interior and exterior membranes with tape. Carpenter Matt Burstein started by positioning a cardboard template (supplied with the ERV) on the wall between two studs, at a height to provide the end users with easy access to controls on the front of the appliance. Burstein then drilled a pilot hole through the wall at the center of the required 10.63-inch-diameter opening. The pilot hole would serve as a guide for making the larger hole needed to install the Zehnder's through-wall pipe.

Outside the building, Burstein used the cardboard circle from the template to lay out successive cuts through the wall material, starting with the wall's ProClima Solitex Mento drainage-plane fabric, and continuing through a layer of Roxul rock-wool insulation and the inner stud wall's plywood sheathing.

On the inside wall, Burstein traced and cut out a circular hole in the drywall, then a larger rectangle that would give him access to make an airtight connection between the interior ProClima Intello smart vapor retarder and the Zehnder unit's plastic pipe. After the hard plastic pipe was installed through the wall, he taped the inside and outside joints using ProClima Tescon Vana tape.

Inside the house, HVAC technician Jason Marias, of Locals Heating (Underhill, Vt.), roughed in the required hard-wired connection for the ComfoAir. The unit can run on 120-volt or 240-volt power, but the current has to be stepped down for the appliance's four-speed 24-volt fan. Marias installed a junction box in the wall behind the Zehnder's planned location, then helped Norbert Wesely wire in a transformer (supplied with the unit).

Next, Marias and Wesely mounted the Zehnder's metal housing onto the wall with drywall anchors. Finally, Wesely slid the insulated air duct of the unit into the through-wall pipe and pushed the ERV into place in its housing (a snug fit).



After locating the center of the required through-wall opening, Matt Burstein lays out a 10.63-inch circle using the cardboard template, and cuts the hole **(2)**. He'll save the larger rectangular piece and use it to patch the wall after sealing up the wall's interior air and vapor barrier. Outside the house, Burstein carefully cuts and peels back the wall's exterior drainage-plane fabric, then uses the same piece of cardboard to scribe for cuts in the rock-wool insulation and mid-wall plywood sheathing **(3)**. After installing the through-wall protective pipe for the ComfoAir's two-way intake and exhaust duct tube, he carefully tapes the pipe to the exterior fabric again, to re-establish the watertight and airtight (but vapor-open) outer weather-resistive barrier **(4)**.

Once the circuits are properly wired, the plastic protective pipe is installed through the exterior wall, and the metal housing is mounted, the appliance can be set in place **(5)**. On the outside wall, Jason Marias cuts the protective pipe and the insulated air ducts flush to the exterior trim, using a Makita multi-tool **(6)**. The final touch: Norbert Wesely screws the vent hood in place over the intake and exhaust openings **(7)**.

The ComfoAir's through-wall pipe and insulated air tube are long enough to reach through a 2-foot-thick wall. For thinner wall sections—as in this example—the pipe and tube can be cut to fit. But because the unit's fan is housed within the through-wall tube, there's a minimum wall thickness. Even Jim Bradley's 11 1/2-inch-thick wall had to be packed out to 12 1/2 inches with a piece of 5/4 material before the ComfoAir tube would fit.

In a typical 2x6 wall, leaving room for the fan would require the tube to project past the wall surface by almost 6 inches, so the wall would need to be built out on either the inside or the outside to accommodate the appliance.

Whatever the trim detail, once the tube is cut flush with the wall exterior, the intake and exhaust tube is caulked and a vent hood is attached.

OPERATION

According to Norbert Wesely, the best way to operate the ComfoAir 70 is to set it and forget it: Leave the dial set to whichever of the four fan-speed settings best matches the home's routine fresh-air needs and run the unit continuously. Then, he says, you can bump the speed up as required for an occasional high-demand situation, such as a house full of party guests. And Wesely notes that routine maintenance is required for the appliance, as it is for any high-performance ERV. Filters should be checked every three months and replaced as needed.

The ComfoAir 70 doesn't require ducts to operate. But you can hook short runs of ductwork up to it. That's handy in certain situations. For instance, you could set the unit up to draw stale air from a kitchen or bath and deliver fresh incoming air to a living room or bedroom suite.

Ted Cushman is a senior editor at JLC.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Air-Sealing Options: Good, Better, Best

New standards for air-sealing require a range of new materials and methods

BY MATT RISINGER

Photos by Matt Risinger

I talk a lot about air-sealing and building tight houses on my blog and in my videos, and I'm still shocked at the comments I receive from building professionals of all stripes about how a house should "breathe." Houses don't have lungs and can't breathe; people and animals breathe. Houses should be tight and well air-sealed so that the money our clients pay to heat, cool, and dehumidify the interiors isn't wasted by outdoor air leaking in and requiring additional energy to condition.

Where I work in Texas, the air leaking into a house typically brings with it humidity, as well as pollen and allergens. This humid air can easily find a spot inside the wall cavity where the dew point makes it condense. Typically, this spot is the paper facing on the back of drywall; I find lots of moldy drywall when I remodel homes.

To prevent such problems and to maintain energy efficiency, I want to build the tightest house possible and introduce and distribute fresh, filtered air only where and when my clients need it.

How efficient or comfortable would your houses be if your clients left their doors cracked open by an inch or two? Not very. Air-sealing is vital to an efficient, durable, healthy build, and I believe it's more important than most other energy-efficiency measures. And in the building of a home that's both durable (meaning it won't rot or develop mold) and energy efficient, air-sealing is second in importance only to waterproofing. No matter how much insulation you stuff into your walls or roof, it's all worthless if hot or cold air leaks in.

FOAM FICTION

This article, in which I survey the good, better, and best air-sealing strategies that have worked for me, has been some 10 years

Spray polyurethane foam insulation (1) works well to resist heat flow, but it is not a whole-house air-sealing solution. Closed-cell foam blocks air pretty well in wall and ceiling cavities and is one of the best ways to seal band-joist areas **(2)**, but foam insulation will not seal all the penetrations in a house. Cracks at plate lines are one obvious example of areas that will need extra attention. The author has also noticed that cracks can develop at the edges of framing cavities when framing shrinks. When he does use foam, his crew prefoams the gaps and cracks in framing cavities before the bays are filled **(3)**.

in the making as I've been working on tightening the houses I build. When I started taking building science seriously (led to this topic by the mold crisis, which erupted in Texas and blew up in importance nationally soon afterward), in the early 2000s, I initially believed I could achieve all the air-sealing I desired for my houses by installing spray polyurethane foam for the entire envelope.

The first all-foam house I blower-door tested had 2x4 walls with 3 1/2 inches of open-cell foam, and 2x6 rafters with 5 1/2 inches of foam. That met code for climate zone 2 (Austin, Texas) at that time, and I expected a very low blower-door score. So I was surprised when the house scored a 4 ACH50. That was acceptable and below what was needed at that time for code, but the house was still not as tight as I had hoped.

Since then, I've been tinkering with various materials and methods to ratchet down my blower-door scores. My company, a general contractor that doesn't do design work, specializes in architect-driven projects, and most of our jobs come from architects who refer us to the clients at the schematic design stage—or sometimes even further along in the design process. As a result, I have limited influence over the design. I push hard to achieve as tight an envelope as possible to offset the eventuality of the architect or owner coming in with a fancy door or unusual windows that aren't optimal for airtightness. In many cases, the rest of the shell needs to be as airtight as possible for the house just to meet code.

In this article, I'm going to begin by covering strategies for meeting the current 2012 IECC requirement of 3 ACH50 (for most of the country), and then I'll move on to some of the products and

To meet minimum air-sealing requirements (3 ACH50 for most of the U.S.), the author air-seals between the foundation and wall framing with peel-and-stick flashing **(4)**. Before drywall, all plumbing and electrical penetrations in walls are sealed with expanding foam to stop air from flowing between the lower floors and the attic **(5)**. Large openings, such as the opening into an attic from an attached garage, are sheathed and the edges foamed **(6)**. To seal rim joists, a carpenter cuts blocks from rigid foam using a template **(7)** that has notches for the top and bottom flanges of I-joists. These blocks must be foamed into place **(8)**.

techniques you can use to ratchet that airtightness toward Passive House levels (0.6 ACH50).

