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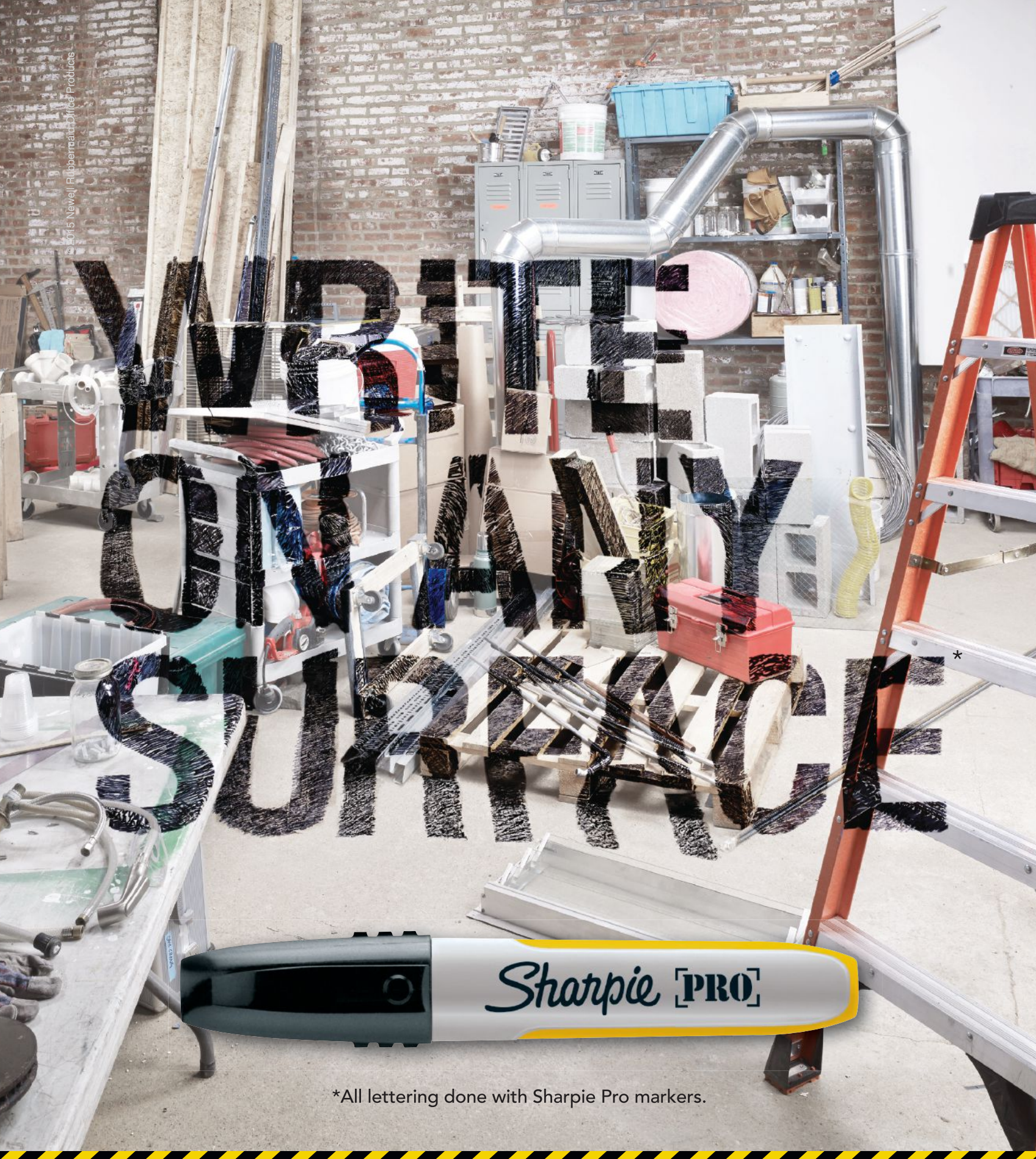

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On the cover: Buddy Plante and Austin Jalbert working for Jones Concrete Design help Jacoby Henrique of GFM Enterprises install a pervious concrete driveway on a steeply sloped site on Cape Cod. Photo by Peter Zoni

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CUTTING WITH DIABLO 10 ¼-INCH BLADE ("POWER UP: 10 ¼-INCH WORMDRIVE," APR/15)

Clayton DeKorne, editor of *JLC*: In the April 2015 issue, Sim Ayers reviewed the Skil Sawsquatch 10 ¼-inch wormdrive and reported he was not happy with the Diablo thin-kerf blade that came with the saw. Diablo Tools took these comments seriously, and in early May arranged to visit Sim on the jobsite. However, during that visit Sim was unable to re-create the problems he initially observed, and he has since reported that he's used several Diablo blades on the Sawsquatch that performed perfectly.

According to Russell Kohl, president and CEO of Freud America, when using a thin-kerf blade you need to let the saw do the work. Yes, a thin-kerf blade can be made to fail. There are plenty of framing applications, explained Kohl, in which the larger-diameter blade can flex if it's overdriven. As the blade flexes, the increased friction generates heat, which can intensify the distortion. In some applications, like long rips or steep bevel cuts, it's especially important to go easy.

"A thinner blade is taking out less wood, so you can drive it faster. But handling that speed takes a new touch," Kohl says. He compares using thin-kerf blades to the adaptations needed when cordless tools first came on the market. Cordless-drill users learned that they couldn't lean so heavily into the tool. If they did, they would bog the motor down and drain the battery quicker. If they lightened up a little, they got better runtimes.

This "new touch" is not just about how aggressively you lean into the saw. There's also a finesse. Kohl referred to the "S"—the movements a saw user makes to correct a cut and hold to a line. The Diablo blade that's currently supplied with each Sawsquatch cuts a 1.7-mm kerf. That's the thickness of the carbide teeth. The plate is 1.0 mm thick. This leaves just 0.35 mm (350 micrometers) on each side in which to correct course without deflecting the blade. It's not a lot. You have to be gentle with the corrections. If you overtwist, as if skiing a tight slalom, you're going to flex the blade. A thin-kerf blade is more like giant slalom—the "S" is a little longer, a little gentler. But if you do it right, the blade runs faster and stays true.

Diablo Tools is working on a thicker-kerf 10 ¼-inch blade for the Sawsquatch. "We know some people are just going to prefer a thicker blade," says Kohl. "Others will prefer the thin-kerf. Eventually, I think they'll learn to love the thinner kerf, but we'll let the market decide."

"SEALING A SOUTH CAROLINA CRAWLSPACE," BY TED CUSHMAN (MAY/14)

Phil Stancil (online, 4/24/15): It looks like the vents [the flood vents in the sealed crawlspace] are one block above the crawlspace floor. If it does flood, what happens to the 8 inches of water that is now under the house and can't soak into the ground because of the sealed poly?

Clayton DeKorne responds: Pump it out. Those vents aren't there to provide airflow, and they're not there to provide drainage. They're special vents meant to keep the wall from collapsing. High, fast-moving water can exert an enormous lateral load on the side of the foundation wall. The vents remain closed until water pressure opens them, relieving the pressure and allowing the house to stand.

Of course, if that does happen, you have a big mess—a lot of soaked crawlspace insulation that needs to be ripped out and a lot of messy water to slop out. But that's much better than picking up pieces of the house.

"NAIL SEALABILITY TESTS," BY MATT RISINGER (ONLINE, 4/16/15)

Scott Grafer (online, 4/19/15): Since the test in question [ASTM D1970 standard for self-adhering roof membranes] places the samples [peel-and-stick and liquid-applied weather barriers] horizontally and floods the surfaces with 5 inches of water over three days, I am wondering if this is the most appropriate test for these products. Unless you are using the membrane on a flat roof, water will be shed naturally by the slope of the roof or a horizontal wall surface. I understand the findings, I'm just not sure they are real-world applicable.

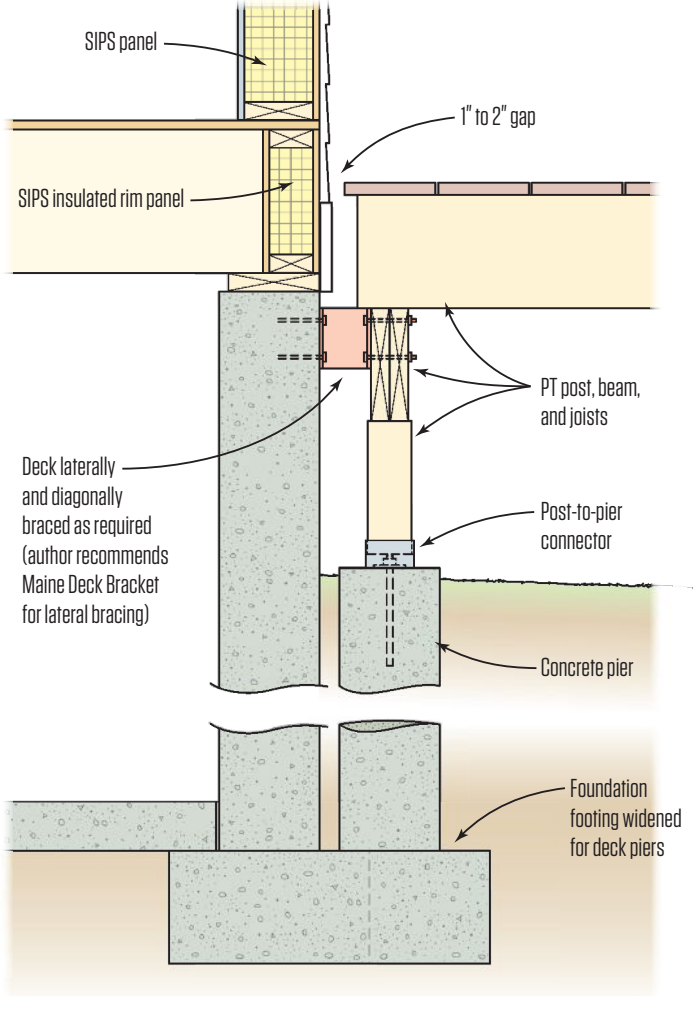
FOAM CUTTING TIP ("BULLET CENTERFIRE FOAM-CUTTING SAW BLADES," MAY/14)

seaweed (online, 5/12/15): I just finished a job where I had to cut a lot of 3-inch-thick white extruded polystyrene foam. I didn't want that stuff flying around, so I looked into making a wire cutter. It was too much trouble. Finally, I just threw a cheap diamond blade onto my table saw and used that. It reduced the foam dust by 80% to 90% compared with a thin-kerf saw blade. I used a continuous rim on my table saw (what I had) and a segmented one on my 4.5-inch angle grinder for detail cutting. Both worked fine. The blade doesn't have to be that fresh. I doubt it wore the diamonds at all.

Q I'm building a SIPs house, and plans call for a porch in front and a deck in back. What's the best way to attach a porch or deck to a SIPs house?

A Paul Malko, technical director at Foard Panel and a speaker at JLC Live, responds: Part of the answer depends on the rim detail. If the structural insulated panels (SIPs) land on top of a conventionally framed deck, you can use 1 ⅛-inch-thick structural rim boards and attach the deck ledger as prescribed by the code. If a SIP rim is used, the panel by itself would not be strong enough for attaching a deck or porch ledger to.

Freestanding Deck or Porch



The foam doesn't have enough compressive strength to be through-bolted.

That said, we have two ways of beefing up the outer skin of a SIP or SIP rim. The first is by adding double 7/16-inch OSB nailers behind the outer sheathing, for a total thickness of 1 5/16 inches of OSB. This strategy creates a heavier outer skin, but I would not recommend going that route for attaching anything but the smallest deck or porch.

For the second method, we embed a 9½-inch-wide by 1⅞-inch-thick LVL behind the outer skin of the insulated rim; and a pressure-treated ledger, which will hold the deck framing, is attached to the outside with SDS or TimberLok screws that don't need to be predrilled. Even with the embedded LVL, I would not proceed without careful engineering that takes into consideration all the particulars of the project.

The third and best option is building a deck or porch that is independent of the house with no direct connection to the house for support. With planning, the footings for the deck or porch can be made integral with the house foundation in a monolithic pour. Alternatively, porch footings can be attached to the foundation with steel dowels.

The freestanding structure is then built with a small gap between the house and deck. I would make the size of the gap as large as practically possible (to encourage drying). I suspect that the size is a balance of aesthetics and safety. A gap of an inch or two is probably fine.

When a porch or deck is built as an independent structure, an important consideration is lateral bracing to prevent racking, which can be accomplished with diagonal bracing between the posts. Another way to provide stability is by anchoring the structure back to the house. For first-floor decks where the post height is minimal, you can anchor back to the concrete foundation, which is better than connecting to the wooden structure of the house. For freestanding decks or porches above the first floor and with taller posts, your only option may be bracing back to the wooden walls of the house. In either case, I suggest using a product like the Maine Deck Bracket, which is a clever improvement over other spacer schemes I've seen.

Q I'm installing ½-inch-diameter screw anchors in concrete footings. How long does the concrete need to cure before I can drill and drive the anchors? And are there concrete mixes that have a faster curing time?

A Bill Palmer, an engineer and the editor-in-chief of *Concrete Construction*, a sister publication of *JLC*, responds: Screw anchors (such as those available from Simpson Strong-Tie or ITW Red Head) are a great addition to the more common concrete anchors on the market today and have the same pull-out strength as expansion anchors or adhesive anchors. Screw anchors start with a smooth hole, but these innovative products create a bond by cutting threads into the concrete with high-strength serrations.

Anchor manufacturers rate the pull-out strength of screw anchors in tension and shear based on specified concrete strength. Most concrete achieves its rated strength in 28 days, although in reality the concrete usually achieves its specified strength more quickly than that. In most parts of North America, 3,000 psi is the minimum recommended compressive strength for footings. Assuming you are using 3,000-psi concrete for the footings, you should be safe installing the anchors after 28 days in most circumstances.

But there are a few things that can greatly alter the "normal" rate of strength gain: concrete temperature and the use of fly ash or admixtures. Concrete gains its strength through a chemical reaction called hydration that depends heavily on the temperature of the concrete. Below 50°F, concrete typically gains strength much more slowly. Adding fly ash to the mix can also make concrete gain strength more slowly.

If you need your footings to harden more rapidly, accelerating admixtures can make that happen. The most common of these is calcium chloride—although it may not be a good choice because it can also cause the anchor bolts to corrode. Non-chloride accelerators tend to be more expensive (and less effective) and should be matched to the specific cement being used. Rely on your concrete producer for this.

If you want to install the anchors before 28 days have passed, and want to be sure the rated strength has been achieved, you can test the concrete footing with a Schmidt hammer. However, this expensive tool is not something that the average contractor is likely to be carrying in his toolbox.

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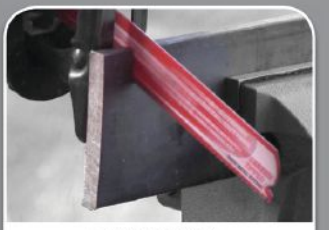
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BY SLOAN RITCHIE

1. A CLT job is a logistics puzzle, and to do it profitably requires planning. At the start of the job, it took time to sort the panels with a crane, but stacking them in the order they would be used saved valuable crane time in the long run.

2. Panels were craned into place. Lifting straps were run through holes drilled near the tops of the wall panels.

Photos: atelierjones

Building With Cross Laminated Timber

In late 2014, my company had the opportunity to frame a 1,500-square-foot infill home in Seattle using a panelized building system called "cross laminated timber," or CLT. We were one of the first residential builders in the U.S. to use it. Although we were familiar with a panelized approach, having used structural insulated panels, we found that CLTs have their own learning curve.

CLT panels are solid, made from 2-by stock bonded together under pressure with a thermosetting adhesive. The layers are cross-laminated, like plywood, with the grain on each layer running 90 degrees to the adjacent layers. Panels for commercial construction (the biggest market worldwide) can have as many as seven layers, but the ones we used for this project had three or four, depending on whether they were for walls or floors.

The panels were made by Structurlam, in British Columbia, from a combination of spruce, pine, and balsam fir, with blue-beetle-kill lodgepole pine in some of the interior laminations. The home required 67 panels, ranging in size from 2x10 feet to 8x35 feet and in weight from 200 to more than 2,800 pounds.

The architect and homeowner, Susan Jones of atelierjones in Seattle, chose my company because of its reputation for cutting-edge work, including the city's first Passive House. She had identified CLT as a sustainable material with a potential niche in the high-end green-home market.

The material is well-suited to an energy-efficient home. The solid panels simplify making the building envelope airtight, and they provide hygrothermal mass—they absorb and re-emit moisture as well as heat, helping to moderate fluctuations in both. Thermal bridging through the panels can be controlled with continuous exterior insulation.

FAST, BUT UNFORGIVING

As one would expect with a panelized system, the job went quickly. The complex floor plan—designed to fit a narrow, triangular lot—took just three weeks to frame, compared with the eight or 10 weeks that stick framing would have required. We based our labor estimate


3


4


5


6

3. The sill plate dimensions needed to be spot on, as panels can't be altered much. Metal hold-down straps anchored the panel to the plate.

4. Wall panels were stood in place on the sills and held plumb with diagonal bracing—just like a stick-framed wall.

5. The panel edges are notched at the factory to receive vertical splines (the darker boards) that hold adjacent panels together.

6. To maneuver floor panels into position, the crew attached the crane cables to threaded hardware embedded in the face of the panels.

on our experience with SIPs and ended up pretty close.

One caution: CLTs can be unforgiving. You can't adjust dimensions on the fly. The foundation dimensions must fit the plan exactly, and the panels must fit together perfectly. Small modifications can be made in the field, but that work wasn't part of our pricing, so we needed the panels to be the right sizes. The architect worked with Structurlam to create the panel order, then we reviewed the shop drawings before the panels were fabricated. This proved helpful, as we identified a couple of minor adjustments that needed to be made.

The ability to do that kind of review is crucial to success with this system. We have a lot of experience using CAD and reviewing shop drawings, but a builder without someone on staff with this experience may run into problems.