AIR-SEALING TO MEET CODE

Meeting the prevailing energy-code requirements is the starting point for "good" air-sealing options. I am a fan of using spray polyurethane foam (open-cell above grade; closed-cell below grade or wherever you can afford it). It's a good choice because it can air-seal some potentially difficult areas, like band joists and joists, and it's great for creating conditioned attics—which we do often in the South because we don't have basements for mechanical rooms.

Before installing spray polyurethane foam insulation, I like to "prefoam" my houses by having one of my carpenters detail all the cracks and penetrations with canned foam and caulk. We focus on breaks in the framing, penetrations, overhangs, mechanicals, and where framing meets the foundation. I initially used lots of caulking for sealing these areas, but now I use flexible flashing tapes where possible, especially where framing meets concrete.

You'll also want your drywall contractor to caulk drywall to HVAC vents, use low-expansion foam around windows and doors, and caulk bottom wall plates. If you follow these general guidelines, you'll more than likely achieve blower-door scores of 3 ACH50 or less.

BETTER OPTIONS

I want all my houses, no matter the design, to blow as close as possible to 1 ACH50. If this is your goal, here are the measures I've

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Better air-sealing (tightening to around 1.5 ACH50) requires a peel-and-stick or fluid-applied WRB, or a taped sheathing system, such as Zip System. Here, the author has installed Cosella Dorkin's Delta Vent SA **(9)**. With a perm rating of 50, it works in all climate zones. Sheathing must be primed before the WRB is applied **(10)**. Windows need to be sealed with a low-expanding foam from the inside and taped on the outside **(11)**. Similarly, all through-wall penetrations must be foamed from the inside and taped outside. **(12)**. Bottom wall plates must be caulked **(13)** or taped inside and sealed with flexible flashing outside.

used to successfully take my projects to an average blower-door score of around 1.5 ACH50—despite some less-tight door and window products being specified.

To reach a "better" level of airtightness, you need to use a peel-and-stick or a fluid-applied weather-resistive barrier (WRB). Zip System sheathing that's fully taped will also work.

In the South, I often use Poly Wall Aluma Flash Plus, which is a foil-faced WRB. But foil is a zero-perm product, which is not a good option in a colder climate. You'll want to avoid this unless you work in the hot-humid regions of the southern U.S. I also like Cosella Dorkin's Delta Vent SA, which is a peel-and-stick WRB that has a perm rating of 50 and works in all climate zones.

Just like with the "good" air-sealing methods, I "prefoam" framing cavities and take care sealing details and penetrations with foam, caulk, and tape. This is time well spent. Once the drywall is hung, these areas will be inaccessible.

At the "better" level, we are doing everything we can to stop air flow at the outside wall. This includes taping framing to the foundation on the outside, as well as caulking or taping the inside.

Better windows and doors. At this level, I also upgrade from standard lumberyard exterior and garage doors, and I want the architect to steer clear of pivoting or sliding doors, unless they are PG50 rated.

A PG50 rating takes design pressure, or DP, into account. A DP50 rating means the window or door can withstand an equivalent wind pressure of 50 pounds per square foot (as measured by an independent company in a lab). There actually are three DP tests, however—one for air, one for water, and one for "structure."

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Reaching the tightest air-sealing standards (below 1 ACH50) starts at the earliest framing stages. Here, the author's crew is installing a Bensonwood home, which includes a double bulb gasket between SIP wall panels **(14)**. Roof panels have a rubber gasket to seal where panels meet at the ridge **(15)**. All panel intersections, including the joints between the walls and roof, are taped-off with SIGA tapes **(16)**. Overhangs are framed in after the exterior has been completely air- and water-sealed.

A window with a DP50-Air rating has withstood the equivalent pressure of a 142-mph wind, without leaking air. DP50-Water involves an 8-inch-per-hour rain with the equivalent wind acting on the window, without water leaks. DP50-Structure means the window or door can withstand the same levels of wind and water without deformation or failure.

A PG50 rating (PG stands for "Performance Grade") refers to a window or door that has passed all three DP tests—for air, water, and structure. If you are looking to ratchet down your airtightness to near 1 ACH50, it's helpful if PG50 windows and doors have been specified. Some manufacturers disclose this on their bids, but for others, you'll have to dig this rating up. The Marvin windows and doors I often use are all PG50 rated.

Doors that are made by some of the other window manufacturers and that come with multipoint lock mechanisms often have a PG50 rating. They are certainly much tighter than the standard lumberyard models.

BEST OPTIONS

When we are looking to ratchet down the airtightness below 1 ACH50, radical things must happen. First, all the windows and doors *must* have a PG50 rating. We can't use any pivot-hinge, steel, or architectural doors or commercial products that "seal" with a brush sweep.

Next, the house must be designed from the start with airtightness in mind. I have two suggestions for framing.

Modified SIP house. I recently had the opportunity to build one of the homes developed by the legendary timber-frame company

All ductwork, plumbing, and electrical are routed within strapped walls and interior framing cavities, keeping everything inside the envelope and minimizing penetrations **(17)**. SIPs made with Zip System Sheathing get taped off before overhangs are installed, for a more dependable air- and water-seal of the shell **(18)**. Another home built by the author is a "Perfect Wall" house **(19)**. The house is framed and sheathed without overhangs, and the entire shell is sealed with a peel-and-stick membrane. Four inches of polyiso board on the walls and 8 inches of polyiso on the roof complete the envelope **(20)**.

Bensonwood, here in Austin. The walls and ceiling panels are factory-framed and result in a super-tight and extremely well-insulated shell. The panels have Zip System sheathing, I-joist studs, and an interior layer of OSB. Everything gets taped inside and outside. Wall panels are joined with double bulb gaskets, including where walls intersect with the slab foundation and where roof panels join at the ridge. The house had no overhangs when it was first framed so that the air barrier (Zip System with a peel-and-stick roofing membrane) could run continuously up the walls and up and over the ridge.

Most SIP homes are similar and are also a "best" option.

Perfect Wall. One option for super-tight construction without factory framing is a "Perfect Wall" house. We recently completed one that used standard wall framing with conventional lumber; again, the design had no overhangs so the WRB could run continuously from the foundation, up and over the ridge, and back down again. This makes for a super-tight house from an air-sealing perspective.

The author of this method, Joe Lstiburek, of Building Science Corporation, calls this a 500-year house. It can be built in any climate zone in the U.S. just by varying the thickness of the exterior insulation to provide condensation control. In our case, we used 4 inches of polyisocyanurate foam board on the exterior walls and 8 inches of polyiso on the roof. No cavity-fill insulation on the inside of the home was needed.

Matt Risinger owns Risinger Homes, in Austin, Texas, and is a regular contributor to JLC*.*

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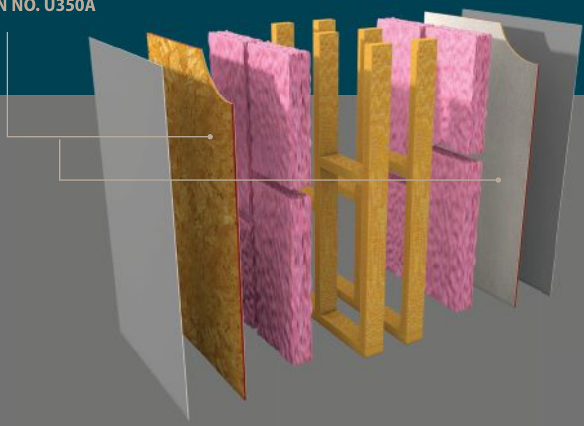

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TECH SUPPORT

Building a Deck on Grade

Helical piers and a trenched beam provide solid support for a curved ground-level deck

BY JIM FINLAY

Photos by Jim Finlay

Our customer's requirements were simple: Build an interesting deck and patio off the back of the house. The deck would be low enough to make rails unnecessary. We recommended curves, and the customer liked our simple, elegant design.

Building the patio was straightforward, but building the deck became challenging. Here in New England, we like to set the height of our decks one riser below the interior floor (a step down of 6 to 7 1/2 inches), to help keep rain and snow out of the house. The area for our 15-by-17-foot deck was mostly flat and about 14 1/2 inches below the kitchen floor. So we would set the deck 6 inches below the floor, leaving 8 1/2 inches for the deck. Fitting the entire structure of a curved deck within 8 1/2 vertical inches, however, is difficult.