STAGING THE SITE

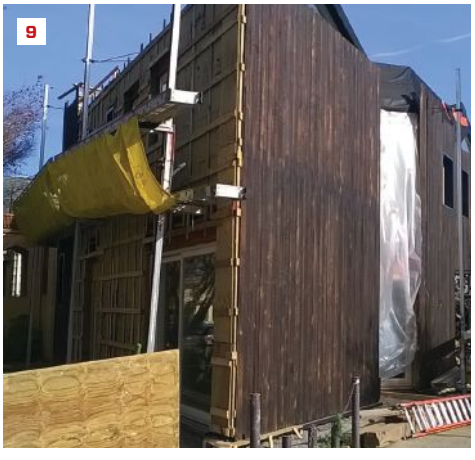
With CLTs, the job is a logistics puzzle, so good organization and planning are essential. We started by staging the panels. This was a small infill lot with room for just two stacks, so we arranged to have the first-floor wall and ceiling panels delivered first. After they were installed, we arranged delivery of the second-floor and roof panels.

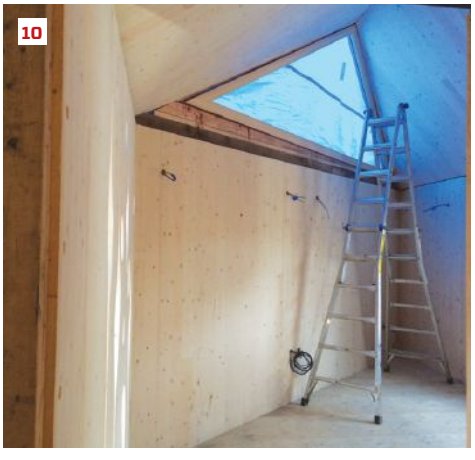
Determining which panels go where isn't complicated: They're keyed to the plans and labeled 1a, 1b, 1c, and so on. Ideally, the panels would be stacked in order and oriented by the supplier in the position they'd be used. But that didn't happen here, so before work could begin, we needed to sort them using the crane, which ate up some time **(1)**.

ASSEMBLING THE PUZZLE

The wall panels had holes drilled through the upper portion. We put lifting straps through those holes, then had a worker or workers guide each panel into place **(2)**.

Like the foundation, the treated-wood sill plate must be perfect because of the fixed panel sizes. And of course bolts can't protrude above the surface of the sill plate. All connections in a CLT project must be specified by a structural engineer; in this case the panels were fastened to the sill plate with vertical straps **(3)**.





7. The engineer specified a series of closely spaced clips to secure the first- and second-floor wall panels to the intervening floor panel.

8. A worker applies a liquid-applied flashing product around a window opening. This material will be spread out to form a continuous film before the windows and insulation are installed.

9. The exterior was insulated with rigid mineral panels and covered with vertical wood siding. Any types of rigid insulation and siding could have been used, however.

10. Outdoor-rated wiring was attached to the panel exteriors, then drilled through to the inside at each fixture location. Plumbing was routed through interior framed partitions and chases.

Once a wall panel is in place, it's plumbed and braced the same as with any wall **(4)**, though the panels are a lot stiffer than a stick frame and tend to need fewer braces. As with SIPs, the CLT wall panels were joined to one another with vertical splines: The last few inches at the edge of the panel were notched to receive a 1-inch-thick plywood spline **(5)**.

The second-story floor panels included what Structurlam calls Rampa connectors: threaded sockets embedded in the panels at key lifting locations. A harness bolts to these connections and to the crane's lifting cable **(6)**. After lowering the floor panels into place, we set and braced the second-story wall panels. Small Simpson clips—which, like the hold-down straps at the base of the wall, were specified by the engineer—held the first- and second-story wall panels to the intervening floor panel **(7)**.

We flashed windows and doors with a fluid-applied flashing product called Prosoco FastFlash **(8)**, wrapped the home with VaproShield WrapShield housewrap, then insulated it with Roxul Rockboard 80 panels. A grid of 1x4 treated battens formed a rainscreen that we covered with vertical board siding **(9)**.

The roof was tricky. Although the home included roof panels, we framed over them with 2x8s so we could install polyisocyanurate insulation. We could have framed the roof without the panels, but the architect wanted the look of the CLTs on the inside.

Our subcontractors had never seen this system, so in order to get accurate estimates, we worked closely with them to plan electrical and mechanicals. You can't simply put pipes or wires inside the exterior walls. Our solution was to run outdoor-rated wire on the outside of the panels, then drill through the walls at each outlet location **(10)**. We ran most of the plumbing in stick-framed interior partitions. In some places, we built chases for plumbing drops.

The overall lesson here is that a builder who has the opportunity to use CLTs needs to systematically think through everything. Given enough upfront planning, it's a great system that creates a high-quality result. We would be happy to build with it again.

Sloan Ritchie owns Cascade Built, a Seattle custom builder that specializes in green construction.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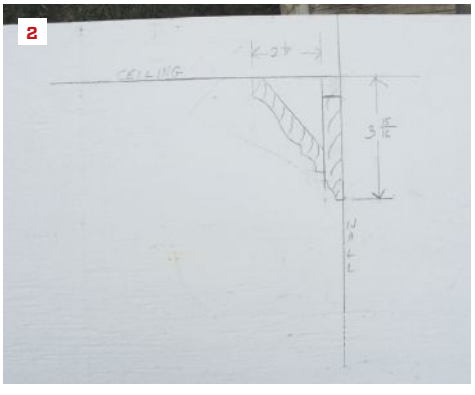

Solo Installation of Crown Molding

BY JOHN CARROLL

Twenty-five years ago, I landed a job installing crown molding in a home. Thinking that I'd need a second pair of hands to handle the long, flimsy material, I hired a helper. But as the job progressed, I noticed that my helper spent much of his time watching me cut the material and fuss with each joint. After that I developed techniques to do the job by myself.

LAYING OUT THE JOB

Before I install crown molding, I take a few minutes to make a full-size cross-section drawing. This drawing lets me know how far down the wall to mark for the bottom of the molding, where to mark for any returns required, and how big to make back-up blocks, if needed, for fastening. Although I don't cut my crown in the "nested" position (tilted up against the fence at the 38-degree angle of the crown), a full-size drawing can also show you where to set up a block to hold the crown at the proper angle as you cut it.

To make the drawing, I clamp a framing square to a sheet of plywood and scribe along both legs of the square: one line for the ceiling and the other for the wall. I place a short piece of the crown molding against the legs of the square, making sure both edges are tight inside the square. Then I scribe all the way around the molding **(1)**. If you're cautious, as I am, you can check the angle of the back line with a Swanson Speed Square to make sure the crown is sitting at the desired 38-degree angle.

When I'm installing a single layer of molding, I'm done at this point. But for the project in the photos, I also needed to draw the upside-down base molding that expanded the profile, so I removed the square, held the base in place, and scribed around its profile as well.

After finishing the full-size drawing, I make some measurements. First, I find the distance from the bottom of the molding to the ceiling, in this case, 3 15/16 inches. Next, I determine the length of my returns. This project had three returns at 2⅛ inches from the corner **(2)**.

With these measurements in hand, I mark the bottom of the crown profile on the wall using a scrap that I cut exactly 3 15/16 inches long **(3)**. I make marks at roughly 32-inch intervals, and at each of the return locations, I mark 2⅛ inches in from the outside corners.

MEASUREMENTS WITHOUT A HELPER

A standard tape measure is just about useless for a

Photos: John Carroll

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single person taking overhead measurements. Despite boasts of up to 11 feet of "stand-out," these tapes can be read only with the numbers facing up. Working at ceiling level, you need to turn the tape over to read the numbers, and when you do that, the tape inevitably collapses.

To overcome this problem, I use a different technique. For an outside corner, for instance, I mark the length of a piece in place. First I take a rough measurement while standing on the floor, then I cut the piece a few inches longer than I need. After cutting and fitting the inside corner, I hold the piece in place with one or two trim screws. On the back of the molding, I mark the outside edge of the wall. This mark represents the short point of the bottom of the cut for the outside corner.

When I need to measure from one inside corner to another, I use a measuring stick and rulers. For the measuring stick, I cut a strip of wood exactly 100 inches long. I butt this strip into one corner and mark the end **(4)**. Then I measure back from the other corner to the mark using an inexpensive metal ruler (I have several lengths) and add that dimension to 100 to find the total length.

If the wall is longer than the length of the material available (usually 196 inches, or 16 feet), I make up the length with two pieces so I don't need to measure corner-to-corner. Instead I usually install the first piece, then hold and mark the length of the second piece without measuring it.

If the wall is between 172 inches and 196 inches long, I first mark 100 inches as described above. Then I use my 72-inch ruler and mark 70 inches from the opposite corner. I am left with two marks a short distance apart. I measure that distance and add it to 170 to find the length I need.

Transferring measurements to a floppy piece of molding can be challenging, especially when measuring from an end that's cut at an angle. When measuring from the long point, I hold the tape in place with a spring clamp to make sure it stays put as I mark the measurement **(5)**. To measure from the short point of a cut, I clamp a Speed Square across the piece at that point and then hook the tape over the square **(6)**.

INSTALLING THE CROWN WITHOUT A HELPER

To hold up the far end of the material as I fuss with the joint and install the piece, I use a simple rig that I assemble on site. My support system starts with a horizontal 2x4 a couple of feet long clamped in a Rockwell JawHorse. To this 2x4, I attach a vertical strip of plywood about 8 inches wide and about 80 inches long. I slide the strip up to the correct height and clamp it to the 2x4 with a one-hand bar clamp **(7)**. This system sets up and moves easily, yet provides plenty of support for the material.

Although they aren't essential to working alone, I've found that work benches can speed up the installation and save trips up and down the ladder. I use a pair of benches that are 6 feet long and 22 inches high with

Photos: 4, Alan Culton; 5, Bill Phillips; 6, John Carroll

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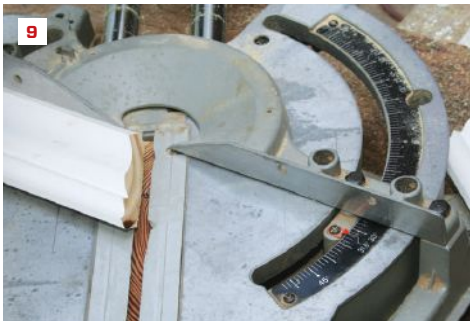
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2x12 tops. When I'm standing on them, my head is below the ceiling and I'm at a comfortable height for installing crown for an 8-foot ceiling. When they're combined, I can walk from one end of the piece to the other as I install the material.

SETTING UP THE WORKSTATION

As most carpenters know, taking a few minutes to set up a workstation at a job always pays dividends in safety, quality of work, and time. When you're working alone, a good workstation is a necessity.

My workstation isn't fancy—just a pair of saw horses with an old door placed across them. To set up my sliding compound miter saw (SCMS) for a job like this, I lay a piece of plywood over the door for a smooth surface. I position the saw all the way to the right of the table, and I set a simple, site-built support on the left side for the material **(8)**. My SCMS table swivels both left and right for miter cuts and tilts both left and right for bevel cuts, so I never need to flip the positions of the saw and the material support to make cuts.

Next to my workstation, I keep a bucket of clamps. You can quickly clamp material, and at times, tools, if you have the right clamps. For clamping small items, such as my tape measure to the molding, I use spring clamps. For stronger clamping, such as holding the crown in place while coping, I use one-hand bar clamps, which allow me to hold the jigsaw with two hands. I never use C-clamps at my workstation: They take way too much time.

TRICKS FOR MAKING COMPOUND CUTS

Working alone I find it easier to keep crown molding flat on the table of the saw instead of resting it at an angle against the fence. On most saws, the scales for both of these actions are clearly marked for the angles needed to make square corners with 38-degree crown molding: 31.6 degrees for the miter and 33.9 degrees for the bevel.

Even with these settings, it can be confusing to set the saw to the right combination of angles. So, to make it easier to visualize the orientation of the cuts, here are a few simple rules.

First keep in mind that the bottom of standard crown molding has the cove. For inside corners, the long point of the miter cut is always at the bottom, and the short point of the bevel cut is always at the front face of the molding **(9)**.

For outside corners, the short point of the miter cut is always at the bottom, and the long point of the bevel cut is always at the front face of the molding.

To see immediately if you're on the right track, look at the top of the cut. When you're making cuts for either inside or outside corners, the cut along the flat, vertical section at the top of the molding should always run perpendicular to the top edge **(10)**.

John Carroll, author of Working Alone *(Taunton Press, 1999), is a builder who lives and works in Durham, N.C.*

Photos: 7, AJ Culton; 8, Alan Culton; 9 and 10, Bill Phillips

*vs. traditional groove joint pliers.

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BY MIKE GUERTIN

Photos: Mike Guertin

Top-Sealing Damper Blocks a Big Hole

Within a span of two weeks on a whole-house remodel, bats greeted us on three mornings when we arrived for work. We couldn't find any obvious entry holes, so we were puzzled as to exactly how they might be getting in. When we found a raccoon clawing at a window trying to get out one morning, I knew the only place they could be getting in was through the chimney flue.

The dampers in both fireplaces were closed but the throat damper frame in the downstairs fireplace had rusted out on one side, leaving a hole big enough for our ring-tailed friend to get through. Replacing a throat damper frame in a fireplace is a cramped, dirty, unpleasant, and time-consuming job. So I decided to install a top-sealing damper instead.

Top-sealing dampers take less than two hours to install and seal out uninvited guests. Unlike flue screens that can also keep critters out, top-sealing dampers close down on top of the flue liner to seal out rain and snow. And unlike cast-iron throat dampers, top-sealing dampers keep conditioned air inside, so they often pay for themselves in energy savings within a couple of years after installation.

START ON THE ROOF

A top-sealing damper has a metal frame that mounts on the top edge of the flue liner. A stainless steel control cable routes through the flue liner and into the firebox to operate the damper. When the cable is released from a retainer bracket inside the firebox, the damper springs open. When not in use, the damper cap seals shut.

Top-sealing dampers install in a few easy steps: Mount the damper frame on top of the flue liner, thread the cable through the flue, mount the cable retainer in the firebox, and adjust the operation.

There are only a few parts to assemble on a damper: the fusible link, the cable, and the cable pull/handle. The instructions for assembly and installation are clear and easy to follow.

Dampers come sized to fit standard flue liners. But to accommodate regional variations in the

finish dimensions of flue liners, the damper frames have wide flanges and may hang slightly inside or outside the flue liner opening.

DRY-FIT THE DAMPER

The damper instructions generally call for the frame to be glued to the top of the flue liner with high-temperature silicone adhesive sealant (usually supplied). Mounting something as large as a top-sealing damper with just adhesive is disconcerting, so I prefer to also bolt the frame to the flue liner using 2-inch or 2 ½-inch galvanized or stainless steel angle brackets.

I center the damper frame on the flue liner and use the angle brackets to locate and drill the holes on the liner and on the frame. Flue liners fracture easily, especially when you're drilling close to the exposed edge. So I pilot each hole with a ⅛-inch masonry bit first and then open up the hole with a ¼-inch or 5⁄16-inch bit to fit the bolts. A hammer drill can speed up the process, but don't push too hard on the drill or you'll crack the liner.

I bolt the brackets to the flue liner with galvanized or stainless steel bolts, taking care not to overtighten the nuts, which could also cause the liner to crack. Threadlock compound or lock nuts prevent them from coming loose.

I dry-fit the damper to mark and drill the holes through the top legs of the brackets and the damper frame. The top legs of the brackets usually extend past the damper flange, so I trim them off flush.

FEED THE CABLE

Before feeding the control cable down the flue liner, remove the old throat damper—it won't be needed and it will get in the way of the new control cable. If the flue liner is not a straight run to the smoke shelf, I tie a weight (a piece of chain or a fishing sinker) to the end of the cable to help lead it down to the firebox **(1)**. The cable usually hangs up on the smoke shelf, so feel around to locate it and pull it into the firebox.

Once the end of the cable is fed through to the firebox, I apply a generous bead of adhesive sealant to the top edge of the liner **(2)**, bed the damper frame, and bolt it to the angle brackets **(3)**. I make sure that the sealant has filled all the gaps and tool it smooth as needed.

MOUNT THE CABLE IN THE FIREBOX

The next step is choosing a location to mount the cable-retainer bracket on the side of the firebox. I prefer to mount it toward the front and just high enough so that it's not visible from sitting positions in the room, but not so high that the chain handle is hard to reach **(4)**.

Locate the bracket holes squarely over a firebrick for a solid, reliable connection; avoid mounting the bracket on a mortar joint, which can cause the bracket to loosen over time. Mark and drill holes for the expansion fasteners or concrete screws,

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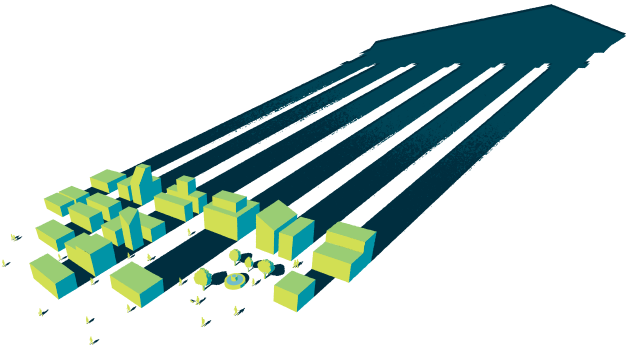

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which are usually supplied in the kit **(5)**.

Mount the bracket **(6)** and adjust the chain handle on the cable so the damper stays closed when the chain locks into the retainer bracket slot. Feed the damper control cable through the large hole in the retainer bracket and pass it through the stop fitting at the end of the handle and chain. Slide the cable into the retainer bracket slot and position the stop fitting against the bracket.

Pull on the cable with pliers until the top-sealing damper closes. When it's shut, tighten the set screw on the stop fitting to lock it on the cable **(7)**. On some models, there is a spring between the top end of the cable and the damper to give the cable a little extra play. Be careful not to pull too hard on the cable when adjusting the lock or you could overstretch the spring.

Check to make sure that the damper is fully closed and re-adjust the cable length if necessary. Then trim the excess cable, leaving 2 inches to 3 inches past the stop fitting on the chain handle.

OPERATING THE FLUE-TOP DAMPER

To open the top-sealing damper, slide the cable and chain handle into the center of the retainer bracket hole and let the spring-loaded cap pull the cable up the flue. Owners should be instructed to leave the cap open until a fire is completely out and to never close the damper when hot embers are still burning—even if no smoke is visible. As long as a fire is still burning, carbon monoxide is being produced, and closing the damper will let the poisonous gas enter the house. In the event of a chimney fire, the fusible link at the top of the control cable releases automatically to open the damper.

TWO KINDS OF FLUE-TOP DAMPERS

There are two styles of flue-top dampers on the market: the pop-up type shown in this article and a hinged type, which has a pivoting cast-metal damper plate hinged to the frame, and has a lower profile so it isn't as visible from the ground when open. The cable and retaining bracket mount are the same for both types.

Both styles of damper are easy to install and operate, and both are reliable. I've used and installed both and have no preference. The dampers on both are spring-loaded for their open position, so if the cable or the fusible link breaks, the damper will open automatically. The stainless-steel cable must be replaced over time. Depending on the amount of use, that could be a couple of years or a couple of decades.

Prices for flue-top dampers run from $150 to $350 depending on flue size, with both types priced comparably. Round flue-top dampers and adapters for square dampers are also available.

Mike Guertin is a builder and remodeler in East Greenwich, R.I., and a presenter at JLC Live.

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BY MELANIE HODGDON

/BUSINESS TUNE-UP/

Profit Is Not a Happy Accident

Last month, we looked at the importance of identifying overhead as the basis of your pricing strategy ("Price the Job Right, Starting With Overhead," May/15). Overhead is the closest thing you have to predictable costs, which means that you can create a budget for your overhead and be pretty confident of its stability. But there is a second number that you can predict with some certainty and that is absolutely essential to building a sustainable business: profit. This month we'll look at how to predict profit and why gross margin is significant.

1. Simple Profit and Loss (P&L)

Income	Money collected as a result of producing jobs	$100,000
Cost of goods sold	Money spent as a result of producing jobs	$67,500
Gross profit	Leftover money to use for covering overhead and contributing to profit	$32,500
Overhead	Expenses required to maintain the company	$27,500
Net profit	The "bottom line" dollars of profit when all costs are paid	$5,000

A simple P&L includes income, production costs (COGS), overhead, and profit. It suggests that profit is what's left over. But profit shouldn't be something you simply hope for.

2. Running the P&L Backward

		Last Year	This Year
	Overhead	$27,500	$32,000
+	Net Profit	$5,000	$8,000
	Total	$32,000	$40,000

Profit should be a target. Start with the overhead you know you'll have, and then add the profit you'd like to achieve.

TARGET YOUR PROFIT

While you can attempt to predict your sales, the actual incoming and outgoing dollars associated with production are going to be, at best, a rough estimate.

But profit is a number you should know. In fact, you *need* to establish it—to build in profit as a target to shoot for, treating it, in essence, as a cost. It may seem counterintuitive to consider profit to be a cost, but unless it's planned for, far too many contractors end up discovering profit as a happy accident, possibly only found at the end of the year when their accountant tells them how they did.

If you start with the mindset that net profit is as justifiable a cost as, say, your office rent, then you can begin to plan on how to make sure that you sell your work with enough added dollars to be able to pay for that profit "cost."

The chart at left **(1)** shows a simplified profit and loss statement (P&L), which includes income, production costs (COGS), overhead, and profit. In this model, the net profit ends up being a leftover. But what happens if we run it backward instead?

Step 1: Start with the most reliable, predictable number you can access: your overhead. Look at what you spent on overhead last year, or over the past 12 months. Write it down. Then put down what you think you will spend on a similar period, going forward. Consider whether you're planning on hiring new office staff, increasing your marketing budget, paying more in rent, and so on.

Step 2: Write down the profit you earned last year. Are you happy with it? Do you want more? Put down the dollars of profit you want this year. Don't be shy!

Step 3: Add the numbers together **(2)**. This is the number of dollars you'll need to have as your gross profit.

Gross Profit = Production Income - Production Costs

THE SIGNIFICANCE OF GROSS MARGIN

While gross profit is an essential line item to account for, gross margin actually serves as a better tool for determining how profitable a given job may be. To see how this works, let's review where we're at.

3. A Bigger Job Doesn't Guarantee More Profit

		A	B	C	D
Income		$1,000,000	$500,000	$250,000	$100,000
Cost of goods sold		$960,000	$460,000	$210,000	$60,000
Gross profit	$40,000	$40,000	$40,000	$40,000	$40,000
Overhead	$32,000	$32,000	$32,000	$32,000	$32,000
Profit	$8,000	$8,000	$8,000	$8,000	$8,000
Sum of overhead + profit	$40,000	$40,000	$40,000	$40,000	$40,000

The size of the job doesn't necessarily determine how much profit you will make. In a sample comparison of four different jobs, they all yield the same profit. The question becomes, wouldn't it be easier to make the profit on a smaller job?

4. Gross Profit vs. Gross Margin

		Job A	Job B
Income	Money collected as a result of producing jobs	$68,750	$598,650
Cost of goods sold	Money spent as a result of producing jobs	$47,973	$428,743
Gross profit	Leftover money to use for covering overhead and contributing to profit	$20,777	$169,907
Gross margin	Gross profit/Income	30.22%	28.81%

Which job was more profitable? Comparing the gross margin of different jobs makes this question much easier to answer.

In Part 1 (May issue) we looked at a simplified profit and loss statement so we could better understand the terms involved. Here in Part 2, we began by running the profit and loss "backward," starting with the overhead we were confident we would need to cover, and then adding the target profit amount we'd like to achieve. The total of these two amounts ($40,000 in our example) represents the dollars you'll need to have left over after you finish producing your work.

It's simple math: If you need to spend $40,000 on covering overhead and meeting your target profit, then the "leftover" dollars from producing work must be $40,000.

Now the questions you need to ask become: What do you need to mark up your costs by? And how much work must you sell in order to make your overhead and profit?

The answer is not as obvious as it might first seem because you can get to that magic $40,000 in many ways **(3)**. A bigger job does not necessarily mean a bigger profit.

The underlying question is: Would you prefer to sell $1,000,000 or only half of that or one-quarter, or even one-tenth, of that in order to earn the same $40,000?

GROSS MARGIN IS A BETTER COMPARISON

In order to understand what's practical for your company, you need to have more information about key numbers associated with your completed jobs. Namely, you need to know: What was your average achieved gross margin over the past 12 months?

Gross margin is related to gross profit but is expressed as a percentage rather than in dollars. You get gross margin by dividing the gross profit in dollars by income in dollars.

$$\frac{\text{Gross Profit}}{\text{Income (\$)}} = \text{Gross Margin}$$

Gross margin is really the percentage of your income that's due to gross profit. The higher the gross margin, the more profitable the job.

Using percentages makes it easier to compare dissimilar jobs. For example, the chart at bottom left **(4)** shows two jobs of different sizes. Which one was more profitable? Is it easier to answer that question based on dollars of profit or on gross margin?

WHAT'S NEXT?

Once you know what gross margin your company can realistically achieve (assuming no major changes in your production process), you can estimate the sales volume and markup required in order to meet your objectives. We'll look at those two—volume and markup—in next month's installment.

Melanie Hodgdon is owner of Business Systems Management. melaniehodgdon.com

Photo: Fred Martin

Roofing With Tile
Guidelines for high-wind zones and cold climates

BY JLC STAFF

Concrete and clay tiles are popular roofing materials in hot climates. But tile can provide a durable roof in any climate zone, provided steps are taken to deal with the prevailing conditions. In this article we'll focus on two of the most challenging environments for tile: high-wind and cold-climate regions.

In high-wind zones, there are two primary issues to solve. The first is to keep wind-driven rain out; success here depends on the waterproofing system beneath the tile. The second is to prevent tiles from either getting smashed by wind-borne projectiles or being lifted by high winds and becoming projectiles themselves. Success here depends on the fastening system. Mechanical fasteners and two-part foam adhesive work best, although they are not the only systems allowed by code.

In cold climates, wind-driven snow can be an issue, but the main problem is ice damming. Tile is brittle and cannot withstand normal efforts to remove snow and ice from a roof, so a design solution must be found. While most severe ice-damming problems are caused by heat loss from the building and can be solved by thorough air-sealing and complete insulation, those efforts alone aren't always enough. Solar radiation can play a role in melting snow, especially at high altitudes, and melt-water may refreeze when

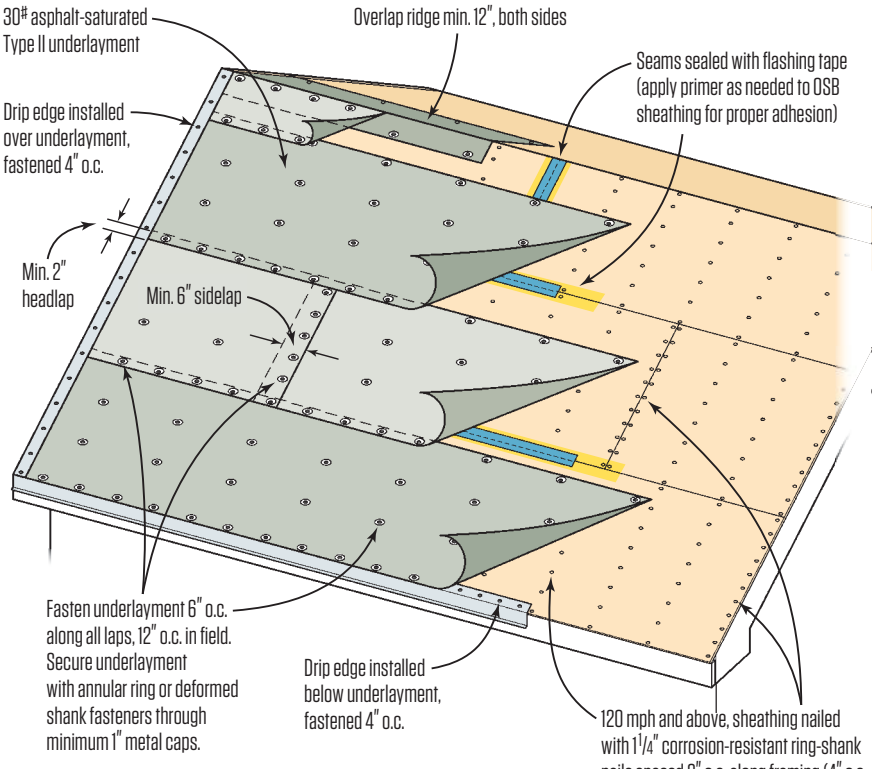
SEALING THE ROOF DECK

For a complete waterproofing system, first seal all seams in the roof deck, using one of the following techniques:

- **Minimum 4-inch-wide peel-and-stick tape** applied over all joints in the roof deck, topped by roofing felt (shown at right). Depending on the surface texture or the amount of wax in the panels, OSB may need to be primed before application of any self-adhered material.
- **Retrofit spray foam.** An alternative to peel-and-stick tape, a closed-cell spray foam can be applied to all panel joints from the attic side.
- **Properly attached synthetic underlayment** with all seams taped. Synthetic underlayments generally last longer, are lighter, and shed water better than felts. Specs for fastening, headlaps, and sidelaps vary by product; manufacturer installation instructions must be followed.

To complete the waterproofing system, a waterproofing membrane—such as a continuous peel-and-stick membrane or a 90-lb. cap sheet adhered with hot asphalt—needs to be applied over the underlayment system shown at right.

Single-Layer Underlayment



Apply waterproofing membrane (e.g. continuous peel-and-stick membrane or asphalt-adhered cap sheet) before installing battens and tile.

clouds move in or night falls. Complete success comes from building a cold roof.

WATERPROOFING FOR WINDY REGIONS

While concrete and clay tiles are durable, it's the underlayment—in concert with flashings—that actually provides the waterproofing. In high-wind regions, it's not enough to simply tack down felt. The goal is to seal the roof deck against wind-driven rain, and the underlying materials need to hold their own in the event some tiles get blown off the roof.

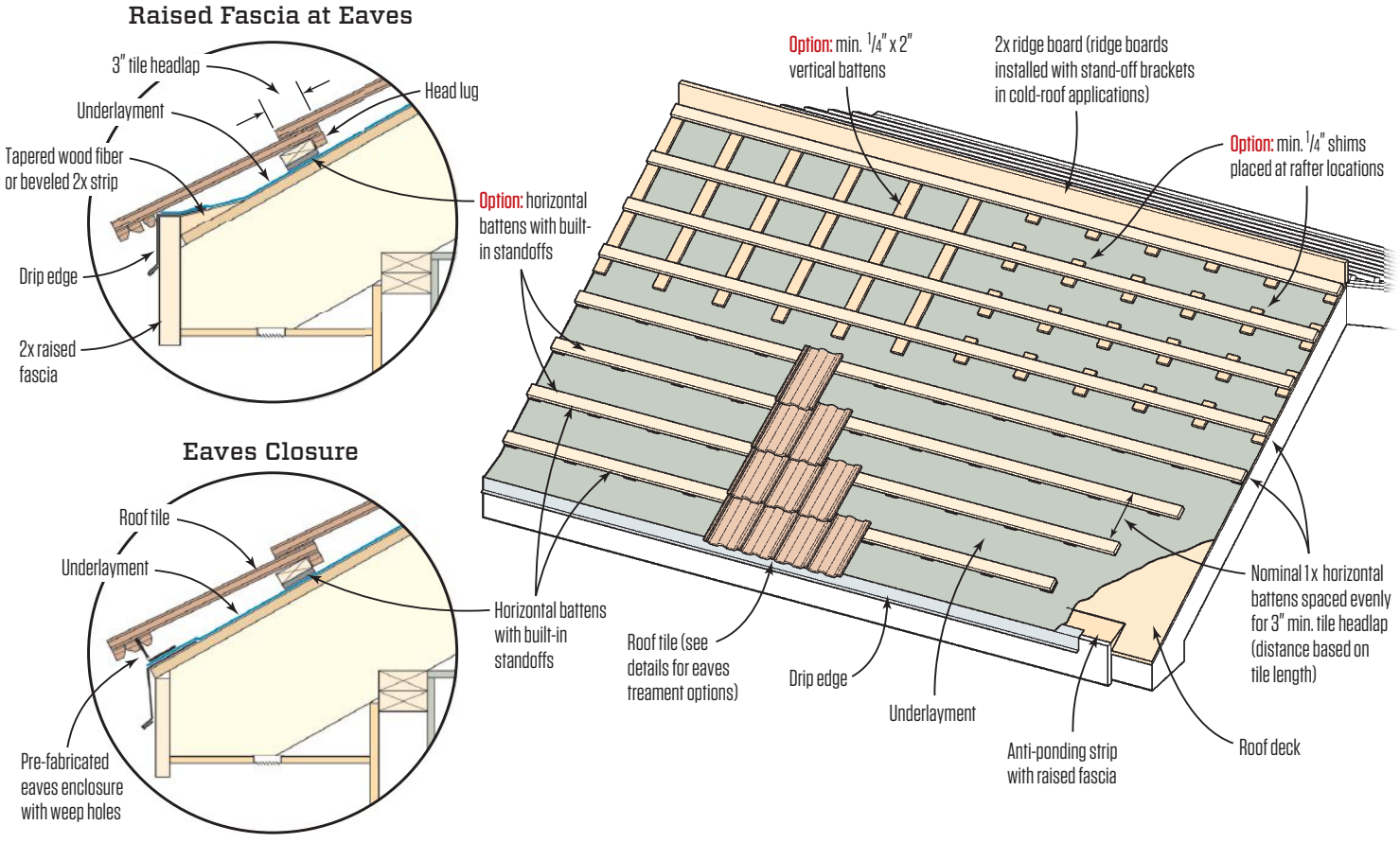
Continuous peel-and-stick. The simplest way to seal a roof deck is with a continuous layer of self-adhering "peel-and-stick" underlayment applied over the entire roof deck. As simple as this seems, it might not be a good idea. When applied directly to the deck, peel-and-stick usually cannot be removed for reroofing without damaging the sheathing. For this reason, some jurisdictions don't permit peel-and-stick to be applied directly to a roof deck. (Note: If it is allowed in your jurisdiction and you are reroofing over an existing layer, check with local code. Installing a second layer of peel-and-stick over the existing layer may be permissible, provided laps are offset between the existing and new layers.)

Single-layer underlayment. The default system is a single-layer underlayment over a sealed roof deck, as shown in the illustration above. To make this a complete waterproofing system, the joints in the roof deck must be sealed with peel-and-stick flashing tape or with spray foam from the attic side (see "Sealing the Roof Deck," above). And over the top of the underlayment, full sheets of self-adhering waterproofing membrane, or the cap sheet for a built-up roof, must be installed. (When completed, the underlayment serves as a bond breaker that allows for roof demo prior to future reroofing.)

Underlayment material. Standard 30-lb. felt is common, but is far from the best choice. Felt has extremely limited tear-resistance, making it vulnerable during the installation of tile. Tile is heavy and difficult to handle gingerly enough to avoid abrasion. Felt also has limited UV resistance (maximum 30-day exposure).

A synthetic underlayment will provide a big jump up in quality. Synthetics are made with polypropylene, polyester, or fiberglass—all of which provide much greater tear and abrasion resistance than felt. Synthetics are also relatively impervious to UV exposure

Batten Layout Details



and can often be left to weather for months. And because synthetic underlayment rolls are generally wider and longer than rolls of asphalt felt, application is often faster (see "Do Synthetic Underlayments Make for Better Roofs?" Jan/13). Of course, synthetics cost two to four times more than felt (depending on thickness and other properties of the specific product), but they also carry warranties of at least 25 years.

Built-up roofing (BUR) is a common substrate in high-wind regions when the tile is adhered with a two-part foam adhesive, which requires an adhered underlayment. However, traditional hot-mop systems may not be the best all-around choice. Asphalt becomes brittle with age and may be too inelastic for climates with routine freeze/thaw cycles. The fumes from molten asphalt are a suspected carcinogen; it can be harmful to workers, and some jurisdictions have rules about when, where, and if you can use hot asphalt. In some cases, you can comply by using a low-fuming product or a kettle that's equipped with a filtration device. In other cases, you may need to switch to a cold-applied bitumen or a torch-down modified bitumen. (For more information, see "Built-Up Hot Mop Roofing," Feb/05).