Double-band construction, using joists attached with hangers to a double rim, would require the least height. But that posed several challenges. To start with, the distance from the house to the girder at the front would be too great for 2x8 joists to span. So we would need to frame the deck with 2x10 joists; but those would not fit into our 8 1/2-inch-high space. Should we dig out and remove a few inches of soil over the entire area?

Another challenge was that, in order to support the joists, the curved rim would need to be doubled. But how could we bend a double rim? Vertical relief cuts (like the cuts shown on page 54) would weaken this structural member too much. Laminating two 1x8s together with glue and nails would create a strong enough member, but setting the correct curve would be difficult. In any case, it was not feasible, because 1x8s were not available with the necessary


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The author's crew began the job by hand-digging a trench for the treated-wood grade beam **(1)**. Next, a hydraulic machine drove steel-tube piers with helical screw ends into the soil until the required pier bearing strength was verified by the machine's on-board torque gauge **(2)**. The crew set adjustable-screw beam brackets onto the steel-tube piers **(3)**, which served to secure and support the built-up treated-wood carrying beam **(4)**. The crew placed large crushed stone into the trench around the beam to provide good drainage and frost protection, wrapping the stone in filter fabric to keep it silt-free.

ground-contact-rated preservative treatment. Finally, even if we could solve those issues and build a suitable curved structural rim joist, the footings to carry that member would have to lie directly under the front of the deck and would actually define the deck's curved edge. Their placement would have to be precise.

POST AND BEAM CONSTRUCTION

So, instead of a curved structural rim joist, we opted for post-and-beam framing. We would locate a carrying beam about 2 feet back from the deck's front edge, under the joists. This configuration gave us two major advantages: First, it reduced the joist span so that 2x8 joists would be able to carry the load; and second, it allowed the joists to cantilever past the beam, which would make shaping the curve much easier.

Post and beam did impose one disadvantage, however: Because the structure of joists on top of a beam would occupy 16 1/2 vertical inches, the beam would need to be set into the ground, with its top just about at grade level. We'd have to dig a fairly deep trench to accommodate the beam, with a drainage space around it. But that work was worth doing, because it would separate the rough work of installing footings from the fussy work of finishing the precise, symmetric curve. We'd rather trim a half-inch off the end of a joist than have to adjust the location of a footing 4 feet deep in rocky ground.

We drew detailed structural plans and calculated weight loads so we could size the beam and joists properly. Although our building code (IRC 2009) requires a 40-pound-per-square-foot (psf) live load for decks, we build all our decks to 60 psf. I still remember when the extreme snow in February 2015 accumulated more than

To frame the deck, carpenters squared the end joists to the house and established the desired pitch for the deck **(5)**, then built up and set the carrying beam using ground-contact-rated treated wood **(6)**. Because the patio stones were not capable of bearing any deck load and might be subject to frost heave (unlike the screw piers that support the carrying beam), the carrying beam had to be carefully cut into the stone patio, rather than rested on it **(7)**. Likewise, crushed stone was placed around the beam to provide drainage, not for support.

4 feet deep in the Boston suburbs. That much snow can indeed weigh 60 pounds per square foot.

Our design imposes a load of 429 to 595 pounds per linear foot (plf) along the angled beams. Over the 6-foot-3-inch spans between footings, we could have used double 2x10 beams; but triple 2x8 beams could support even more weight and saved us 2 inches of digging.

Trenching a beam requires more than just digging a long hole. The beam needs space underneath to prevent frost from pushing it up in winter. Over time, dirt would fill in that space, so we overdug the trench, lined it with landscape cloth, and surrounded our below-grade beam with loose, clean stones. Those stones drain well and will move aside if frost threatens the beam. The landscape cloth prevents soil from infilling the spaces between the small stones.

FOOTINGS

For the deck footings, we could have used concrete poured into Sonotube forms, but that method would impose two difficulties here. Digging for the tubes would be dangerous so close to the patio, and properly compacting the soil around the 4-foot-deep piers was not feasible: Soil would settle over time and cause the adjacent patio to sink. Instead, we used helical footings—long galvanized pipes with a large screw at the end. A hydraulic machine twists them into the ground without disturbing the surrounding soil, and the machine's torque gauge tells us when the required bearing capacity has been achieved. We twisted each 7-foot helical footing into the ground below the frostline, and cut the end off once it exceeded the required bearing capacity. We then attached adjustable brackets to support our beam.

Above, carpenter Eric Roberts used 6-inch TimberLok screws driven at an angle to secure the end joist to the deck ledger **(9)**. Holding a joist flush to the ledger **(10)**, he pinned the joist in position with a pneumatic nail. Next, he permanently attached the joist to the ledger with a galvanized connector and 12d nails **(11)**. To achieve a flat deck frame, he laid a straight 2x4 across the joist system at mid-span and used 6-inch TimberLok or HeadLok screws to pull the joists into alignment **(12)**. With the joist system straightened, he reinforced the deck frame with solid blocking, fastened with 4-inch TimberLok screws.

FRAMING

The initial deck framing was fairly conventional. After leveling our two reference joists, we inserted the beam below. The helical footing bracket adjusts easily on its screw, so setting the beam height was simple. Once the beam was set, we flushed the top of each joist even with our carefully leveled house ledger, shot nails to temporarily fasten the joist, then installed joist hangers.

An interesting issue arose on the left side of the deck. Our design called for the deck to extend a few inches over the patio to hide its edge and provide a clean look. We could not let the side joist merely rest on the patio, because the patio is not a structure and is subject to frost. We had to support that side joist like all the other joists. Thus we had to extend our beam into the patio.

The solution was obvious, but somewhat tedious: We carefully notched the patio stones and reset them around the beam. It's too bad the finished deck hides this craftsmanship.

THE 'ROBERTS RIDGE'

One minor deck problem has irked us for years: The finished surface of our decks was always a little uneven, and our synthetic decking often squeaked under foot. We use #1 treated lumber for our joists, but even these are often slightly warped and vary in height considerably, at times causing adjacent joists to differ in height as much as 1/2 inch or more.

Our carpenter, Eric Roberts, devised a simple, elegant solution. Setting the joists perfectly level at the house is easy, and the beam makes them fairly even near the front edge. The problem lies in the

Roberts laid out the deck's curved edge using a simple string-and-pencil compass **(14)**, then cut the curve with a circular saw **(15)**, finishing the cuts with a recip saw at the bottom where the space was tight. The band joist was framed with 2x8 treated wood. To allow the band joist to bend and follow the curve, Roberts cut closely spaced kerfs into the material **(16)**. Leaving the joists loose above the carrying beam, he clamped the band joist into position **(17)** and nailed it to the joist ends **(18)**, before finally fastening the joists to the carrying beam.

middle. Before installing the mid-span blocking, he laid a straight 2x4 on edge, across the deck and perpendicular to the joists, as a sort of a strongback. He then twisted 6-inch TimberLok or HeadLok screws through the 2x4 "ridge" into each joist below. The screws pulled all the joists into a common alignment, flush to the bottom of our straight 2x4. In 20 minutes, our deck joists were perfectly level and in plane.

To preserve that consistent, level height, we nailed mid-span blocking in place and secured each piece tightly with 4-inch TimberLok screws, two at each end.

We removed our "Roberts Ridge" when we were ready to begin decking. A little movement and some squeak were noticeable in the frame, but installing the decking (especially because we installed it diagonally) eliminated that. So we were able to level the deck, reduce deflection, and virtually eliminate noise—all in a few minutes, and just with a temporary 2x4 and a handful of screws.

CUTTING THE CURVE

Since we had separated the beam structure from the edge of the deck, building a smooth, evenly curved rim became easy. We marked the curve on the joists using a string-and-pencil compass and cut the joists to length, finishing each cut near the ground with a recip saw.

Carefully selecting and scoring the rim joist was crucial to creating an evenly curved deck. The rim joist could have no large knots, and a smooth curve demanded evenly spaced relief cuts. But the long radius (11 feet 6 inches) allowed our rim joist to easily bend into

A bench along the high side of the deck serves a safety function in addition to providing seating. Roberts plumbed the seat's 4x4 supports **(19)**, then fastened the posts securely to the deck frame using ThruLok screws **(20)**. He lowered a ladder-framed bench structure into place over the post ends **(21)**, then finished out the bench using the same Fiberon material used for decking and deck trim **(22)**. The crew will return in a few months to inspect the bench and re-tighten fasteners in case lumber shrinkage has loosened any connections.

shape. Clamps on the ends and two screws in the middle held the curved rim in place. Leaving the joists loose over the beam allowed us to adjust any joist left or right until it tightly contacted the rim. We then aligned the height and nailed the rim to each joist.