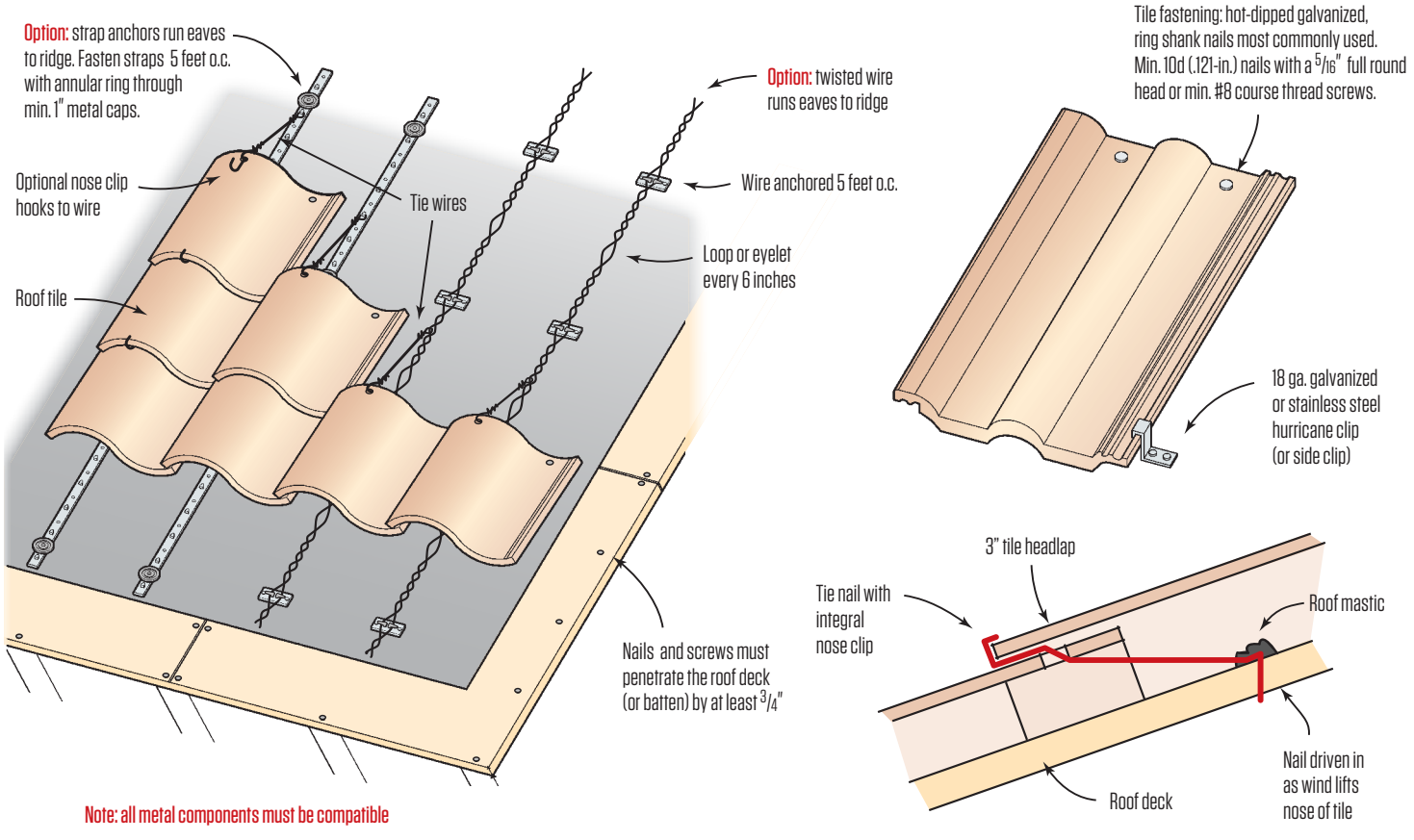
Flashing. A complete tile waterproofing system incorporates flashing interwoven with the underlayment. Metal flashing is required at junctures between the roof and sidewalls, at roof edges, in valleys, and around skylights, plumbing stacks, and other penetrations. Often these flashings are lapped over the underlayment shingle-style and sealed with peel-and-stick. On BUR applications, the metal is often sealed with cold-applied asphalt cement and a 4-inch or 6-inch cotton-mesh reinforcing fabric.

Edge trim. A lot of tile profiles also require a bird-stop. The traditional approach is to pile on a lot of mortar in the tile openings, but this is rather labor intensive. Metal bird-stop, nailed off at least every 18 inches along the eaves before tiles are installed, is typically more cost-effective. At rake edges, either curved tile (see illustration, page 45) or a raised-profile metal rake trim must be used to close off the gap between the roof deck and tile when battens are used.

COUNTERBATTEN BENEFITS

Traditional mission- and Spanish-style (barrel) roof tiles can be applied directly to the deck. But many of the flat-profile tiles have

Wind-Resistant Tile Fasteners



a head lug that requires installing them on battens. But there are advantages to battens, even if not required for the profile. The primary benefit is fewer penetrations through the waterproofing membrane. Typically, only three corrosion-resistant 8d ring-shank nails are needed per 36- or 48-inch batten (24-inch-on-center nailing minimum).

Horizontal battens over vertical counterbattens will promote positive drainage and are recommended in all climate zones, as this system provides plenty of drainage and airflow. But installing a double layer of battens is a lot more work. In wet regions where wind-driven rain is a primary concern, it may be more cost-effective to use horizontal battens with built-in standoffs (for example, Boral's Elevated or Tru-Flow Batten systems).

Horizontal battens—typically 1x2s nailed directly to the roof deck—aren't likely to provide adequate drainage for extreme weather events. While the butt ends of battens (maximum 4-foot battens allowed; spacing between courses depends on tile size) should be gapped about ½ inch, it's a judgment call whether this will provide adequate drainage. If the roof is in an exposed coastal location subject to intense wind-driven rain, battens with built-in standoffs or a counterbatten system would be a much better choice. In a hot, dry, or even moderate climate, ordinary horizontal battens might be just fine.

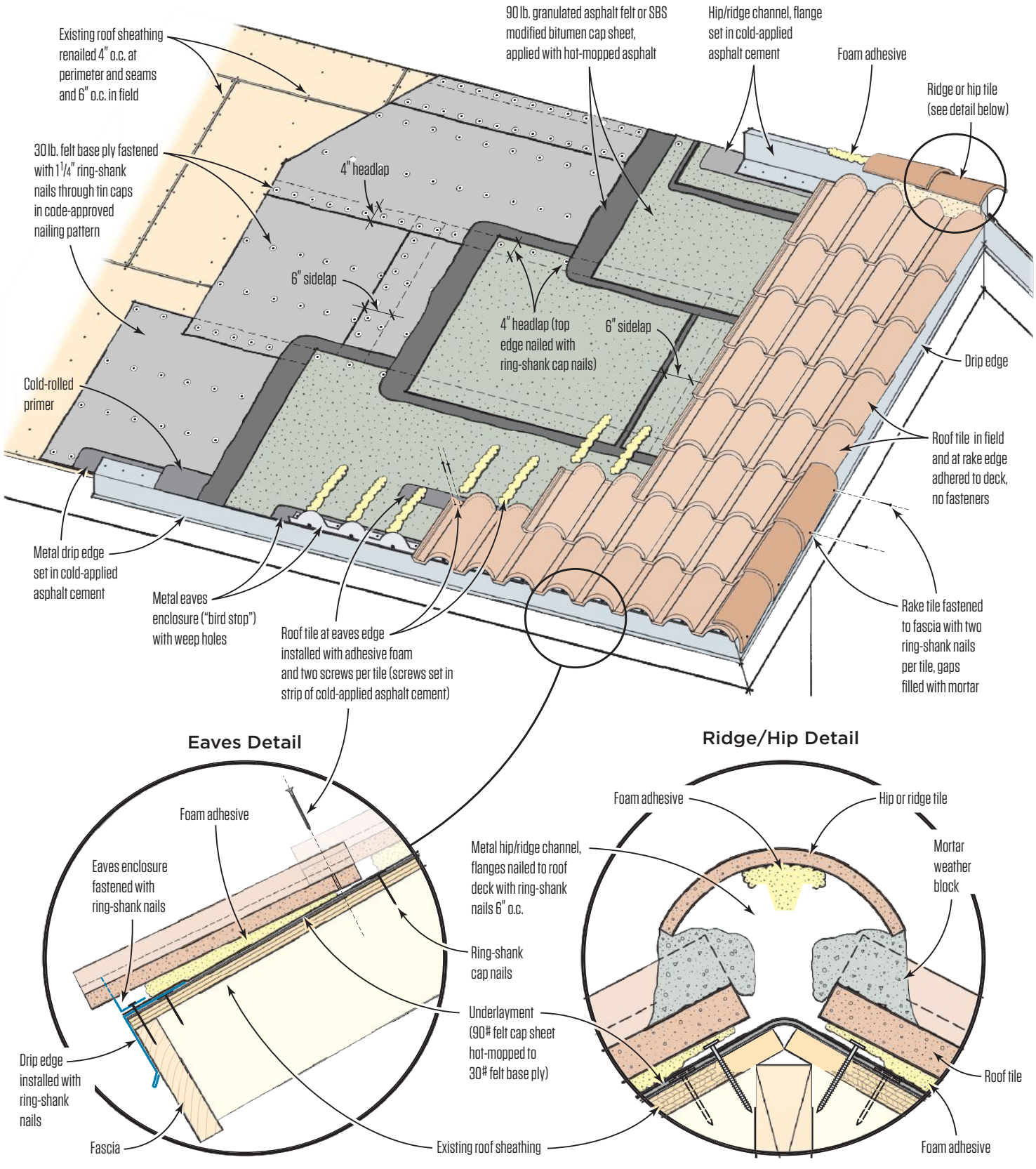
In wet and windy climates, wood battens are going the way of organic felt. While western red cedar is the preferred type, it is still prone to decay and won't last as long as the tile the battens support.

TILE FOR HIGH-WIND ZONES

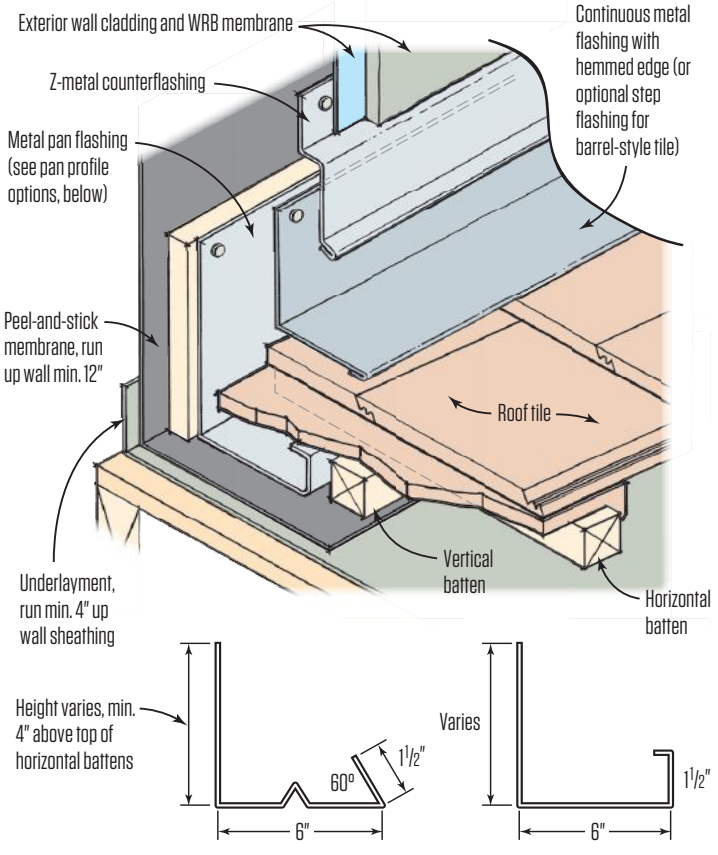
In hurricane zones, wind-borne projectiles smashing into a tile roof can be the cause of the roof's demise (and if the waterproofing system fails, possibly the demise of the home's interior, as well). Concrete and clay roof tile used in high-wind and hail zones should be rated for impact. The test—FM4473—evaluates the durability of the tiles when ice balls are fired at a test assembly. Class 3 tiles can withstand a test using 1¾-inch-diameter ice balls; Class 4 materials can withstand impact from 2-inch-diameter ice balls.

Securing tile. Two fasteners per tile will provide the required uplift resistance for a 130-mph wind zone. Hot-dipped galvanized, ring-shank nails (minimum 10d, or .121 inch, with a 5/16-inch, full-

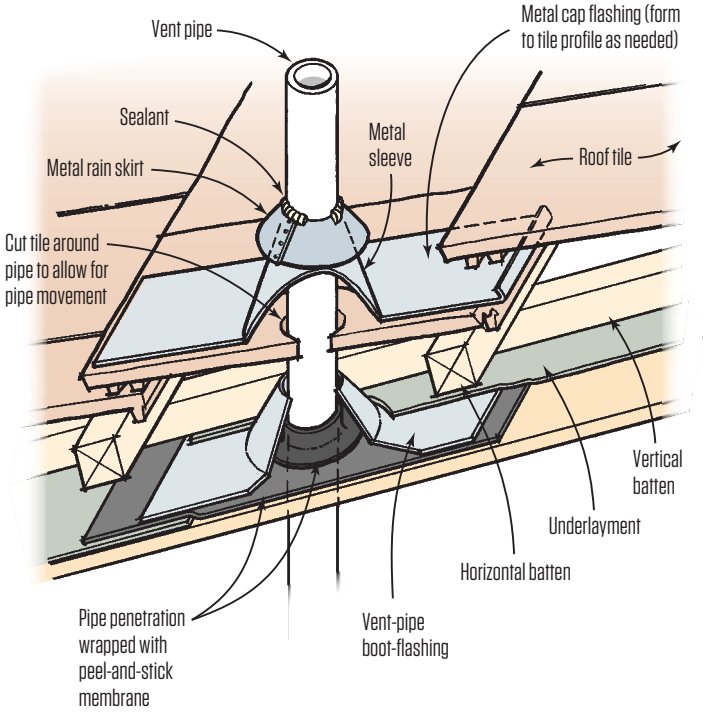
Adhesive-Set Tile Roof



Sidewall Flashing



Vent Pipe Flashing



round head) or minimum #8 course-thread screws fit the bill. Nails and screws must penetrate the roof deck or batten by at least ¾ inch.

In a high wind, the most intense uplift pressures on roofing are along eaves edges and along hips and ridges. Mortar-set tile, or mortar-set hip and ridge tile, is typically not permitted in high-wind zones—only an approved 2-part foam tile adhesive or mechanical fasteners are. Often a combination of nails or screws, hurricane clips or twist-wire connectors (see illustration on page 44), and two-part foam for securing overlapping tiles is the fastest and most reliable system.

COLD-CLIMATE CONCRETE TILE

In cold climates, the steeper the roof, the better. A steeper roof will reduce snow loading as well as promote air flow through roof venting.

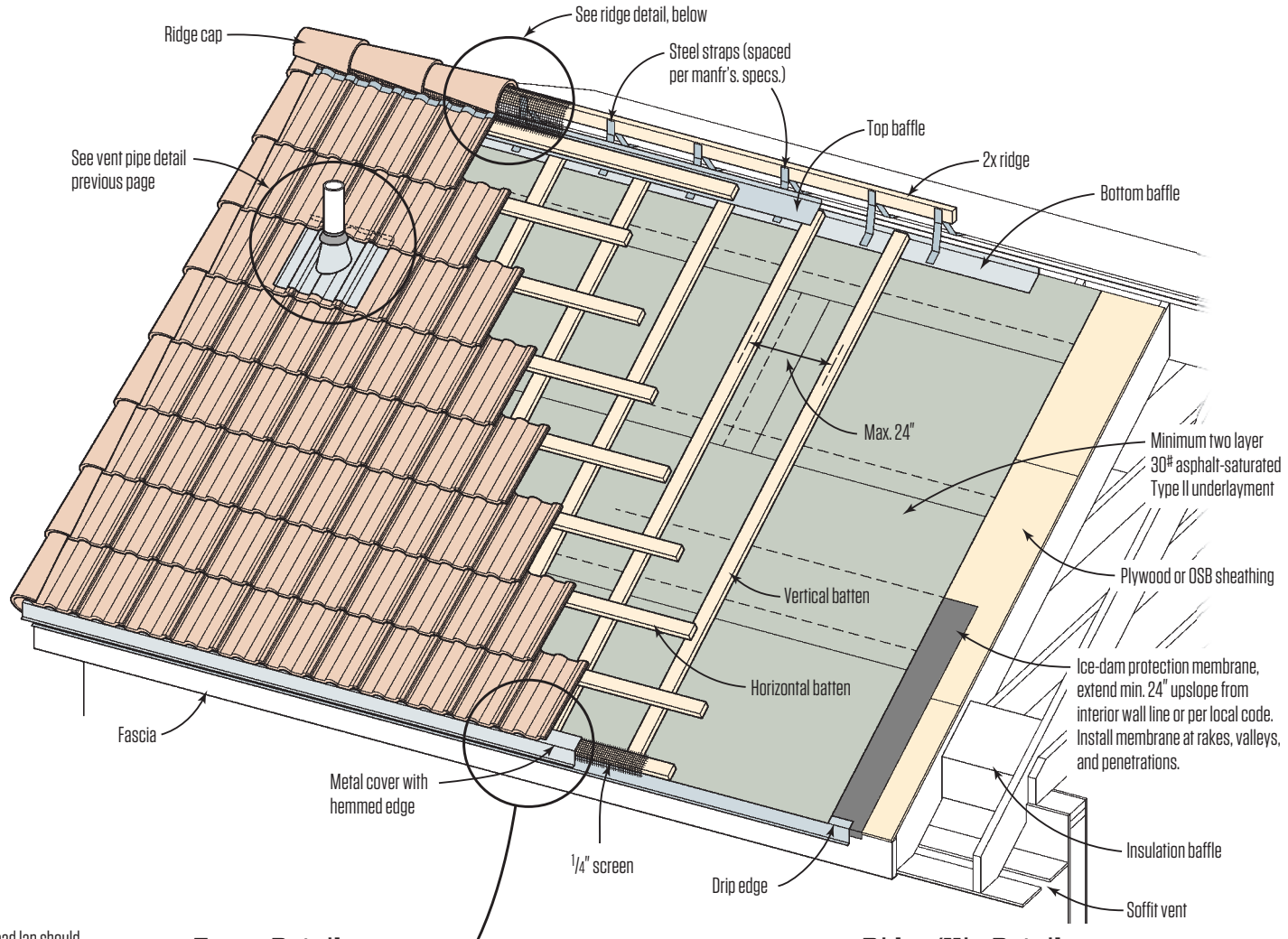
Build a "cold roof" using a counterbatten system, whether or not the attic is ventilated. Use 2x vertical battens with the eaves intake and ridge outlet baffled to keep out wind (see "Cold-Climate Tile Roof," facing page). Depending on snow accumulation and roof pitch, 2x cross battens may be required to support snow loads. In extremely cold and snowy climates, or with long, low pitch (around 4:12) roofs that require more ventilation space to promote airflow, vertical battens greater than 1½ inches (for example, 2x4s on edge) may be required. Be sure to consult an engineer for this application. Brackets may be required to prevent the battens from tipping under live-load conditions.