THE SAFETY BENCH

As planned, the step down from the deck to the patio was about 8 1/2 inches, but sloping ground on the right side increased that drop to almost 16 inches—too tall to comfortably or safely step off. We addressed this hazard by building a bench along the edge of the deck.

A standard bench with pairs of legs might have looked too massive for this small deck. We opted instead for a "floating bench," which employs single 4x4 legs that extend down into the deck frame. The key to making the bench solid and stable is to through-bolt each leg between two joists below and between pairs of cross supports on the upper frame. We clad the bench frame with Fiberon's synthetic ProTect fascia, ripped to height, and softened the bench edges to improve sitting comfort by holding that trim 1/4 inch below the seat.

Treated wood shrinks considerably as it dries during the first months of its exposure, and the initially tight joints in our bench may become loose and wobbly in six or nine months. Fortunately, this shrinkage stops and the wood remains moderately stable thereafter. So we'll return within a year and tighten our connections.

Roberts trimmed the curved deck edge using synthetic Fiberon ProTect fascia **(23)**. At $^{3}/_{4}$ inch, the composite material is flexible enough to follow the curve. After applying Fiberon decking, he rough-cut the deck boards to the curve with a circular saw, then made a second, finer cut with a jigsaw **(24)**. He smoothed the edge with a router equipped with a flush-cut bearing bit (**25**), then covered the exposed end cuts with a second trim piece **(26)**.

TRIMMING THE DECK

To hide the framing, we covered the rim and side joists with more Fiberon trim material. At $^{3}/_{4}$ inch, it was thin enough to easily follow our curved rim joist.

For decking, we used grooved Fiberon ProTect Advantage $^{5}/_{4}$x6, fastened with hidden clips. We ran the deck boards diagonally and left them long, hanging past the trimmed rim. Cutting the decking straight along the side trim was easy using a circular saw.

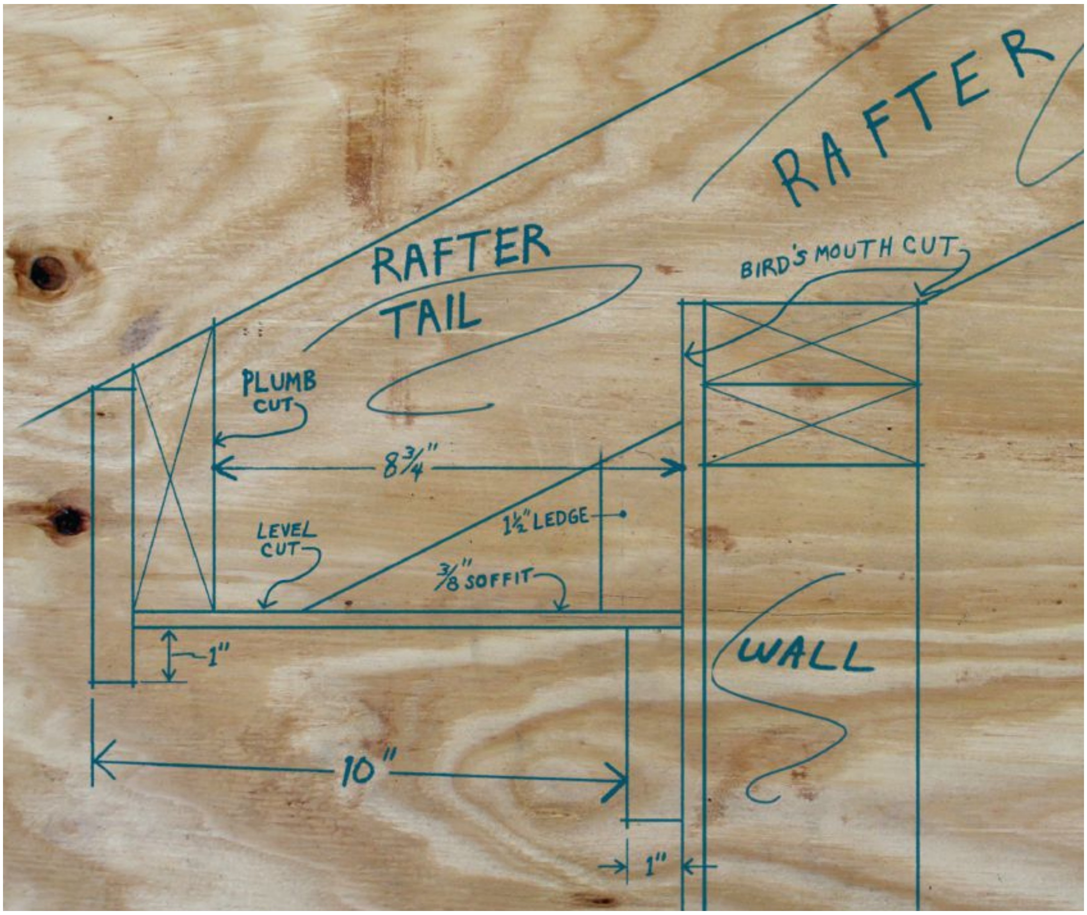
Cutting the decking around the curve took two steps. We first used a jigsaw to roughly cut each board about $^{1}/_{4}$ inch beyond the trim. We finished the curve with a router and a $^{1}/_{2}$-inch-diameter flush trim bit. The bit's bearing ran smoothly along the curved deck trim and guided the blades to create a flush, even edge.

To hide the exposed ends of the decking, we installed a second trim piece, flush with the top of the decking. We ripped the same fascia material to $2^{1}/_{2}$ inches and fastened it with stainless steel trim nails through the lower trim, and with clear silicone and stainless steel pin nails into the ends of the decking above.

The diagonal decking left one small sliver that demanded some care (and an extra face screw), but the results were worth that effort.

Our completed deck looks simple. But making it solid, flat, and quiet, and ensuring that its curve was smooth and even, took some craftsmanship.

Jim Finlay is the owner and general manager of Archadeck of Suburban Boston, a custom deck franchise outside Boston, Mass.



Framing Eaves and Rakes

Full-size drawings and a handy jig speed layout and minimize the chance for errors

BY JOHN CARROLL

Eaves and rakes that overhang a building's sidewalls are critical to the life of a building. Shedding rainwater away from siding and trim—especially from door and window sills—can greatly reduce rot, mildew, and a host of other problems that can be caused by water streaming down the face of the building. And aside from the practical considerations, well-proportioned overhanging eaves and rakes can also be an attractive design element.

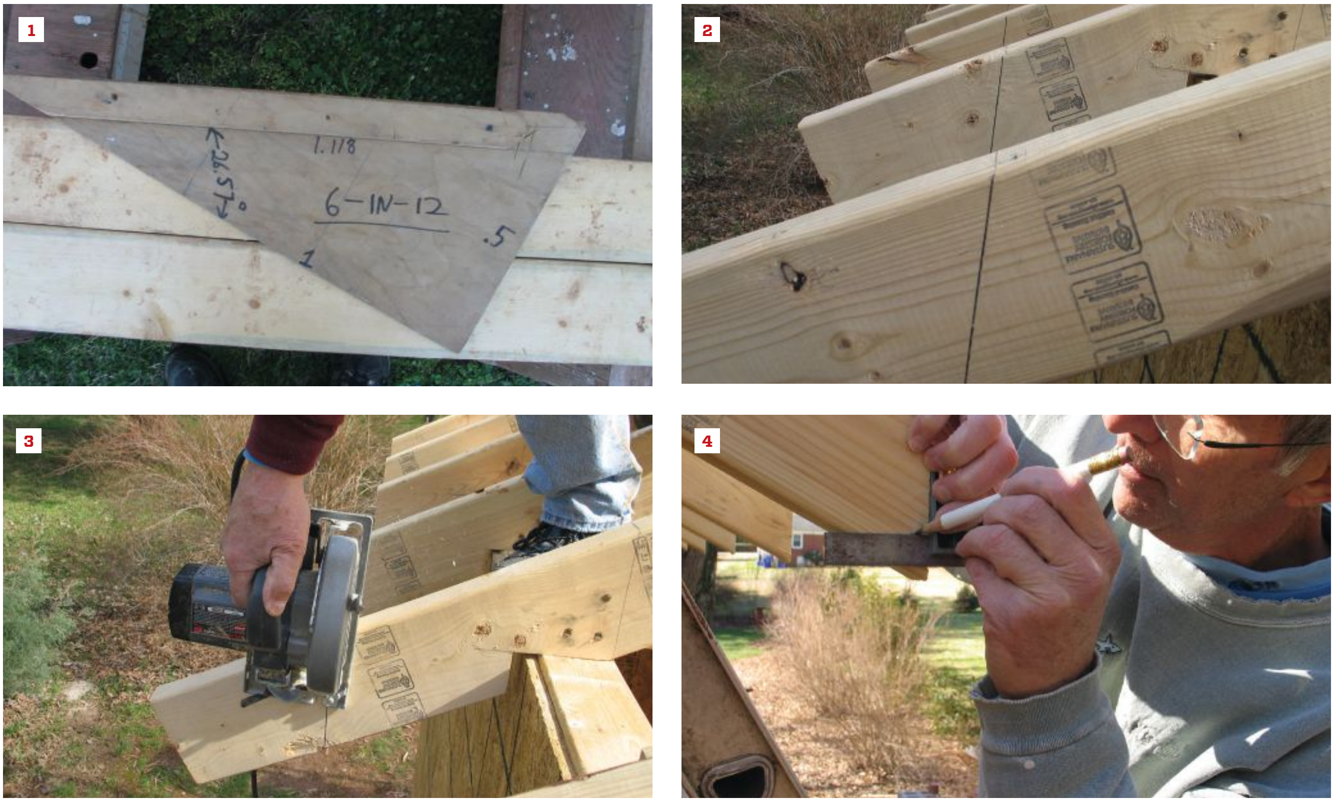
There are many ways to frame eaves and rakes. My system is straightforward and provides strong, positive attachment of the overhanging elements to the building, as well as solid nailing for the finish materials. I recently built a small outbuilding with a 6-in-12-pitch roof that offers a perfect example for showing the process I use to build eaves and rakes.

START WITH THE RAFTER TAILS

The main component of any eaves detail is the rafter tail—the part of the rafter that extends beyond the exterior wall. To determine exactly what the rafter tail will look like, I always make a full-size drawing on a scrap of plywood of all the eaves elements, including framing and finish materials (see illustration, above).

The first thing I determine on the drawing is the overall width of the eaves. For this project, that was 10 inches from the outside of the frieze board to the outside of the finished fascia. After drawing

Photos by John Carroll



A rafter jig facilitates drawing the eaves detail, as well as laying out the rafters **(1)**. Rafter tails are installed long. Then the author measures and marks the first and last rafters and snaps a chalk line between them to align all the tails perfectly **(2)**. Cutting the rafter tails from above causes the kerf to open naturally and let the waste fall away harmlessly **(3)**. The plumb cuts are too long for the fascia, so the author measures and marks the ends of the tails for level cuts **(4)**.

the wall framing, the sheathing, and the 1-inch-thick frieze, I squared a level line from the outside face of the frieze and marked 10 inches out from there. Aligning the edge of my jig on the mark, I drew a plumb line that represented the outside face of the fascia. From this reference, I marked another plumb line 3/4 inch in for the thickness of the fascia, and 1 1/2 inches in from there for a 2-by subfascia. This established where I would need to make the vertical cut for the rafter tail, which turned out to be 8 3/4 inches from the sheathed wall.

To help with the drawing and with laying out rafters, I used a simple rafter jig that I built on site from a piece of plywood with a factory corner **(1)**. From that corner, I cut a right triangle at the roof pitch, doubling the rise and run dimensions so the jig could be used for cutting full-size rafters. For this 6-in-12-pitch roof, I made one leg 12 inches and the other 24 inches. After cutting the angle, I attached strips of 1x2 along the hypotenuse on both sides. I also labeled the jig with the pitch and the angle; I save all my jigs and stow them for the next time I need to cut a roof with the same pitch.

To use the jig, I simply hook the 1x2 to the top edge of the rafter stock and I instantly have both plumb and level edges to scribe to.

The rafter tails can be shaped on the ground using the rafter jig to lay out the pattern rafter quickly and accurately. But I prefer to cut and install the rafters with just the ridge cut and birdsmouths, leaving the tails long to be cut in place. So after the rafters were nailed in, I measured out from the sheathing the distance—8 3/4 inches—I'd determined for the overhang, and I marked the first and last rafters. I plumbed lines up from those marks and then snapped a chalk line from one end of the roof to the other across the top edges of the rafters. Using that snapped line as a guide would put the rafter tails in an arrow-straight line.

On each rafter, I plumbed a line down from the chalk line using a Hanson Pivot Square set at a 6-in-12 pitch (I could also have used my jig at this point; there just needs to be enough room to align it on the tails) **(2)**. The Pivot Square also provides the angle, which for a 6-in-12 pitch is 26.5 degrees. Then, standing on top of the wall, I cut down each plumb line with a circular saw **(3)**.

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After the subfascia is installed, a line is squared over to locate the ledger for the soffit **(5)**. The ledger is left long to be trimmed when the returns are built **(6)**. Notches under the rafters allow for the use of full-dimension stock on the ends to better support the returns. Blocks made from 2x4s attach to the rafters and to the ledger to support the soffit material and soffit vent **(7)**.

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I like to cut the tails from above because the saw kerf opens as the cut nears completion, letting the waste fall harmlessly down and away from the saw.

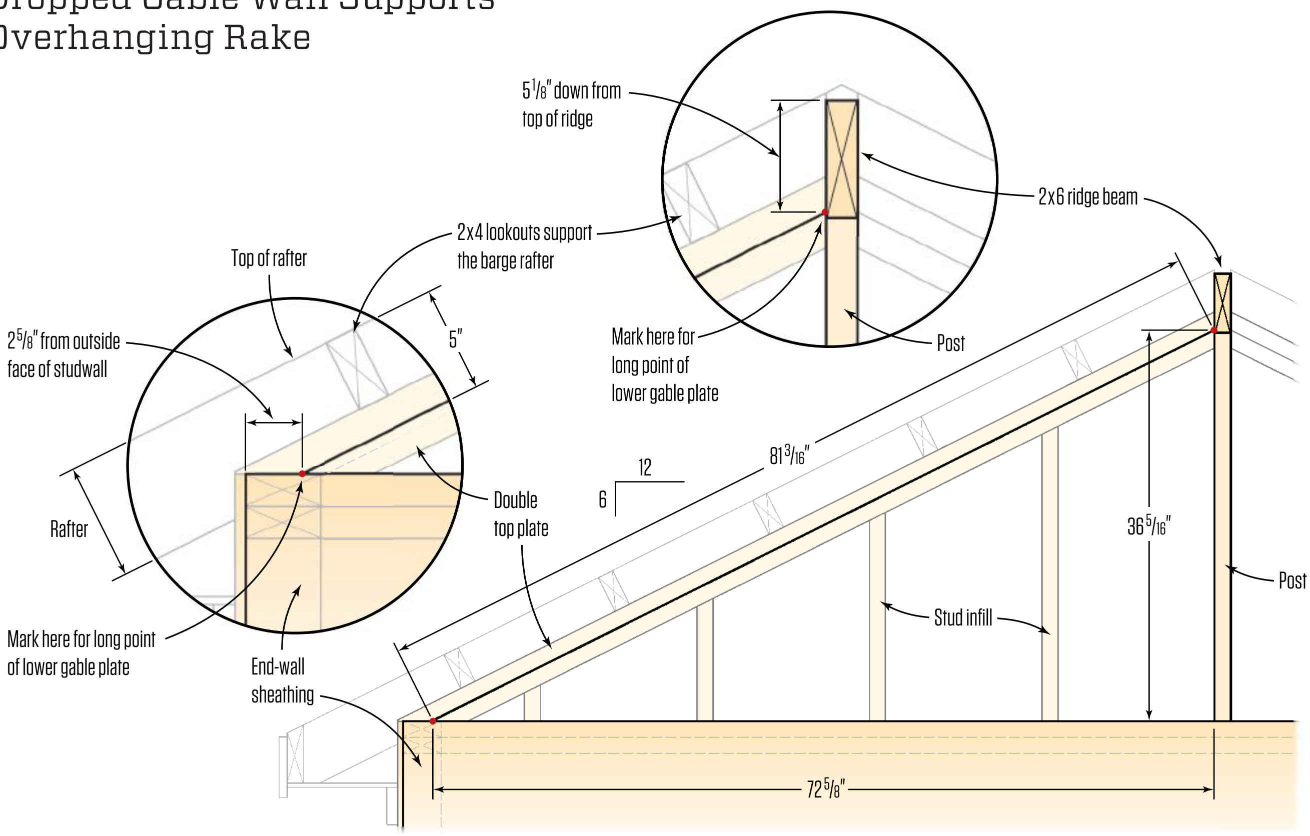
The plumb cuts on these rafter tails were more than 6 inches long—too long for the 1x6 fascia that I intended to use. To shorten the plumb cut, a level cut along the bottom of each tail was needed. I went back to my full-size drawing and put the top outside edge of the 1x6 fascia in line with the top of the rafter. Then I drew the lower finished surface of the soffit 1 inch up from the bottom of the fascia. (This amount is arbitrary, but a 1-inch overlap has always looked right to me). The 3/8-inch thickness of the soffit material came next. That line also indicated the bottom of the subfascia.