When the attic is ventilated, install ridge boards with standoff brackets to allow attic airflow to exhaust, as shown in the illustration on the facing page.

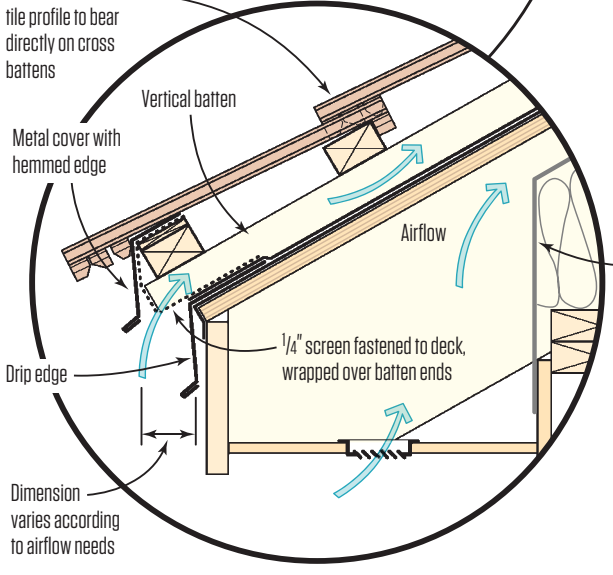
Underlayment. Best practice calls for a double layer of 30-lb. felt. Under the International Residential Code, "in areas where there has been a history of ice forming along the eaves," a self adhering "ice barrier" is also required for the first 24 inches inside (or above) the exterior wall line. Some code jurisdictions may require more ice protection.

Valleys. While not required by code, peel-and-stick is recommended along valleys. Long valleys are also difficult to vent. The battens running along the valley should be segmented, and vertical battens should be gapped so they do not intersect the diagonal valley battens. Closed valleys using "WW" metal (with added

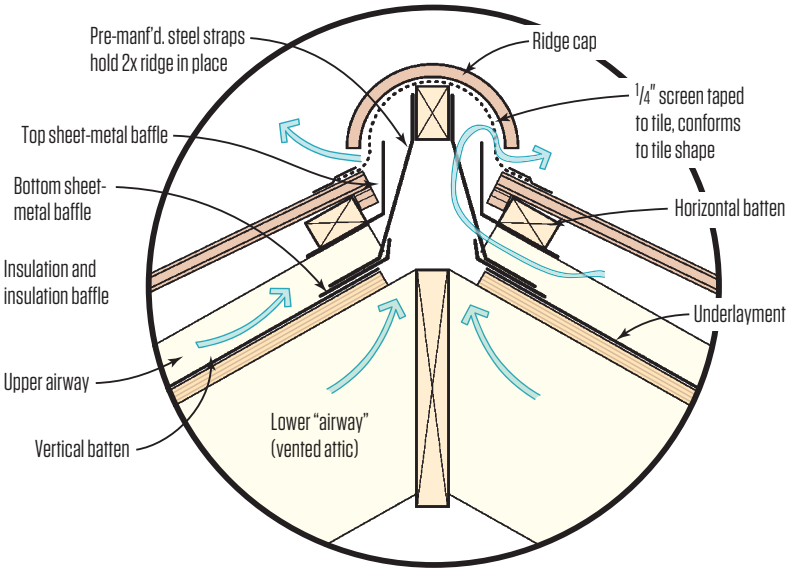
Cold-Climate Tile Roof



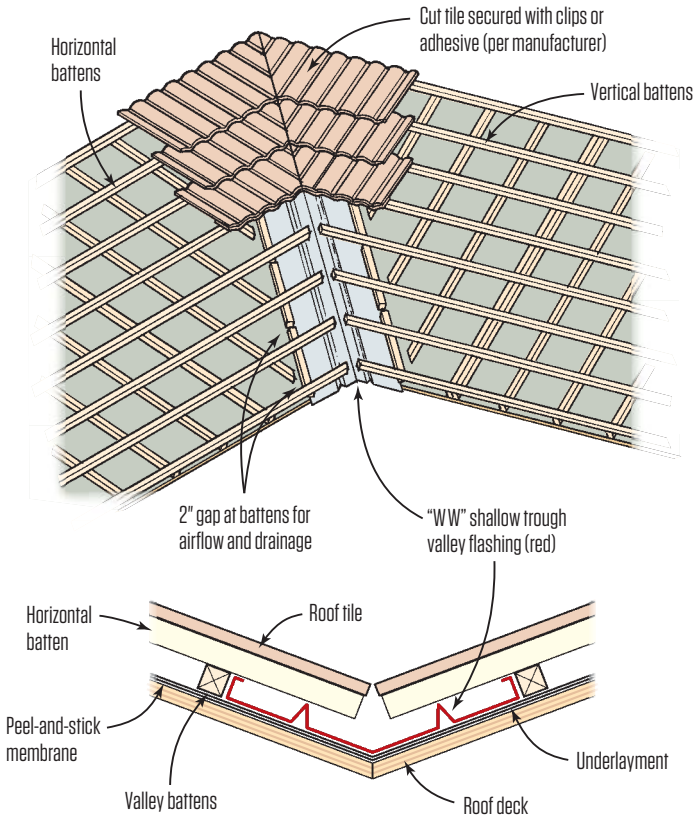
Eaves Detail



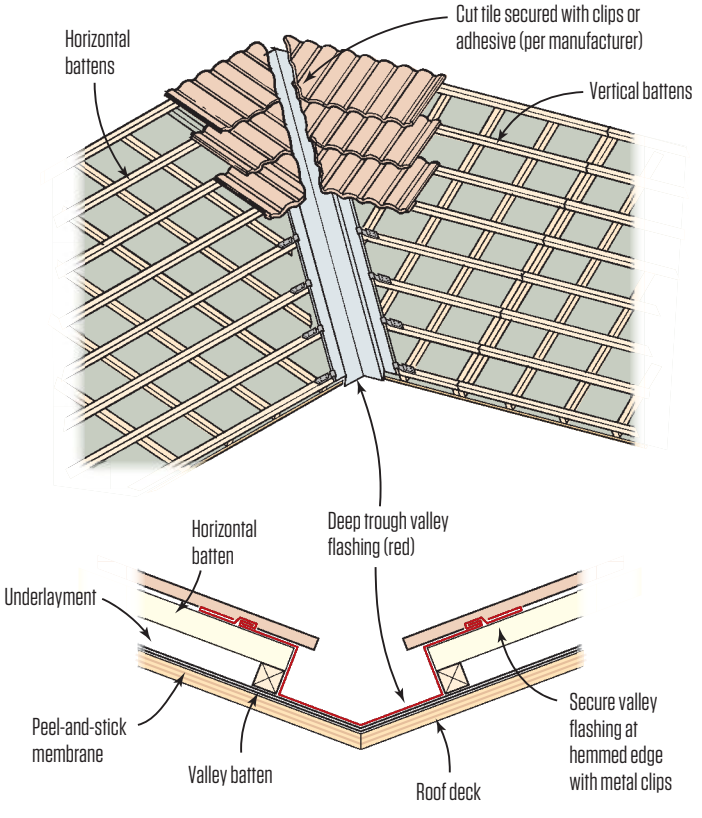
Ridge/Hip Detail



Closed Valley



Open Valley



standoffs to support cross battens), will be less likely to get clogged with debris. Valley metal for tile roofs needs to have upturned edges to contain the water flowing down them.

Sidewall flashing. Extend underlayment at least 4 inches up the wall and add a wide peel-and-stick that extends onto the roof plane as well as up the wall. The vertical leg should extend at least 4 inches above the top of the horizontal cross batten. Like valley metal, a metal flashing with an upturned edge to contain water, and padded out from the wall to allow for a robust counterflashing, must be installed as shown in the "Sidewall Flashing" illustration on page 46.

Flashing for roof penetrations needs to not only keep water out of the roof deck, but must also keep water from getting under the tile. In essence, you're creating a dual-layer flashing around penetrations. A conformable metal, such as lead, may be needed to seal the tile on top, depending on the profile. Crickets are a must above chimneys, skylights, and other large penetrations projecting through the roof.

Vents for combustion heating appliances should be boxed in a chimney to isolate them from the roof and reduce the chance that snow will melt around them. Preferably, the stack should be placed high on the roof, with the top of the stack above the ridge to prevent heated exhaust air from blowing across the roof surface and melting snow.

Snow retention brackets must be designed for tile and must hook over horizontal cross battens. Brackets designed for membrane roofs with a flat leg running along the roof line won't be adequate to support the loads.

TILE ROOF RESOURCES

For more details, anyone designing or installing tile roofs should consult these important resources (available free as downloadable PDFs from the Tile Roofing Institute; tileroofing.org).

- For high-wind installations, see *FRSA/TRI Concrete and Clay Roof Tile Installation Guide for Florida* (5th Edition, 2014).
- For cold-climate applications, see *Installation Manual for Cold and Snow Regions.*

In addition, IBHS, the Insurance Institute for Business and Home Safety (disastersafety.org), provides best-practice guidelines for homes in hurricane regions under the Fortified Home program. See *Fortified Home: Hurricane Standards* (free PDF).

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Tarping and Taping
Protecting work on the jobsite

BY RICHARD A. BLAINE

Photos: Richard A. Blaine

Remodeling a home can be grueling and expensive. With all that goes on at a jobsite, it's important to pay close attention to jobsite protection—not protection from criminal activity, but from the remodeling process itself. Damage to the existing house and to the new products and materials being installed can occur during any phase of a project and can be disruptive to the schedule and costly to repair.

As the senior lead carpenter for a design/build remodeling company, I am responsible for jobsite protection and for the protection of everyone working on the job, as well as for ensuring that the jobsite is safe for the homeowners. Knowing what's going to happen next at the job and knowing which subs are going to be on site and when they're going to be there allows me to prepare for possible problems.

Before every job breaks ground, we sit down with the homeowners and have a preconstruction meeting during which we explore where problems are likely to occur and what items may have particular value to clients—for example, they may want to reuse the refrigerator or protect an ornamental tree in the yard. This meeting is also the time to tell homeowners about the dust and debris the job will generate and how we plan to control it. Once this meeting is over, we all have a better understanding of what


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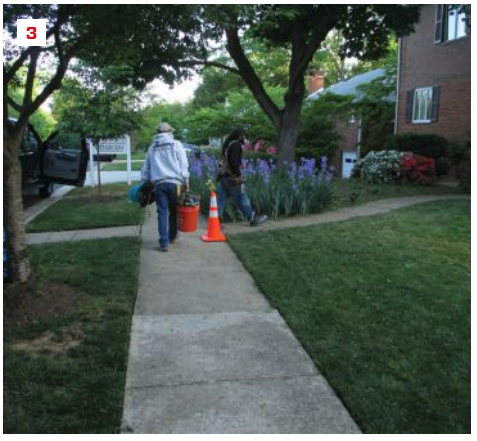
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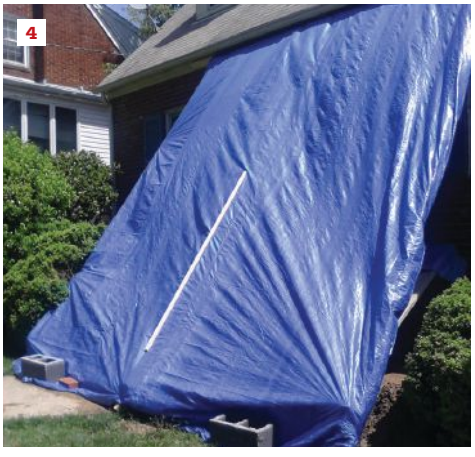
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needs to be protected. Half of our protective measures are a matter of common courtesy, while the other half are just common sense.

Our typical project may last from one to four months and require extensive work both inside and outside the house, using a variety of protection methods. Because jobs usually start with the exterior, I will start there.

OUTSIDE THE HOME

A remodeling job is a highly visible project. Potential clients will notice a clean, organized, and safe site. They will also notice unsightly piles of trash and unprotected lumber in the yard, which looks unprofessional. We think of it this way: Our company's sign in the yard or on the side of the house tells passersby what great work we do; a messy jobsite would tell them something else entirely.

Before construction begins, we often stake out areas of the property that the homeowners have asked us to protect. For example, we use silt fencing or orange plastic construction fencing around the drip line of an apple tree in the yard to keep everyone away from the area. We are especially careful if we start a job in fall or winter—what might look like a pile of dead leaves could be a prized perennial garden.

Material storage. We ask the homeowners beforehand where they want materials stored. Ideally, we store lumber inside the building, but when that's not possible, we cover materials with 6-mil plastic sheeting or tarps secured with ropes or bungee cords **(1)**.

It's not a bad idea to check with the town about storing materials. On one job several years ago, a county inspector required us to move lumber that we'd stacked and covered in an alley that we had incorrectly assumed belonged to the homeowners.

Roll-offs. We assist our roll-off drivers with placement of the dumpsters in an approved location and place traffic cones at the corners if the bins are left on the street **(2)**. Check with the town: Some local municipalities might require a permit to leave a container on the street; others may require that it be tarped at the end of the day—which is a good idea anyway, as it prevents wind from blowing trash around. A tarp might also discourage neighbors from dumping unwanted debris after dark.

Deliveries. Heavy concrete trucks can crush a driveway faster than they can pour one. Think ahead about where the driver will want to unload and take any precautions you can.

Give some forethought to the most suitable place for washing out the concrete chute after the delivery. Most roll-out dumpsters are not watertight and should not be used if the drain water will leak off the site. If there isn't a suitable place on site that will not drain onto another property or into a storm sewer, you may need to work with the ready-mix supplier to provide a washout bin.

It's also important to know where to locate the portable toilet. I always try to be on site when it gets delivered so the driver puts it in a place the homeowner and I have agreed to.

Traffic. For the most part, our employees and the subs we use are courteous and respectful of the homeowner's property. However, we sometimes define acceptable parking areas for their vehicles. You shouldn't need to tell someone to use the walkways instead of wearing a path across the lawn, but a traffic cone can be an effective reminder **(3)**.

Tarping in. Until a job is dried in, keeping water out of the house's interior is paramount. The most important thing we do for exterior protection is tarp the job thoroughly. We generally use standard blue tarps **(4)**, which are inexpensive and sometimes last a few jobs, depending on how long they are in place.

Blue tarps will hold up well against heavy rains and wind only if they are installed correctly. The tarp's edges must be placed over the roof peaks and along side walls and screwed down using furring strips—which can be made from ripped plywood and lumber—to keep edges tight. These strips prevent wind from causing the tarp to flap, which will quickly wear it out, or from getting underneath the tarp and ripping it. Placing old towels or insulation over sharp corners of the framing helps prevent tearing **(5)**.

Water is heavy and will collect anywhere the tarp is not taut, so I try to anticipate where water is going to flow. Until the roof sheathing is installed, you may need to use temporary "ribs" or other members to prevent the tarp from drooping.

Sometimes, even these measures are not enough. Temporary "tent poles" may be needed to channel water out of trouble areas **(6)**. Remember: Tarps aren't a set-it-and-forget-it measure. Whenever it rains or is really windy, I closely monitor the tarps for leaks, pooling water, and torn areas.

Window and door openings. Once we've completed the exterior framing, we leave window and door openings covered with the housewrap, which keeps rain and snow from getting into the house. And until the doors and windows are installed, we screw pieces of plywood over the rough openings from the inside to prevent falls and to keep out unwanted visitors **(7)**.

Here are a few more points about doors and windows. Whenever we take delivery on a window order, I count all the insect screens and make sure they all arrived with the order. Then I store them in a garage or an attic, safely out of harm's way.

On a recent job we did, an expensive mahogany front door was the main passageway into the home. I removed the mahogany door, stored it in a safe place, and made a temporary plywood door, complete with a lockset, that everyone could use until the job was just about complete.

Landscaping close to the house can be subjected to a lot of abuse, especially if the job entails roofing or siding work. Our roofing and siding subs are responsible for tying back and covering shrubbery or flower beds, but as always, the buck stops with me, so if their protection measures are inadequate, it's my job to make things right **(8)**.

ON THE INSIDE

Protecting the interior of the house is an ongoing task. Before the job starts, we protect what's already in the house, and then, as the job progresses, we protect the work we've finished. Typically, before interior work begins, I cover the floors as needed, seal off rooms, and move or protect the furniture, appliances, and existing trim or woodwork that could get damaged.

I like to use padded movers' quilts to protect existing appliances and immovable built-ins and large pieces of furniture **(9)**, and then cover them with plastic sheets. Do it correctly at the beginning of a job, and you won't have to worry about it again.