The top of the 2x6 subfascia was beveled to continue the line of the 6-in-12 roof pitch. To make sure the level cut of the rafter tails didn't interfere with the soffit installation, I drew the cut 5 1/4 inches from the short point of the plumb cut to provide plenty of clearance. After measuring down that distance on the plumb cut of every rafter, I marked the level cut square to the plumb cut and made the cuts using a circular saw **(4)**.

FINISH THE EAVES FRAMING

After ripping the top of the subfascia with a circular saw set to 26.5 degrees, I flushed the top ripped edge with the top of the plumb cut on the rafters and screwed the subfascia to the rafter tails. On both ends of the roof, I let the subfascia run out beyond

Dropped Gable Wall Supports Overhanging Rake



The triangular part of the gable wall is built after the rafters are installed. The diagonal plates are 3 1/2 inches down from the tops of the rafters to support 2x4 lookouts for framing the rake. After locating the end points of the plates, the length is found using a base-1 triangle for a 6-in-12 pitch where the hypotenuse is 1.118 times the length of the base. After the gable is framed, lookouts extend from the first rafter inside the gable wall out over the plates to support the overhanging barge rafter.

the anticipated width of the rakes. This well-anchored cantilever will provide firm support to the lower end of the barge rafter, as well as supporting the return.

Once the subfascia was attached, I squared over from the bottom of the board and marked a line level on the wall sheathing at both ends of the wall **(5)**. I snapped a chalk line and then fastened a 2-by ledger to the wall with the bottom edge on the line. On this project, I notched the ledger to fit below the rafters so that the ends where the return framing would be attached would have the full stock dimension. As with the subfascia, I ran the ledger out past the anticipated width of the rake on both ends of the building. The cantilevered section of the ledger will support the rake returns **(6)**.

Because I planned to use continuous eaves vent on this project, I added cross blocks to support the inside edges of the soffit material, as well as the vent itself. I cut the cross blocks to fit and installed them next to the rafter tails. Installing the blocks before the finished fascia lets me nail through the subfascia and into the ends of the cross blocks **(7)**. These blocks can be installed at any point after the subfascia and ledger are installed; on this project, I installed them after the barge rafter had been installed.

FRAMING A DROPPED GABLE WALL

One of the keys to framing the rake with my system is building a "dropped" gable-end wall, the top of which is 3 1/2 inches below the tops of the rafters. Then, after the wall is built, I install 2x4 "lookouts"—blocks that extend from the first rafter in from the end of the building, over the dropped gable, and out to a barge rafter to form the overhanging rake (see Dropped Gable Wall Supports Overhanging Rake, above).

To save time, I added the triangular "gable" part of the wall after the lower walls were built and raised. I framed the dropped gable with a double top plate, and I began by finding the end positions of

To find the long points of the lower plate on the dropped gable, set a square to 5 inches (3 1/2 inches for the lookouts and 1 1/2 inches for the top plate). Slide the square down the rafter and mark where it touches the top of the wall **(8)**. Then measure that distance in at the end of the wall for the bottom long point of the gable plate **(9)**. Slide the square up to the ridge and mark where the blade touches **(10)**. Mark that distance down from the top of the ridge for the upper long point of the gable plate **(11)**.

the lower top plate. The top edge of that plate was 5 inches below the tops of the rafters. So I set my combination square to 5 inches and slid the fence down a rafter until the blade touched the top of the wall plate **(8)**. I marked that point and then measured from it to the outside face of the wall (2 5/8 inches). At the end of the side wall, I measured in 2 5/8 inches, which marked the bottom long point of the lower plate for the dropped gable **(9)**.

To find the upper long point of that plate, I slid the combination square up the rafter until the blade touched the ridge **(10)**. After marking and measuring that point (5 1/8 inches down from the top of the ridge), I marked that distance along the ridge above the end wall. This line marked the top long point of the lower gable plate **(11)**.

Before building the gable, I marked and cut the section of the ridge that extends out for extra support at the top of the overhanging rake, which was probably overkill given all the lookouts holding the barge rafter. To cut the ridge, I plumbed up from the wall below and then measured out 10 1/2 inches for the overhang plus the sheathing, and marked the vertical cut. For the horizontal cut, I set my combination square to 3 1/2 inches (the width of the barge rafter) and slid it up one of the rafters to the ridge. As before, I marked where the blade of the square touched the ridge and measured from the top of the ridge down to that mark. On the overhanging part of the ridge, I marked and cut a level line at that distance, minus 1/2 inch to allow the slope of the barge rafter to continue to the peak.

To build the gable, I installed a plumb post from the top plate of the end wall up to the ridge. I confirmed the gable layout by measuring up the post to the plate layout point marked on the ridge, and then out from the post to the layout point on the plate of the end wall. Because the rise should be half the run in a 6-in-12 layout, those measurements confirmed that the layout was correct.

The next step is to determine the length of the lower gable plate,

For the lower gable plate, mark the pitch angle on one end using the rafter jig **(12)**. Then cut the angle **(13)** and smooth the cut with a belt sander. Cut the plate to length making a plumb cut at the top. After putting in the studs for the dropped gable, cut and install the second plate **(14)**. Cut and install the 2x4 lookouts on top of the dropped gable, leaving the ends long **(15)**. Snap a line across the lookouts to make the ends straight, and then install the barge rafter, cutting the end flush with the subfascia **(16)**.

long-point to long-point. To do this, I took the number I'd written on my rafter jig for the hypotenuse of a base-1 triangle.

This number is easy to find using an old-fashioned framing square. Under the "6" on the square is the number 13.42, or the length of a rafter per foot of run. I divided 13.42 by 12 inches to come up with 1.118 when the length of the base is 1. Then I simply multiplied the length of the base (72 5/8, or 72.625, inches) by 1.118, which equaled 81.195 (or 81 3/16) inches, or the length of the bottom gable plate, long-point to long-point.

On both edges of a 2x4, I laid out matching 63.5-degree cuts (the complementary angle of a 6-in-12 pitch) using the level edge of my rafter jig **(12)**. This acute angle formed the long point at the low end of the gable plate. After cutting along both of these lines with a circular saw **(13)**, I smoothed the cut with a belt sander. Then I pulled the plate measurement (81 3/16 inches) from the long point of this cut to mark the long point of the plumb cut, which I made on a miter saw.

I aligned the ends of this plate with the marks on the ridge and end-wall plate and then fastened the plate in place at both ends. After checking to make sure the plate was straight, I laid out and installed studs, keeping them in line with the studs of the wall below. I made the angled cuts for the top of each stud with the miter saw set to 26.5 degrees and nailed through the plate to attach them at the tops. To finish framing the dropped gable, I cut and installed a second top plate over the lower one **(14)**.

BUILDING THE RAKE

After measuring and marking the cantilevered portion of the subfascia 8 1/2 inches from the gable wall, I cut it in place with a circular saw. On the gable plate, I laid out the locations of the 2x4 lookouts at 16 inches on-center. I cut and installed the lookouts a little long **(15)** and then snapped a line across their top edges 8 1/2 inches out from the wall. Again, this snapped line put the ends of the

To frame the return, plumb down and cut the ledger to length **(17)**. Then screw a 2-by block to the back of the barge rafter and to the ledger **(18)**. Cut and fill in the triangular piece, keeping the face in plane with the barge rafter and the bottom edge in line with the blocking for the soffit **(19)**. Before the roof sheathing goes on, take advantage of the access to easily attach the return framing and nailers for the rake **(20)**.

lookouts in a perfectly straight line. After squaring down from the marks, I cut the lookouts in place with a circular saw.

With my rafter jig, I laid out and plumb-cut the top of the barge rafter, leaving the bottom uncut for now. To install the barge rafter, I pushed the top end tight against the ridge and ran it past the ends of the lookouts and the subfascia. After nailing the barge rafter at all those points, I cut the bottom end flush with the outside face of the subfascia **(16)**.

FRAMING THE RETURN

The ledger that was left extending past the rake provided support for the return framing. To cut it even with the barge rafter, I plumbed down from the face of the rafter with a small level, and marked a plumb line on the ledger **(17)**.

After cutting the ledger to length, I built the return with scraps of 2-by material. I didn't waste time trying to join the materials edge-to-edge. Instead, I built the return using nailer blocks. I began by cutting a scrap of 2x6 with a 26.5-degree miter at one end. I held this piece vertically, with the miter lined up with the top inside edge of the barge rafter and one edge butted against the ledger, and I marked the bottom edge. After cutting the block to length, I screwed it to the inside of the barge rafter **(18)**. Using my rafter jig, I laid out and cut a triangular piece that fit under the rafter and butted against the side of the ledger. This piece screwed to the 2x6 block and built out the surface of the return in plane with the barge rafter **(19)**.

The last pieces to go in were nailing blocks above the ledger for the back of the return, and at the bottom edge of the soffit for attaching the rake **(20)**. With no sheathing on the roof, there was plenty of access for an easy installation from above and behind the return.

John Carroll, author of Working Alone, *is a builder who lives and works in Durham, N.C.*

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Source: Dodge Data & Analytics 2015 SmartMarket Report - Green and Healthier Homes: Engaging Consumers of all Ages in Sustainable Living

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BY LAUREN HUNTER

1


2


3


4


1. Marble-Inspired Quartz
HanStone Quartz is expanding its signature Cascina Collection with six new veining patterns—Brava Marfil, Campina, Savoy, Strato, Empress, and Nova Bisque. Like the original colors in the collection, the new additions will call to mind veining patterns in natural Carrara marble, with colorways ranging from ivory and taupe to neutral gray. HanStone Quartz countertops are stain- and heat-resistant, durable, and nonporous. Pricing varies by pattern and thickness. hanwhasurfaces.com

2. Cool Triangular Tiles
Move over, penny rounds and hex tiles—the triangle is making a statement in the Triangle Tile collection from Fireclay Tile. A 9-by-2-inch scalene cut and right triangles in 3-, 4-, and 6-inch sizes are available in more than 100 colors. Designers can play with patterns like chevrons, pinwheels, stripes, and squares, or they can add just a few tiles to create fun focal points. Priced starting at $35 per square foot, Triangle Tiles are not mesh-backed and are shipped loose. fireclaytile.com

3. Cabinetry With Texture
Laminate panels with tactile finishes mark Kountry Kraft's Textural Cabinetry line. Available in three door styles, the 22 finishes mimic natural wood grains in look and feel. Door panels can be crafted with matching cabinet boxes, or with boxes sporting a complementary laminate. For smaller budgets, pair panels with a melamine cabinet box. Cabinets can be ordered with linear custom range hoods and select millwork; expect an eight-week lead time. Check with dealers for pricing. kountrykraft.com

4. Smart Home Security
Home security is built right into light bulbs with the BeON Home Protection solution. Compatible with Android and iOS, BeON devices screw in and operate like standard light bulbs and offer advanced features through the BeON app. Using Bluetooth, the LED bulbs learn lighting habits and can turn lights on and off accordingly while your clients are away. Thanks to an integral battery backup, bulbs also can provide emergency lighting for up to five hours if the power goes out. A variety of kits are available depending on home size; outfit a two- to four-bedroom home for about $200. beonhome.com

5. Mortar for Large Stone & Tile

Designed for large- and heavy-tile, thin-bed, and wall installations, Laticrete's Tri-Lite is a lightweight, high-performance mortar. Developed to be easier to transport and trowel on, a 30-pound bag of Tri-Lite can provide the same coverage as a 50-pound bag of traditional mortar. The mortar works to a creamy consistency and offers non-sag capabilities for vertical applications. For large and heavy tile in medium-bed installations, Tri-Lite can be built up to 3/4 inch thick without shrinking. Check with distributor for pricing. laticrete.com

5

6. Bright & Balanced Box Level

With dual ultraviolet LEDs, optical brightener, and high-contrast e-Band vials, Empire Level's e95 UltraView LED series of box levels brings high-definition viewing to the jobsite and improved utility in low-light environments. The levels have precision-milled edges and all-metal frames and are IP54-rated for protection from dust and water. The center acrylic block vial is reinforced for longer life and accuracy. Magnetic and non-magnetic models are available in 24- and 48-inch lengths. Prices range from $55 to $80. empirelevel.com

6

7. Soft-Close Sliding-Door Hardware

Johnson Hardware's new soft-close hardware works like a cabinet-door closer with pocket, sliding, and wall-mounted doors, allowing doors to open effortlessly and close quietly and securely. Suitable for new or retrofit installations, the hardware installs quickly on a wide range of the maker's doors. Priced at $60 for single-directional configuration or $87 for bi-directional, each set includes a soft-close dampener, two door hanger plates, an acutator, and a ball-bearing door hanger. johnsonhardware.com

7

8. Liquid Flashing for Tricky Windows

MaxFlash liquid flashing membrane offers high-performance flashing for complex window configurations in a continuous application that eliminates voids and pinholes. The one-component elastomeric material can be used as a flexible waterproofing flashing membrane around rough openings and to prepare sheathing joints for subsequent air- and water-resistive-barrier installation. It can also be used with water-resistive gypsum sheathing. Able to manage damp substrates and withstand immediate rainfall, MaxFlash has a fast cure time that lets contractors install windows within hours of application. wallsystems.basf.com

8

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9. Fold-Away Wide-Span Doors

Opening exterior walls to outdoor living spaces is a popular trend, and NanaWall's new FoldFlat system helps blur the lines even more. FoldFlat glass wall panels smoothly fold and then pivot back to stack out of the way and parallel to the opening rather than sticking out into the outdoor space. FoldFlat is available in aluminum and wood-framed options; check with dealers for pricing. nanawall.com

10. Integral Downdraft Range

Jenn-Air recently added a 30-inch range with built-in downdraft to its line of cooking appliances—Jenn-Air's first option for duct-free range installation. The full-depth design installs into a standard opening and is available in dual-fuel and all-electric models. The downdraft whisks away smoke, steam, and cooking odors without a bulky hood interfering with sightlines or requiring additional venting. Ranges have four brass burners, and an included aluminum die-cast griddle. The 6.2-cubic-foot oven has a 3,200-watt true convection element. Retail price is $3,500. jennair.com

11. Moisture Barrier for Wood Decks

Deckwise is introducing WiseWrap flexible flashing tape for wood decks. WiseWrap LedgerTape—a polyethylene ledger-board flashing with a self-sealing rubberized asphalt adhesive—can be applied to deck ledgers or to in-ground wood deck or fence posts as a barrier against fungi and soil moisture. WiseWrap JoistTape, a narrower version of the same material, creates a waterproof seal when applied to the tops of deck joists and helps future-proof against squeaking deck boards, according to the maker. LedgerTape retails for $36 per 12-inch-by-25-foot roll; JoistTape costs $29 per 3-inch-by-75-foot roll. deckwise.com

12. Fire-Safe Attic Insulation

Demilec's Sealection 500 open-cell spray foam insulation is now third-party approved for use in unvented attics without the need to apply a secondary ignition barrier. Sealection 500 expands to 120 times its liquid volume to insulate and seal cracks, gaps, and joints with a single application, at an R-value of 3.81 for 1 inch. Made without CFCs, HCFCs, or ozone-depleting chemicals, Sealection 500 will retain its shape and half-pound density over time without settling or compacting, according to its maker. Check with distributors for pricing. demilec.com


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A Smart Bluetooth Laser Measure

BY BRUCE GREENLAW

After reviewing 18 laser measures over the past three years, I think that small refinements are now making the biggest splash. When Bosch introduced the economical and feature-rich GLM 50 C laser measure late last year, key selling points included a bold new display and intuitive menu navigation. I've been evaluating this laser for a couple of months, and for me it sets a new standard for ease of use.