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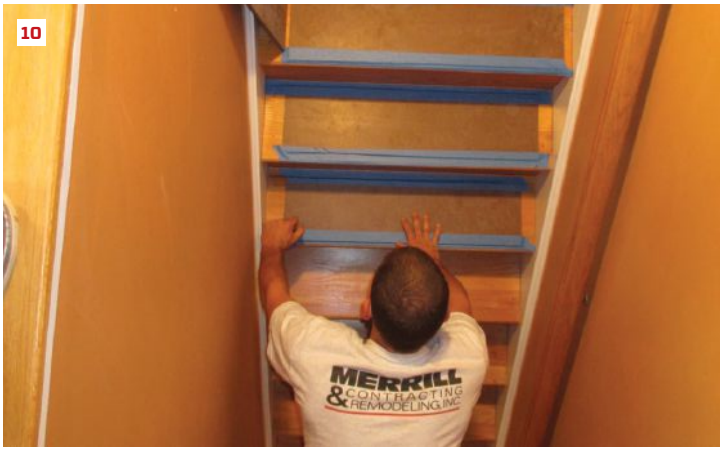

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Staircases can get a lot of traffic. I cover carpeted stair runners with a roll of sticky-backed plastic sheeting that adheres to the carpet's nap without leaving any residue when it's removed. Blue painter's tape holds the plastic to the edges of the stairs.

I cover wood treads with rips of inexpensive lauan plywood, also held in place with blue tape **(10)**. You should also think about covering banisters and newel posts.

Full sheets of lauan work well to cover the entire area of a floor during the job. I duct-tape the seams to keep dust and grit from getting between the sheets.

Another good option for covering floors is Homasote (homasote.com). This panel stock is made from recycled cellulose, which helps absorb sound. And because the panels are thick and soft, they make an excellent cushion over finished floors, especially if we need to set up a table saw or staging in a room.

I've often used protection products made by Ram Board (ramboard.com). Ram Board is 46-mil-thick 100% recycled paper that comes in 38-inch-wide, 100-foot-long rolls **(11)**. You can spill a little paint or coffee on it, and it won't soak through, but the material is permeable. According to the website, Ram Board can be laid over concrete floors without affecting the curing process.

I've also used the company's Ram Jamb for protecting finished door jambs. Available in 36- or 60-inch lengths, they are heavy-duty, molded paper products that snap in place over jambs from 4 to 9 inches thick and stay in place without tape.

To cordon off rooms, we use Zip Wall (zipwall.com), especially on wider openings **(12)**. Temporary stud walls hung with plastic and painter's tape work well, too, if an opening is going to be exposed for the length of a job.

I cover passageways with plastic sheeting held in place with painter's tape. If a doorway will still get used, I'll often use sheets on both sides of the opening and leave one side loose; that way, people can get through one side without completely exposing the other **(13)**.

Existing countertops and vanity tops should be protected because workers are always tempted to use flat, horizontal surfaces as work tables. I like to cover them with movers' blankets and a plastic sheet or a thick piece of cardboard.

I take the same measures with new countertops immediately after installing them. Preventing the expense and embarrassment


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of a hammer chipping a custom marble countertop is well worth the time.

Bathtubs also need protection. If you just use plastic sheeting or even a moving blanket, it will sag and fall into the tub. I like to tape a moving blanket around the edge of the tub and drape it down the side, then cut a piece of ⅝-inch plywood to fit tightly over the blanket **(14)**. Quarter-inch lauan won't support the weight of the first guy who sits or stands on it.

What you do about dust from drywall and floor sanding during a remodel can make or break your reputation with clients. You might have made it through the rest of the project without stomping on a single flower bed or putting even the smallest scratch on a wall, but if the whole house gets covered in fine dust from the drywallers or floor sanders, things can turn sour.

I spend at least five hours every week on jobsite protection of one type or another, and I'm especially careful to check and recheck everything before the dust storms begin. If the house has a forced-air system, I tape furnace filters over all the return ducts **(15)**. Box fans propped in windows and doors can exhaust a lot of dust to the outdoors **(16)**. The fans are also handy for pulling noxious fumes out of a building. Just recently I set up fans to get rid of the strong smell of a coating we were applying to basement walls.

WORKER AND HOMEOWNER PROTECTIONS

The employees in your company need to be thought of as well. New workers need to be taught the basics, including proper safety procedures for power tools, ladders, and fall protection. Wearing the proper safety equipment is a requirement. We hold periodic safety meetings with all employees present where we discuss a wide range of safety issues and where we hand out protective equipment.

A few rolls of plastic caution tape can go a long way toward warning people of a falling hazard. Even better are temporary railings and barriers made from 2-by stock. I always point out danger zones to homeowners and make sure their kids know that the jobsite is not an after-hours playground and that everything on the jobsite—tools, piles of material, stacked-up doors, windows, roofing, siding—is always and unconditionally off limits. As an extra precaution, workers should always leave power tools unplugged and covered when they're not being used.


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ULTIMATE RESPONSIBILITY

While many of the protection measures I take are really just a matter of common sense and common courtesy, you can't underestimate how quickly things can happen. On one job, I watched an electrician make a cut with a Fein Multimaster, shut off the tool, then set the still-oscillating blade down on a finished countertop. The blade skittered across the surface, leaving a long scratch.

Was it my fault for not making sure the counter was covered or his for putting down the tool? Ultimately, it was mine.

At some point we have all heard a subcontractor or an employee say, "I didn't do that," or "I don't know how that happened." Once damage has occurred, it doesn't matter who did what; the problem must be rectified in a manner acceptable to the client. It is important to remember that subs are an extension of your company and should be included in decisions, details, and expectations. Their knowing what their job is and how you expect that job to be done can help prevent problems. We tell our subs that they are responsible for cleaning up any debris from the work they do.

The subcontractors' crews also need to work in the same professional manner. Make sure they don't learn a valuable lesson at your expense. Mistakes do happen, but a lot of them can be avoided.

A CLEAN SITE IS A SAFE SITE

On Monday through Thursday, we knock off work at 3:00 and spend a half-hour straightening up. Cords and hoses are coiled up and tools are put away. Scraps are chucked in the dumpster or piled neatly if they might be used later. Before we leave for the day, all the floors are swept.

On Fridays, we spend the last hour of our day cleaning up, taking special care that all hazardous areas are safe for the weekend, when homeowners will inevitably want to walk through the project, often showing off the work being done to family and friends. Their safety and the protection of their home is my responsibility. I'm usually the last one to leave the site at the end of every work day, and I always do a final walk through before leaving.

Once we have completed a project, an independent company sends our clients a job survey that they can answer online or mail in. The results are then sent to us. We ask clients to rate us on such aspects as cleanliness, jobsite safety, post-job clean up, dirt- and dust-control, and courtesy; our final question asks how likely it is that they will recommend us to future clients.

There are many good products available for protecting all areas of a jobsite. Efforts, or the lack thereof, to protect the clients' home and belongings are always noticed. When clients see that you are putting cardboard, drop cloths, or moving blankets over their new kitchen countertops, they feel more confident in your work and in their choice of contractor.

Some steps to prevent problems may go unnoticed by the clients or the boss, but not covering the glass-doored wine cooler will be noticed—especially if it gets broken. Producing a high-quality job while protecting the clients' home and investments will make it much more likely that they will recommend your company to a future client, making all the extra precautions well worth the time and effort.

Richard A. Blaine is a certified licensed contractor and senior lead carpenter with Merrill Contracting and Remodeling (merrillcontracting.com) in Arlington, Va.

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Placing Puddle-Proof Pavement

Pervious concrete solves drainage and runoff issues

BY PETER ZONI

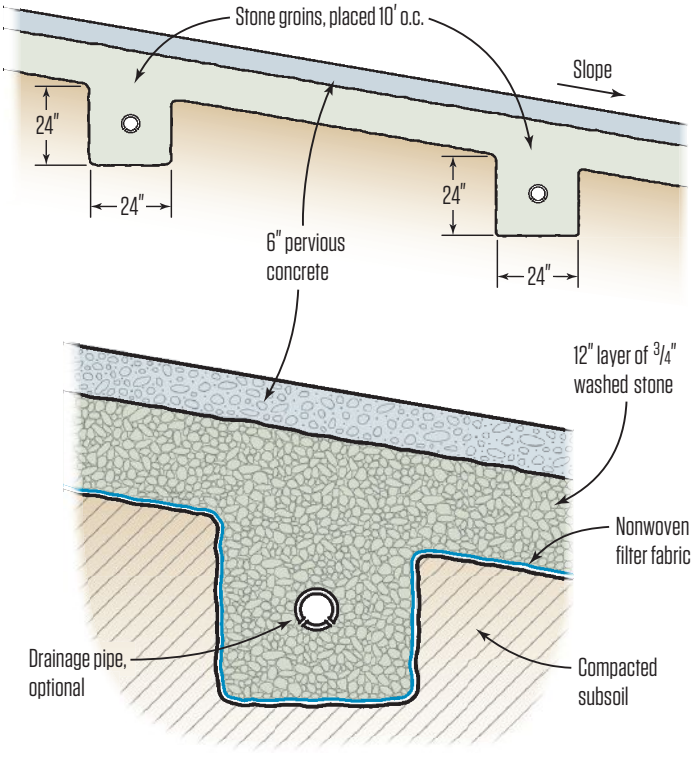
Our concrete company on Cape Cod has installed pervious concrete for many projects over the years where drainage or the accumulation of surface water was an issue. At a local senior center, for example, we used pervious concrete for a walkway to keep it from collecting water. Poolside areas are a common application, and we have even installed pervious concrete for the floor of a greenhouse to drain away the overflow and overspray from watering the plants.

Pervious concrete is a mix of Portland cement, coarse aggregate, water, and admixtures. Because there is little or no sand in the mix, the concrete contains bigger voids than ordinary concrete does. These voids let water and air pass through, making pervious concrete a good choice anywhere you need to control runoff. In many cases, using pervious concrete can eliminate the need for expensive drainage and collection systems.

Recently, a client approached us to build a driveway up a steep, 15% incline to a horse stable behind her home. The original driveway was a rutted dirt and gravel path that washed out in heavy rains. The client wanted to replace it with a paved surface that could handle heavy horse trailers and farm equipment, and she wanted it to look "elegant and charming" in the natural wooded area near her house and stable. But this driveway abutted protected federal land,

Photos: Peter Zoni

Draining a Sloped Pervious Concrete Driveway



so it also needed to intercept, contain, and filter any stormwater that cascaded down its surface. Pervious concrete was the perfect choice for meeting all of these challenges.

PREPPING THE SITE

Having a uniform subgrade is essential for any driveway, but it is especially important for one made with pervious concrete. The subsoil must be the right density to provide adequate support and still be permeable enough to drain away surface water. Fortunately, the Cape is blessed with sandy soil that is excellent for both drainage and support. We began by excavating about 18 inches below grade, down to the sandy subsoil, all along the path of the driveway.

After compacting the subsoil layer, we dug "groins," or trenches, every 10 feet along the entire length of the driveway (see illustration, above) to enhance drainage and help anchor the driveway to the slope, essentially preventing it from sliding downhill. These groins are about 24 inches wide and 24 inches deep and run perpendicular to the slope of the driveway.

We then covered the entire driveway—including the trenches—with a natural nonwoven landscape filter fabric that allows water to drain through while keeping the soil from filling the voids in the different layers of the driveway. As a bonus, the fabric allows the formation of a bacterial matrix that eats and dissolves petrochemicals—the fabric actually cleans the rainwater and runoff as they pass through.

Next, we added a 12-inch layer of ¾-inch washed stone **(1)**, filling the groins with crushed stone at the same time. We used a skid-steer machine to transport and spread the stone; the machine also helped to compact and smooth the stone in the process.

In certain soils, perforated pipe may be included in the groins to channel away water that drains through the driveway. Because the sandy subsoil on this project provided excellent drainage, pipe was not needed.

We do not add rebar or steel screen, both of which can rust and corrode over time, to strengthen a driveway. Instead, we add a nylon-fiber mesh to the mix to provide additional strength.

The last part of the prep work was staking 2-by boards on edge along both sides of the driveway. These would act as forms to contain the concrete as we placed the driveway.

THE POUR—WORKING AGAINST THE CLOCK

With the sublayers prepared and the forms in place, we were ready for the concrete. Our company has its own proprietary mix of pervious concrete, called Perk-Crete, and computer-controlled scales at our batch plant carefully weigh the exact amounts of the mix ingredients and aggregate needed for each load.

Noticeably absent from the list of ingredients is sand. In conventional concrete mixes, sand fills the voids between the aggregate, which is the exact opposite of what we are trying to create with pervious concrete.

Under the direction of our quality-control supervisor (who is certified for pervious concrete by the National Ready Mixed Concrete Association), water is added to the mix following tight tolerances. With no sand in the mix to give it "tooth," the concrete paste needs to be thick enough to coat the aggregate and adhere to it completely. Because of this quality, the conventional "slump" numbers that are typically used to measure the thickness of a concrete mix cannot be applied to pervious concrete mixes.

With such a low water content, pervious concrete must be transported to the jobsite and discharged from the truck as quickly as possible. As each truck arrives at the site, the supervisor visually inspects the consistency of the mix. It's rare that additional water is needed, but if it is, it must be added judiciously and only by the trained supervisor. Precise control over the water content ensures that the concrete creates bridges between pieces of aggregate and properly bonds them together without the paste running off and filling the voids that will be needed for drainage.

Because of its consistency, pervious concrete cannot be pumped; in fact, it's so thick that we need to use a short concrete chute to discharge the mix **(2)**. Given the limited access on this site, the most efficient way of getting the mix from the truck to the driveway was with a skid-steer machine. The truck discharged the mix into the bucket of the skid steer, which then carried each load to the driveway.

As each load was dumped **(3)**, crew members roughly distributed the concrete with rakes **(4)**. Then, while the machine was being refilled, other crew members compacted the edges and screeded the surface flat with a straightedge **(5)**. We use a special straightedge with ends that step down 2 inches to the surface of the driveway to keep the surface perfectly flat. The "ears" at the ends of the screed


5


6


7

ride on top of the forms. After screeding the concrete flat, radius edging tools softened the edges of the driveway along the forms.

The next step we call "densification"—a specific kind of compaction of the top layers of concrete. We use a steel vibratory roller, which we adjust to the width of the driveway—in this case 12 feet **(6)**. An engine spins the roller to increase the density of the top couple of inches of the driveway. This process helps to keep individual pieces of aggregate from loosening and kicking up when vehicles drive over the surface.

Because the pervious concrete mix has such little water, the crew must work as quickly as possible to spread and consolidate the mix. We placed this driveway in the fall when the air temperature was relatively cool. If we'd been working in the summer, we may have needed to resort to other measures, such as using chemical retarders that slow down the curing process and extend the working time for the mix.

To make sure that hydration in the concrete occurs properly, we cover the driveway with a thin, 2-mil plastic sheet while the concrete is still wet. Before the concrete is delivered, the crew unrolls the sheet for the entire length of the driveway. Then they roll the sheet back up and keep it at the ready. After each batch has been screeded, edged, and densified, they immediately unroll the plastic and press it into the fresh, wet concrete to keep it from curing too quickly **(7)**. By that point the skid steer usually has returned to dump the next load. The process then begins again for the next section of the driveway.

ROLLING THE SURFACE

Most concrete surfaces are troweled and floated to create the finished surface, a process that brings the slurry or paste to the surface and closes all the voids. Finishing a pervious concrete surface with conventional means would therefore defeat its purpose.

Instead, with the plastic covering the wet concrete, a crew member rolls a heavy steel roller over the surface **(8)**. The roller compacts, consolidates, and smooths the surface, while preserving the voids and ensuring that the plastic stays in complete contact with the driveway surface so that hydration does not happen too quickly. The roller is pushed back and forth over the surface in a cross-hatch pattern. The plastic keeps the roller clean and prevents it from pulling up the top layer of concrete.

CUTTING CONTROL JOINTS

Because this driveway was more than 200 feet long, it was necessary to cut control joints in the concrete. Essentially, control joints score the surface of the concrete and "show" it where to crack as it shrinks in the curing process. Pervious concrete doesn't shrink as much as conventional concrete, so we typically space the control joints about 20 feet apart.

To create a control joint, we use a rolling joint tool (also called a pizza cutter). A blade in the middle of the roller cuts a groove about 1½ inches deep, or about one-quarter of the thickness of the concrete slab. To cut the joint, the crew member carefully places the roller on top of the plastic-covered wet concrete and pushes the roller across the driveway from one side to the other **(9)**. The blade cuts through the plastic sheet and into the concrete surface, leaving a groove that functions as a control joint.

FINISHING UP

We leave driveways covered for a minimum of seven days, allowing the concrete to cure properly. Then we take off the plastic and strip the forms, leaving a finished surface that is smooth overall and ready to be driven on, but that has voids between the aggregate **(10)**.

For this project, we also cut back the excess landscape fabric and lined both sides of the driveway with crushed stone. The top and bottom of the concrete driveway butted into the existing parking surfaces.

The owner now has a driveway to safely access the stable with her horse trailer, with no concerns about the sloped driveway washing out in severe storms. And there is no concern about runoff adversely affecting the sensitive natural land nearby.

Pervious concrete does require a bit of maintenance. We ask owners to sweep debris off the surface as it accumulates. If debris does begin to clog the drainage through the pavement, the driveway may need to be vacuumed or blown out with a leaf blower, compressed air, or a pressure washer. The maintenance schedule can vary. Some surfaces that we've installed require annual maintenance, while others continue to drain perfectly with no maintenance at all.

Peter Zoni is the head of sales at Cape Cod ReadyMix, in Orleans, Mass.

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BY DOUG HORGAN

New Infrared Options for Remodelers

Four years ago our company invested in a $2,000 Flir i7 infrared (IR) camera. This was a steep investment, but we put the camera to good use on many of our jobs and it was well worth it. Recently Flir introduced a couple of lower-priced IR cameras—the TG-165 (about $400) and the C2 (about $700)—which we were looking forward to evaluating. Before I talk about them, though, I want to explain how we use thermal imaging on our jobs, to provide context for the IR-camera features we like.