STANDALONE FUNCTIONS

The GLM 50 C can measure lengths from about 6 inches to 165 feet. It is accurate to ±1/16 inch and shows fractions down to 1/32 inch. The backlit display shows bold white numbers on a dark-blue background instead of the usual black on white; this advanced display is easier to read in most interiors but can be harder to read in the bright outdoors. Given that these laser measures are mostly used indoors, that's a reasonable trade-off. The display can be set to rotate automatically for an easy read regardless of orientation.

The GLM 50 C offers many of the same functions as competing models. You can measure a distance by simply pointing and clicking, or take a continuous reading while moving toward or away from a target and click when you're ready to hold a measurement, which also freezes the minimum and maximum distance measured (Bosch calls this the "Real Time" mode). But the former is usually the default mode when you power up most laser measures, while the latter is usually a menu option. With the GLM 50 C, however, Real Time is the default mode so the laser more closely mimics a tape measure. In Real Time, you can also either display the numbers in a large font with the minimum and maximum measurements omitted for an easier read, or display them in a smaller font along with the minimum and maximum.

The GLM 50 C can also calculate square and cubic feet, add or subtract dimensions and calculations, and lay out a series of equal intervals. A built-in inclinometer provides digital leveling, but it also works in the background to make indirect vertical or horizontal measuring exceptionally easy where direct measurements are impractical or impossible. The laser's memory stores the last 30 dimensions or calculations in order, and you can delete individual entries or the entire memory.

During my target practice, I seemed to burn through the two included AAA alkaline batteries in a hurry. Switching to AAA lithium batteries would probably help. Too bad the device isn't powered by a rechargeable lithium-ion battery, as is the longer-range Bosch GLM 100 C.

EASY MENUS

Unlike other deluxe laser measures I've tested, the new GLM 50 C is a joy to navigate. Other than the measuring-reference button (which sets the device to measure from the front, the back, or the tripod socket) and the Bluetooth button, all basic settings and measuring functions live under the function button. Quickly press and release this button, and a revolving menu shows the measurement options plus the memory. You cycle through this menu by pressing the + or – buttons, then select a mode by hitting the function or measure button. Press the function button for about a second instead, and another revolving menu allows you to, for instance, turn on the bold Real Time display or switch the units to metric.

Thankfully, there is only one button combination required; when viewing the memory, you can wipe it clean by quickly pressing and releasing the clear/on/off button while holding down the measuring-reference button.

CONNECTIVITY

Bosch offers two free apps that let the laser interact with compatible iOS and Android devices. With my iPhone 6, I downloaded the "GLM measure&document" app and gave it a workout. The Bosch manual doesn't address the apps, so I learned to use this one by tapping the help icons.

The GLM measure&document app can manage your measurements in various ways. For instance, you can quickly transfer the laser's memory to your mobile device, where you can delete or name individual measurements, perform calculations, and email the edited list as an Excel spreadsheet. Raising the bar, you can create and name a project folder, snap photos with your mobile device, draw dimension lines on the photos with a finger, and then shoot the measurements with the laser measure. Follow the simple rules, and the app places these measurements next to the appropriate dimension lines while also listing them under a separate tab. You can drop text and audio memos into each photo, where they appear as virtual Post-it notes.

When you're ready, you can email a PDF of the project that includes everything but your audio memos. You can even insert your company logo and address. I created several test projects and emailed the PDFs and spreadsheets to my laptop easily. You can also email the labeled photos or the measurement list separately.

I did encounter a couple of minor glitches with this app. For instance, it showed *5'4"* as *5'3"1*. Also, the app's calculator defaults to metric during some operations.

THE BOTTOM LINE

I wish the Bosch GLM 50 C had a rechargeable battery, and you need to press the buttons firmly to register all of your entries. But this laser measure is a breeze to use, offers all the measuring functions I can imagine needing, and has a Bluetooth module that makes it easier to manage and share measurements. The standard $150 price tag would work for me, but the laser currently costs even less at amazon.com.

Bruce Greenlaw is a contributing editor to JLC *and* Tools of the Trade.

Easy-to-use navigation and Bluetooth functionality. The two revolving menus are easy to access and navigate (top). Thanks to a Bluetooth Smart module and two free Bosch apps, the GLM 50 C can pair with mobile devices to expand its capabilities (above).

GLM 50 C Specs

Power: two AAA batteries
Range: 6 inches to 165 feet
Accuracy: ± 1/16 inch
Smallest fraction: 1/32 inch
Price: $150
Included in kit: two AAA batteries, hand strap, belt pouch, target cards
Warranty: 1 year (2 years if registered), 30-day money-back guarantee

Top photo by Bruce Greenlaw

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Nissan North America	16	NissanCommercialVehicles.com
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Poly Wall Building Solutions	34	poly-wall.com
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ProWood	20	ProWoodLumber.com/use
Remodelers Summit	38-39	Remodelerssummit.com
ROXUL	11	roxul.com/DIY
Simpson Strong-Tie	19	strongtie.com/concealed
Surface Shields, Inc.	18	surfaceshields.com
Tjernlund Products, Inc.	71	tjernlund.com

Classifieds

BY JEFFERSON KOLLE

The Hammer Man

Brent Bailey figures he has made more than 16,800 hammers at his forge in Orland, Calif., along with lots of other woodworking and blacksmithing tools. When he was in his 30s, he asked one of the hands at his father's ranch to show him how to use an old Lincoln welder and a torch in one of the outbuildings. After a half-hour lesson, Bailey, now 45 years old, was on his way to a new career.

His claw hammers are tools of beauty and utility. Many customers, he says, focus on the beauty and never use them for their intended tasks. When he has asked customers for feedback, "lots of guys have told me that they've never even hammered the first nail," he says. "They get them and put them on the mantle as a display piece."

It takes Bailey about 2 1/2 hours to make a claw hammer, and that includes the time it takes to shape the hickory handle. After heating an ingot of steel in a coal-fired forge, he punches out the handle's eye, then forms the head with a plain or checkered face. The claws, straight or curved, are formed with a chisel. Heat-treating comes next. The process involves heating the steel until it turns a bright orange, then dousing it in water or oil. Finally, the hammer head is dressed and polished.

Bailey can make a finish hammer head in any weight up to 2 1/2 pounds. His framing hammer weighs in at 2 3/4 pounds. It features a teardrop-shaped face that reportedly concentrates the hammer blow, and an extra-thick claw with a beveled grind at the tips for use as an adze. All his hammers come with a lifetime warranty, excluding the handle. He also makes a variety of big hammers, forging hammers, farrier tools, wood chisels, and drifts, and he welcomes custom orders (brentbaileyforge.com, 530.865.4176).

A Brent Bailey finish or framing hammer costs $145. Sledges up to 25 pounds run $235; the Piggie—a 7-pound straight pein made for driving goes for $175. With every hammer ordered, he includes an American-flag key fob complete with all 50 stars, formed using a special punch. He also sends along a hand-forged bottle opener. So even if you decide just to display your new hammer on your mantle, you'll probably figure out a good use for the bottle opener after work.

Former JLC *senior editor Jefferson Kolle writes from his home in Bethel, Conn.*

The Bailey Finish hammer (top right) is as much a work of craftsmanship as it is a tool, but that shouldn't dissuade you from using it. The steel on all of Bailey's hammers is heat-treated (right) to increase the steel's hardness, and then tempered to make it less brittle and increase toughness so it won't fracture on impact.

Photos: Brent Bailey Forge


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