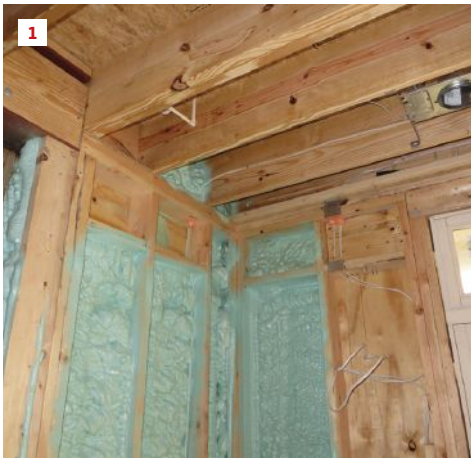
USES FOR THERMAL IMAGING

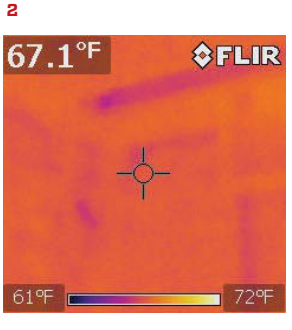
We use our IR camera mostly to find and fix air leaks and insulation flaws. It's particularly helpful as a quality check for spray-foam work **(1, 2)**. Our experience is that even the best crews accidentally leave voids. The thermal camera shows these quickly and clearly, and when the crews can see the issue with their own eyes, they don't feel we're being overly strict when we ask them to fix the gaps.

When you're looking for air leaks and insulation, it helps to use the camera with a blower door. By depressurizing the house and pulling outdoor air in through air leaks, even small leaks will become evident (see "Thermal Imaging With a Blower Door," Nov/13).

Better communication. Communicating problems to installers is a huge plus. What I hadn't anticipated is how useful an IR camera is for helping clients understand the value of air sealing—particularly in attics, along band joists, through cantilevers, bays, and so on—and insulation. When we first meet, our clients really have no idea. But when we hand them the camera, or email them images showing freezing air blowing into their living spaces, their heads instantly start nodding. The key is being able to provide clear visual evidence, so good screen resolution and output options are essential camera features for us.

Leaks and moisture. A thermal camera is also good for leak investigations. Most porous materials are cooler when wet (because the water evaporating from the surface cools it), and the camera can "see" what areas have been affected by a leak from all





1. Visually, the foam in this wall looks pretty good. **2.** On the camera, a flaw in the narrow corner stud bay is clearly visible as a cold (dark) spot.

Photos: Doug Horgan

WORKING WITH INFRARED

An IR camera is only indirectly reading what you are looking for—it measures infrared light emissions, not temperature. Under certain conditions, you can get anomalous readings. Here are things to watch out for.

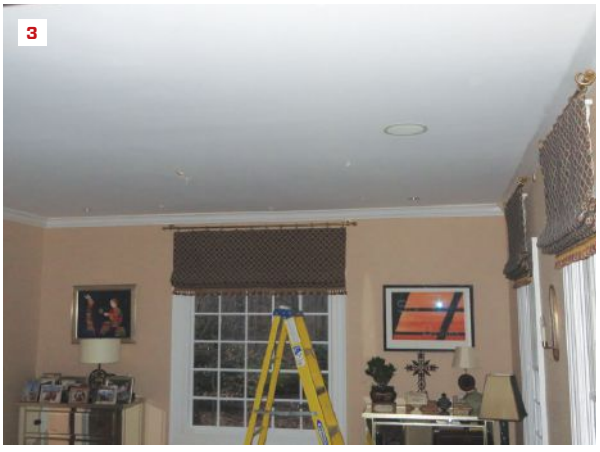
Emissivity. Most of the surfaces we see emit about the same amount of infrared, so temperature readings are comparable. The exceptions are low-emitting surfaces like shiny metal or reflective, smooth surfaces like glass. These surfaces reflect temperatures around them and don't emit much IR when hot. To see how these surfaces compare, I put a strip of blue tape on the surface. The tape has a similar emissivity to other building components and will "read" correctly.

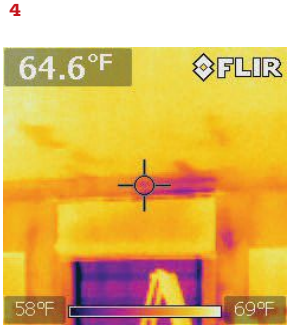
Ranging. Most of the cameras I've used automatically set one end of the color scale to the coldest temperature in the frame, and the other end to the hottest. The scale is relative to what's in view, so when you swing around a room looking for cold spots, the color that represents "cold" can change. This is especially noticeable when a hot light bulb comes into the picture. Suddenly the high temp in the picture goes from 75°F to about 200°F, and areas that looked warm suddenly shift into the "cold" range.

The way to prevent this is to lock the range. Point the camera at a representative area of the room, with no major heat sources or freezing cold window frames, and use the lock feature to hold the color range steady

the way across a room, as shown in these photos of a ceiling below a bath leak **(3, 4)**. The wet areas appear as "cold" spots. It's not that you couldn't figure it out with a moisture meter or by cutting open the finishes, but with the thermal camera you can quickly evaluate the entire affected area of drywall or flooring. You can take photos, which help clients and insurance companies understand the scope of work, and you can start at the source of the problem rather than having to trace it from the area first found to be wet.

In-floor heating. We use an IR camera on heated floors, too. Besides using it for ordinary problem solving (for example, to determine which loop is which on an 8-loop header), we often use it when we need to return to a job. In our custom construction business, we need to drill a hole or install a floor-mounted door bumper in the middle of a heated floor a couple of times a year. With the thermal camera, we can see exactly where tubing or electric heat wires are located. Even when they are 1 ½ inches apart **(5)**, we can confidently locate where to put the door stop or the mounting point for a frosted glass panel. One trick we've learned is to put masking tape on the floor in the area in question and mark that with pencil. If you warm up the pencil in your hand for 10 seconds, it will show up nice and bright on the camera screen and you can verify you are marking right on top of the warm wire in the floor.





3. We knew some of this ceiling was wet from a bath leak above. But where exactly were the wet areas? **4.** With the infrared camera, we could see the wet areas as cold spots (darker colors), showing the extent of the leak.

5. The Flir i7 autoranging has proven effective in use. The range can be manually locked. **6.** The TG165 lacks a lock feature and the automatic ranging sometimes doesn't show enough contrast.

WHICH MODEL?

This is not a comprehensive review of all the models available. But a comparison of the three Flir models we've used can provide a basis for making a buying decision.

The TG-165 is a solid performer at the tasks it's designed for. It's a compact, solid tool that feels like it would hold up fine in a tool bag. It's designed primarily for electricians, HVAC techs, and facility managers as an alternative to a pistol-grip spot thermometer. At $400, it's roughly twice the cost of a top-of-the-line Fluke or Klein spot thermometer. But in addition to measuring temperature, this tool can provide an infrared image of the whole area around the spot you're aiming at—useful information that will help in verifying electrical installations and diagnosing mechanical problems. For a general contractor, though, it lacks key features that make an IR camera such a worthwhile investment.

In particular, the smallish screen has a low resolution (60x80) that does not show much detail. You *can* find hot and cold spots in walls, ceilings, and floors, as long as you move around and approach the spot to get an accurate gauge of temperature differences—but the saved images are hard to read and not very useful in reports or emails.

I also found the autoranging feature especially frustrating. The TG165 seems to re-range frequently, and the colors constantly cycle back and forth. When I used the tool to search for warm floor heat wires, for example, I couldn't confidently see the wires . The tool showed the whole floor at the same color **(6)**. My old i7 was able to range correctly to show the heat wires in a different color from the rest of the floor.

The C2 (7) is almost as useful as our i7, but at much less than half the cost. This new, compact model combines a visual camera

7. The author at work with the Flir C2 , which is only about as big as a smartphone.
8. With the addition of "MSX," this image from the C2 of wet carpeting in a workout room is more useful and is suitable for reports and emails.

with an IR imager. You can set it up to save both infrared and visual images at the same time, which makes reporting and later viewing much simpler. (To get a visual image with our i7, I must first take the time to set the same times on a separate pocket camera and on the i7, then walk around taking pictures with both devices. Later I have to match up the images from the two sets and put them together for a report.)

A key feature is what Flir calls an "MSX" overlay. This view combines the IR image with faint lines outlining all the objects and patterns from the visual image. The combined image provides a clear and recognizable representation of the area, while also providing thermal information **(8)**.

Though the C2 uses the same 80x60 resolution infrared sensor that's in the TG165, the addition of the MSX overlay makes the image more readable—even more readable than the 120x160 infrared-only images we get from the i7.

The C2's touchscreen makes access to options quick and simple—better than the mushy buttons on our i7, which are hard to operate. (I often hit the adjacent one in addition to the one I want). On the C2, thermal range can be locked with a single touch, and other options are usually two touches. My fat, clumsy fingers had no trouble with the on-screen buttons.

The physical button on the side of the tool for taking photographs was a bit stiff on the demo unit. I felt it was hard to hold the camera steady while pressing it. But the pictures all seemed to come out fine.

One interesting shortcoming is shooting in dim light. Because the key to usable images is the MSX overlay, the visual camera needs to be able to "see" the outlines of objects in the photo area. When I tried using the camera to take pictures outdoors on a cold morning, the dim pre-dawn light was inadequate for the visual camera, and I got no outlines on my infrared image. With the low-resolution infrared sensor in the C2, the picture was not very useful—though the tool was still great for actively looking for hot and cold spots. A similar situation happened in a poorly-lit crawlspace. The camera was still useful—I could see one of the crawlspace walls was much cooler than other areas—but I couldn't get the great picture I could get when there was better light.

I think the next step up from the C2 is a $2,700 E6 camera, which has MSX as well as a much larger sensor.

Doug Horgan is vice president of best practices at BOWA, a design/build remodeling company in McLean and Middleburg, Va.

within that narrow range. Hot objects won't change the color range as you scan the room and you'll be able to see minor temperature differences.

Evaporation is a cooling process, so wet areas appear cooler. With most building materials, the line between wet and dry is clearly visible from across the room, and the camera is a fantastic tool for identifying these locations. With some materials, though, evaporation is minimal, and little or no difference shows on screen. Polyurethane floor finish and glazed tile, for example, don't let water through. Use a moisture meter for these materials. I always carry one when investigating a leak.

Thermal capacitance. When you look at a wall, the studs can be either warmer or cooler than the surrounding drywall—depending on a number of factors. Remember that things cool off at night (and then take a while to warm up), and warm up during the day (but take a while to cool off). Sometimes the studs look cooler than the wall even during the air-conditioning season, particularly in the morning, due to night cooling.

Radiation effects. If you ever bring a camera out on a sunny day, you'll quickly realize the warm sun overwhelms any effects of insulation or water. First thing in the morning is the only good time to see a lot of exterior issues. Don't forget that the side of the house facing the wind will have a much more even temperature due to the air washing that occurs on the surface, which masks any temperature differences. And any surface facing the sky will cool off on clear days or nights as heat radiates into space.

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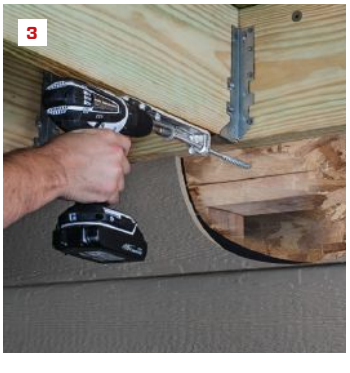
BY LAUREN HUNTER



1. Catch It on Camera

Keep up with jobsite progress with help from Brinno's BCC 100 Time-Lapse Construction Camera. The worker-friendly camera can be set up anywhere indoors or out, thanks to a dust-proof, water-resistant housing. The wide-angle lens gives a 140-degree view of the jobsite, and the battery lasts up to 10 weeks when the camera is taking pictures at 30-minute intervals. Find the BCC 100 on Amazon.com for $214 on its own, or for about $270 with additional accessories. brinno.com

2. Outlet When You Need It

Keep outdoor-rated outlets out of sight until they're needed with the Thomas & Betts Red Dot Deck Grommet Pro Floor Box. Hardwired, the unit can add a power outlet to any part of a raised deck. When not in use, the unit folds down into a deck board, with just its nonmetallic cover showing. The Deck Grommet Pro is UL-approved in the U.S. and Canada and complies with the National Electric Code for unattended in-use plugs in wet locations and required "extra duty" outlet box hoods. tnb.com

3. Spread the Load

Simpson Strong-Tie's newest tension tie allows attachment of a deck to the house from the outside, sparing builders the trouble of making bolted connections inside. The DTT1Z meets 2015 IRC requirements for four 750-lb. lateral connectors as an alternative to two 1,500-lb. connectors. Connectors are galvanized and are available online for $1.79 apiece. Check with your dealer for pricing on packs that include the fasteners needed for installation. strongtie.com

4. Electric Tankless

The new Vero line of whole-home electric tankless water heaters from Trutankless is designed to provide more than 20 years of maintenance-free service. The product line features patented heating technology and a self-flushing design to eliminate scale and mineral buildup. With breakers built into the unit, installation is easy, and it works with multiple wiring configurations. The Trutankless Vero heater meets the new Energy Factor guidelines in recent updates to the National Appliance Energy Conservation Act. Starting at an affordable $1,000, it's budget friendly too. trutankless.com

5. Satin Shower

Bendheim's SatinTech frameless shower doors offer an etched, brilliant finish that combines a popular frosted look with easy maintenance. The chemically-etched surfaces are reportedly resistant to fingerprints and staining over the life of the product. In this barn-door installation (shown at right) from Mosaic Interiors SF, the etched surface faces outward while the polished surface brightens the bath's interior. SatinTech shower doors retail for about $30 per square foot, plus the cost of hardware. bendheimarchitectural.com

6. Flashing Forward

Dow Corning has added a new liquid flashing to its Silicone Air Barrier System. The 778 Silicone Liquid Flashing is made for sealing windows, doors, and other challenging through-wall transitions. The material features extended tooling time and has a primerless formulation so there is no need to prime rough openings and wait for primer to cure. The flashing can be used with the rest of the Silicone Air Barrier System or as a stand-alone product in other projects. The full system includes other 100% silicone components for tight, weatherproof seals, according to the manufacturer. Check with your dealer for pricing. dowcorning.com/construction

7. Garage Gadget

If the power goes out, chances are the garage door opener goes out too—unless it's plugged into a CyberPower Uninterruptible Power Supply (UPS) like model LE825G. A UPS safeguards small electrical loads, such as garage door openers or office workstations, in the case of a power outage. The UPS plugs into an outlet, and the opener or workstation plugs into the UPS for back-up power. For about $90, the unit offers enough power for a handful of full open-and-close cycles. cyberpower.com

8. New Drawer Design

Noting a 20% increase in demand for microwave drawers in each of the last three years, Sharp has introduced its newest Microwave Drawer Oven. It offers an easy-open handle or "Easy Touch" power-open and hands-free drawer close. A concealed control panel tilts out 45 degrees for access. The drawer design puts the microwave at a more convenient undercounter height for wheelchair users or for homeowners wary of pulling hot dishes from a raised appliance. The Microwave Drawer Oven comes in 24- or 30-inch models priced from $1,300. sharpusa.com

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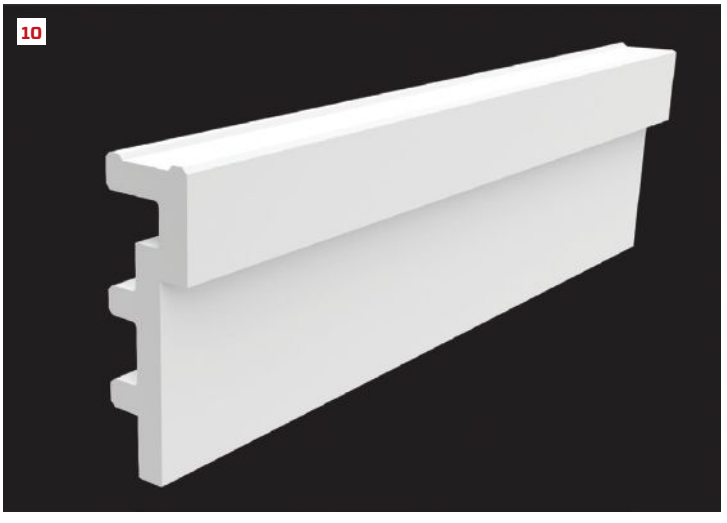
9. New Carriage Style

Garage door replacements are among the most valuable home improvement projects in *Remodeling*'s 2015 Cost vs. Value report. Wayne Dalton's new Model 9405 in its Carriage House Steel Collection is designed to capture old-world charm. A painted, galvanized-steel backer adds strength and helps prevent thermal cupping. Options include two-tone paint finishes, windows, and decorative hardware. Wayne Dalton say the door is "intermediately priced," but check with your dealer on how options will affect pricing. wayne-dalton.com

10. Extruded PVC Rake Board

Layering trim boards on site can be time-consuming. Azek is helping contractors reclaim some of those labor hours with the Ready Rake, a one-piece extruded profile offering the finished look of a stacked 1x8 and 1x3. Available in 18-foot lengths with a smooth finish, Ready Rake comes ready to install and features a $^{13}/_{16}$-inch cut-out to cover siding edges when being used as a frieze or fascia board. The cellular PVC trim comes from the factory in white and can be painted. azek.com



11. Cedar-Grained Composite Siding

The Tapco Group has introduced Grayne Engineered Shake & Shingle Siding. The prefinished materials mimic natural cedar with deep graining, depth, and shadows. The collection's Plain Sawn Shingle replicates the cutting profile used to make cedar shingles, with wood-grain textures visible on all surfaces, from butt edges to keyways. Available in six nature-inspired colors, Grayne's composite makeup is designed to be durable and weather-resistant, and reportedly won't absorb moisture. Check with your dealer for pricing and availability. grayne.com

12. Podium on Wheels

Werner introduced its Podium ladders in 2014 and now the company has made them easier to move around the jobsite by adding casters. Factory-installed on 375-pound Type IAA and 300-pound Type IA ladders, the casters are spring-loaded and deactivate automatically when a ladder is in use. The new Podium ladders with casters are available in heights from 9 to 16 feet and offer large platforms with plenty of workspace so users can keep their tools at hand. A 36-inch guardrail wraps the work zone for added safety. Pricing starts at around $320 online. wernerpodium.com

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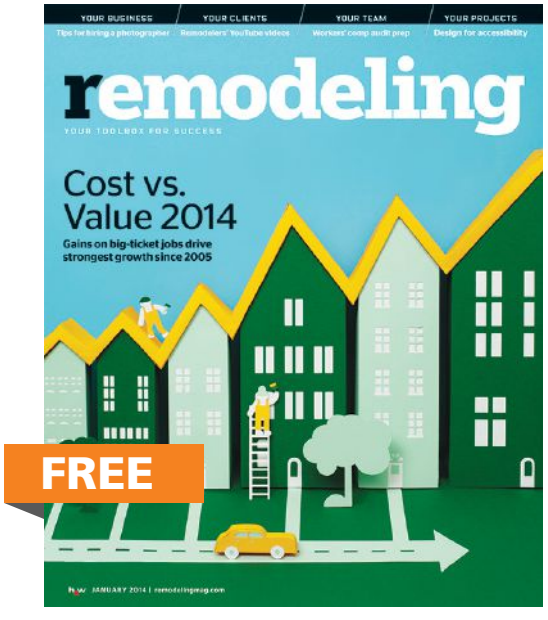

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EDITED BY BRUCE GREENLAW

Milwaukee M18 Fuel 1-Inch SDS Plus Rotary Hammer

BY SIM AYERS

We've been doing seismic retrofits on northern California homes, where anchoring a sill to a foundation often requires us to squeeze into a crawlspace to drill a bunch of holes in concrete to accommodate anchors or epoxied threaded rods. We usually use a corded Bosch 1-inch SDS Plus Bulldog Xtreme rotary hammer for these holes, but dragging a cord can be a hassle when you're working on your hands and knees.

When *JLC* asked us to try Milwaukee's new M18 Fuel 18-volt 1-inch SDS Plus rotary hammer, we were starting a new retrofit and were curious to see if the tool could drill the holes as quickly as our corded Bosch while delivering ample runtime per charge.

FEATURES AND PERFORMANCE

Like Milwaukee's other M18 Fuel tools, the new rotary hammer can be powered by any M18 battery, has an efficient brushless motor, and has protective electronics. The 4-amp-hour batteries included in the 2712-22 kit we tried have built-in fuel gauges and take almost 1½ hours to fully recharge. Other features include rotary-only and hammer-only modes, anti-vibe components, an LED headlight with a 10-second afterglow, and a depth gauge with a convenient release button.

Although 1-inch rotary hammers can drill 1-inch-diameter bits through concrete, they don't have the power to do it quickly. According to Milwaukee, to estimate the optimal capacity of a rotary hammer, divide the maximum capacity in half and add ⅛ inch; by that formula, we expected Milwaukee's new one-incher to easily handle ½-inch and ⅝-inch anchor holes. We weren't disappointed. According to Milwaukee, the M18 Fuel can drill fifty ½-inch-by-2 ½-inch holes in concrete per charge under optimal test conditions. It's impossible to get consistent test results when you're squatting or kneeling, but for the record, we drilled nineteen ½-inch-by-4 ½-inch holes on the first battery charge, and in one timed trial it took 33 to 52 seconds to drill each hole. To compare, we timed our corded Bosch Bulldog Xtreme, which took 30 to 45 seconds *longer* per hole.

We also used the M18 Fuel to drill ten ⅝-inch-by-7-inch holes in the same crawlspace. The tool had plenty of power to handle this more demanding application, but drilled only seven and a half holes before we had to swap batteries. During our trials, the M18 Fuel got warm, but it never got hot.

THE BOTTOM LINE

The M18 Fuel rotary hammer easily drilled our ½-inch and ⅝-inch holes in concrete, and in one timed trial, exceeded the speed of our corded 1-inch Bosch rotary hammer. We will definitely add one to our tool arsenal for doing seismic retrofits and other jobs. As with many of the latest cordless tools designed to compete with corded models, though, battery runtime can be an issue for the most demanding applications. For those, we will still use our corded Bosch.

2712 Specs

Motor type: brushless
Weight with battery: 8.5 pounds
Modes: rotary-hammer, rotary-only, hammer-only
Rpm: 0 to 1,400
Impact energy: 1.7 foot-pounds
Blows per minute: 0 to 4,900
Maximum spiral-bit capacity in concrete: 1 inch
Optimal spiral-bit capacity in concrete: ⅝ inch
Maximum thin-wall-core-bit capacity in concrete: 2 ½ inches
Price: $300 for 2712-20 bare tool, $500 for 2712-22 kit, $600 for 2712-22DE kit with dust extractor
Warranty: 5 years tool, 3 years batteries

Sim Ayers owns SBE Builders, in Discovery Bay, Calif.

SawStop Jobsite Table Saw

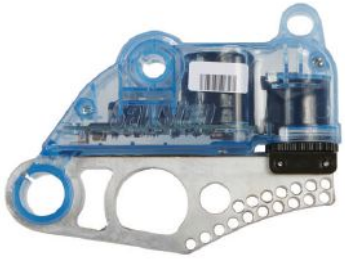
BY MATT RISINGER

I reviewed our SawStop 10-inch Contractor Saw in the January 2014 issue of *JLC*. It's precise, stable, and almost vibration-free, and if you touch the whirling blade with a good electrical conductor, such as a finger or an arm, the blade barely nicks the surface before a spring-loaded blade brake (see photo, below), stops it cold. However, the Contractor model, outfitted with an integrated base and a Biesemeyer-style fence, weighs over 300 pounds. It takes four guys to carry it, so it isn't always practical to bring onsite.

We do own Bosch and DeWalt portable table saws, which can be better suited to the jobsite. But a former employee cut his thumb on one of those, so the SawStop safety feature would be our first choice. Naturally, when SawStop unveiled its Jobsite Saw, with the same finger-saving blade brake, I jumped at the chance to review it.

The new Jobsite Saw weighs just 108 pounds, including its mobile stand. It has tons going for it. The user guide is fantastic, and the saw was easy to set up. The accessories, including a spare blade and a spare brake cartridge, store conveniently on board. A separate brake cartridge is available for use with an 8-inch dado set.

The blade can be fully raised or lowered with a single rotation of the handwheel. To change the tilt angle, you just squeeze the handwheel's backplate, swing the handwheel to the desired position, and let go. Once you're in the ballpark, you can fine-tune the tilt angle by turning a micro-adjustment knob—a great feature. The large paddle switch can be turned off with a thigh bump. Green and red lights under the switch indicate the status of the saw and the SawStop safety system, and are clearly explained on a chart located near the switch. The rolling stand sets up and breaks down easily.



SawStop replacement brake cartridge

On site, my crew was impressed with the saw's power. We used it mostly for back-beveling 1x6 poplar baseboard so we could easily scribe it to the finish flooring. But we also used it for ripping 2-by pine, 2-by white oak, 1-by ipe, and equivalent materials, slowing our feed rate when necessary to prevent the saw from bogging down. When we hooked our vacuum to the saw, it efficiently collected most of the sawdust.

Unlike our other portables, this is a belt-drive rather than a direct-drive saw. The belt significantly helps reduce vibration.

FENCE LIMITATION

One concern I have about this saw is the fence. The T-style rip fence clamps only to the front rail of the saw, instead of gripping the front and the back of the table. Exerting pressure against the fence can push the rear of the fence out of parallel, resulting in inaccurate rips. We noticed this in the first few rip cuts we made. And the problem was worse when we used a feather board.

The SawStop Jobsite Saw I tested might be fine for rough cuts or decking work, but it does not deliver the same accuracy for finish work that our larger Contractor Saw does. It's an otherwise awesome portable table saw with important safety features. But SawStop needs to rethink and redesign the fence.

Jobsite Saw Specs

Blade: 10 inches; ⅝-inch arbor
Amps: 15
RPM: 4,000
Cutting depth at 0 degrees: 3⅛ inches
Cutting depth at 45 degrees: 2⅛ inches
Maximum rip: 25½ inches
Weight with stand: 108 pounds
Price: $1,300
Replacement standard brake cartridge: $69
Included with saw: mobile stand, 40-tooth combination blade
Warranty: 1 year

Matt Risinger owns Risinger Homes, in Austin, Texas. See his video blog at JLConline.com.

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Kreg Foreman Pocket-Hole Machine

BY BRIAN CAMPBELL

It's hard to beat the simplicity of pocket-screw joinery for assembling many of the butt joints required for woodwork and finish carpentry. Using a special stepped drill bit and a pocket-hole jig or machine, you bore steeply angled countersunk pilot holes (or "pockets") at the end of one of the two adjoining workpieces, clamp the joint into alignment, and then drive a self-tapping pocket screw into each pocket to complete the joinery. Where pockets will be exposed, you can finish them by installing plastic or wood pocket-hole plugs.

The Kreg Tool Co. offers several jigs and kits that make it easy to drill perfect pockets with a hand-held drill. Jig prices range from $22 to $150. Kreg also makes a range of electric and pneumatic machines that significantly speed the work, with prices running all the way up to $10,900. I own a couple of the jigs for jobsite work and have used one of Kreg's stationary pneumatic machines in a shared shop.

Until recently, Kreg's most affordable portable electric machine was the 40-pound, 110-volt Foreman DB110, which cost $850. To drill a pocket, you position your stock against a fence and pull the handle. The single pull starts the motor, clamps the stock against the tabletop, and plunges the drill bit into the workpiece from below. Most of these machines are being used in serious cabinet and woodworking shops, while carpenters in the field or those who only occasionally construct cabinets or built-ins have typically been using a jig and a hand-held drill.

But Kreg has now replaced the Foreman DB110 with the Foreman DB210, which costs $400 and weighs just 20 pounds. After using the DB210 twice on jobsites and once in the workshop, I think it's a game changer.

PERFORMANCE

When the new Foreman arrived, I installed the included vacuum port, shroud, and hose inside the base so I could hook it to a vacuum. The machine accommodates materials from ½ inch to 1½ inches thick. You need to follow a simple, three-step procedure to adjust for the thickness of the stock and the length of your screws. One caution: If you don't adjust it properly, you can drill right through the fence when you pull the handle (don't ask how I know that).

So far, I've used the new Foreman to splice 1x8 baseboards, join window and door casings, and build cabinets. It drilled the pockets cleanly and accurately, and the dust collection worked great when I hooked it to my Fein vacuum. The base has rubberized feet and grips surfaces well, but you can also clamp or bolt it down.

I do have minor complaints. The handle, which contains the trigger and lockout button, is awkward to use left-handed. Although I'm a righty, work flow sometimes requires holding material with my right hand, and it would be helpful to be able to easily operate the handle with my left hand.

Also, although the fence has adjustable and retractable stops for repetitive drilling, they're small pieces of plastic that slip into a T-slot and are secured with socket-head screws. Small plastic parts are seldom durable enough to stand up to rigors of shop and jobsite work, and the screw heads are so close to the tabletop that turning a hex key to loosen or tighten them is a bother.

The DB210 has a 5-amp motor versus the 8-amp one on its pricier predecessor, so I would use an especially sharp bit with hardwoods.

Criticisms aside, this new Foreman performed well. It's not designed to replace the industrial machines used in production shops, but I expect it to become a popular tool on jobsites and in small shops.

Foreman DB210 Specs

Amps: 5
Weight: 20 pounds
Material thickness range: ½ inch to 1½ inches
Drill-bit options: Kreg standard, Micro-Pocket, and HD
Price: $400
Warranty: 1 year

Brian Campbell owns Basswood Artisan Carpentry, in North St. Paul, Minn.

BY JEFFERSON KOLLE

Vintage Handsaws

I spent the first month of my carpentry career moving piles of building materials. During the second month, my boss showed me how to use a circular saw—a menacing, chromed 8-inch Porter-Cable sidewinder that was like holding onto a gyroscope once the blade got going. Two weeks into month two, the power went out when we were cutting rafters. I figured we'd go home early, but the boss walked me over to the back of his truck and opened his lidded toolbox (which, for some reason, he called the dog coffin).

Inside, under the half-width sliding tray, sat his quiver of handsaws, resting in kerfs cut in narrow boards attached across the bottom of the box. He pulled out the vintage saws one at a time—two had belonged to his grandfather—and pointed out the differences between them: a wide ripsaw, an 8-point and a 12-point crosscut saw, and a backsaw.

Back at the sawhorses, he showed me how to cut straight and square with the 8-point, while giving me a few pointers. No need for a death grip on the handle. Don't force the saw, use long strokes and the whole blade. Keep both eyes open; you're not taking aim, you're just cutting to a line. He told me to cut a pile of twisted unusable studs into 4-inch-long chunks, "for practice," he said. Then he drove to town to do something.

By quitting time, I had a ragged, oozing blister on the thumb web of my left hand (I'm a lefty) and I'd snagged my right index fingernail with the sharp saw teeth. But I damned well knew how to cut with a handsaw.

If you buy a brand-new handsaw from a big-box store, it's going to have a squared-corner chunky blade and splayed, vicious teeth that look like they belong on one of those deep sea fish that never see any light. The hand hole in the plastic handle will feel as comfortable and natural as wearing someone else's shoes.

Matt Cianci restores and sharpens vintage handsaws and he has nothing against new handsaws. Not at first. "Very sharp," he says. "The blades are good steel."

The blades on vintage saws were handmade and taper ground on 4-foot-diameter grinding stones. Taper grinding means the blades are thicker on the edge with the teeth and thinner toward the top of the blades. "A taper-ground blade won't bind in the kerf you've cut," Cianci says. "That means the teeth don't need as much set as those on a modern saw." Lots of set means the saw cuts a wider kerf, which is necessary so the untapered blade won't bind. But a wider kerf means the blade is more difficult to control when cutting to an exact line.

Vintage saw handles, known at totes, are things of ergonomic beauty. "They were made one at a time, usually from a hardwood like apple," Cianci says. "Individually shaped by hand. Very comfortable to hold." It's better than fit-like-a-glove and more like shaking hands with your best friend.

Modern handsaw blades are sharpened by high-speed, electric grinding machines. "Machine sharpening ruins the steel's temper," Cianci says. "Then they can't be resharpened once they get dull." Another throw-away tool. He sharpens blades by hand with files.

On his robust website, thesawwright.com, Cianci lists his sharpening services. He also gives sharpening classes and, on occasion, lists restored saws for sale. If you want to buy a vintage handsaw elsewhere, every third or fourth tag sale probably has one. Minor rust can be removed with steel wool and oil. Avoid blades with rust pits that are more than surface deep and check for a loose or cracked tote with broken horns. There's a chance that a previous owner carved his initials or stamped his name on the tote—a sure sign that someone else recognized the fineness, beauty, and precision of the tool.

Jefferson Kolle writes from Bethel, Conn.

Photo: Jefferson Kolle

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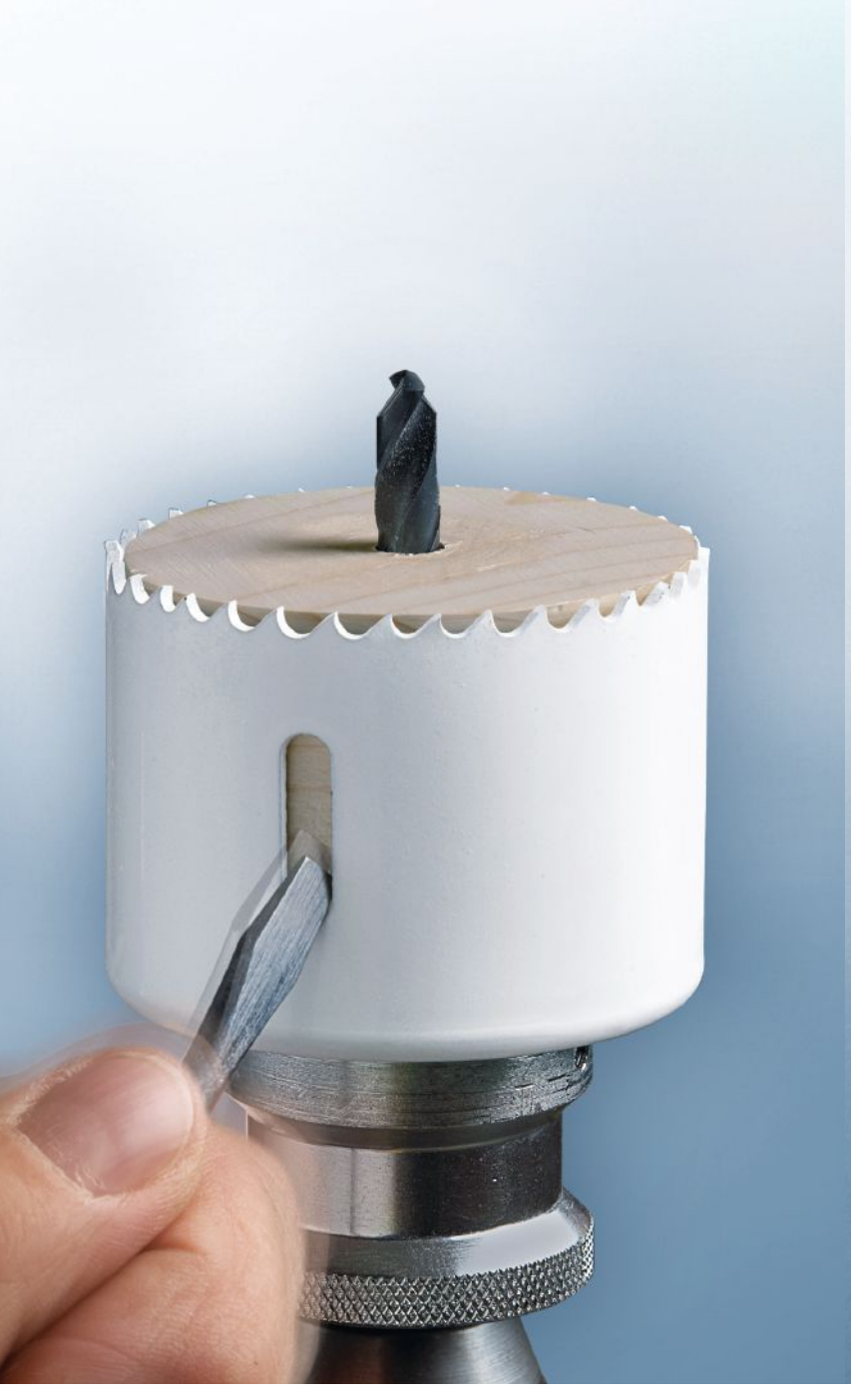

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