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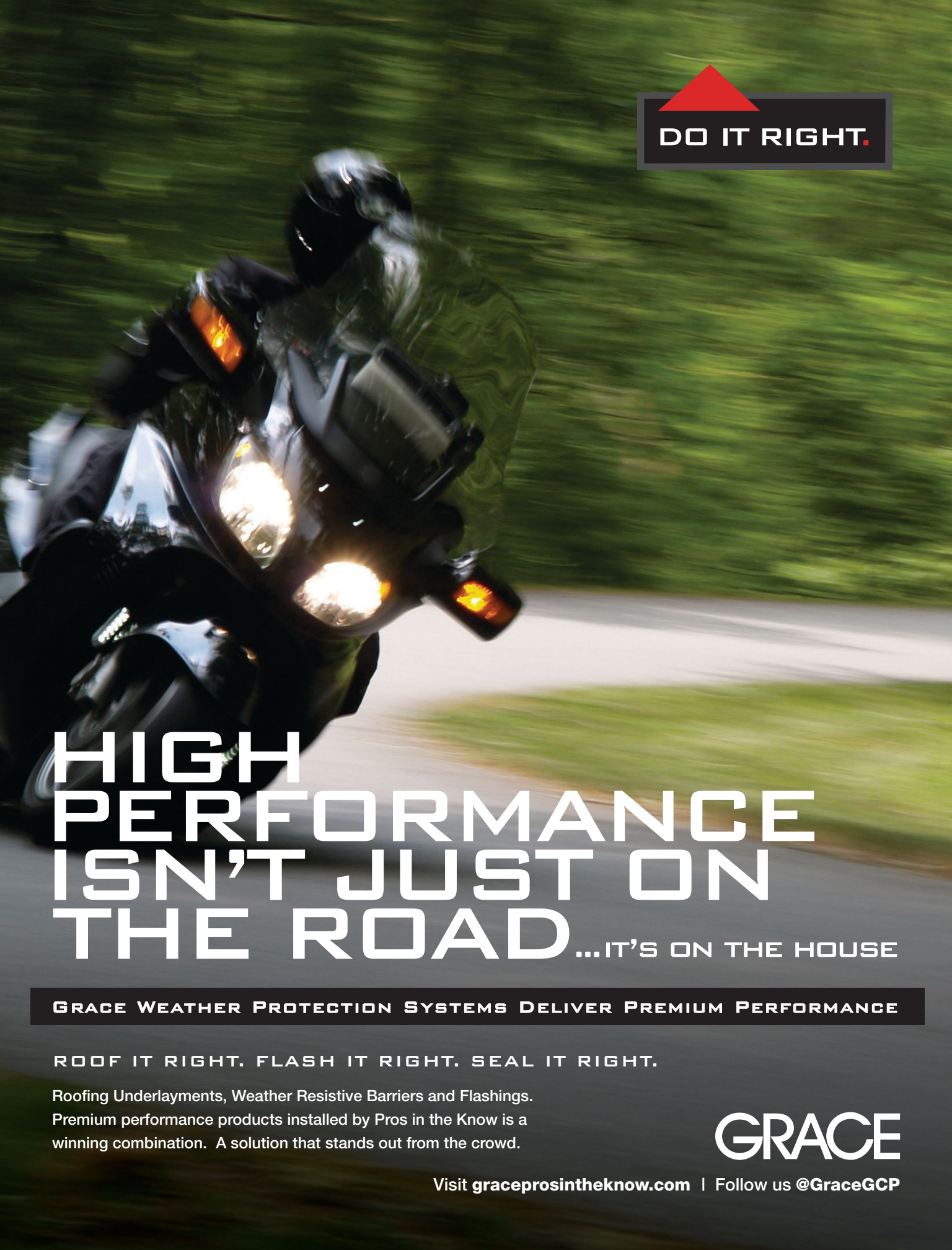
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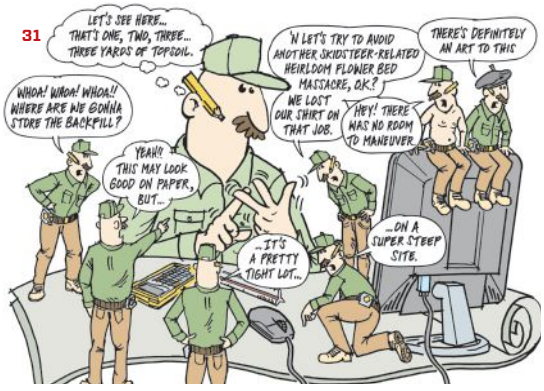

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"RETHINKING WINDOW FLASHING," BY HARRISON MCCAMPBELL (NOV/15)

Duane Oglesby (online, 10/28/15): The method used by the author is close to the AAMA 2400-02 standard. In coastal climates where there is a lot of wind-driven rain, we use "Method B" with a beveled sill. We also use custom stainless steel sill pans for our windows, and threshold pans on our doors. We strengthen our corners with FortiFiber's corner shield, too. This is pretty much common sense, but I see all the time that contractors or installers just never get the proper training.

We stay away from certain housewraps, too, that just don't work in coastal climates. Some plastic housewraps get destroyed by the tannic acid that leaches from wet cedar or redwood shingles and siding. We use BlueSkin and FortiFlash for most of our projects.

You need to pay attention to certain caulks, too, because they may be incompatible with the housewrap or flashing and may melt the membrane. This is why we always use the manufacturer's recommended brands.

It all comes down to one thing: Do it right the first time using either a known standard or the manufacturer's recommendation. Usually the standard will be better than the manufacturer's recommendation, as the author stated in his article.

Editor's note: For more on AAMA "Method A" and "Method B" window flashing, see Gene Summy's article, "Installing Residential Flanged Windows: Two Strategies Compared," on page 37.

"INSTALLING HIGH-PERFORMANCE WINDOWS," BY STEVE BACZEK (OCT/15)

Matt Capitolo (online, 11/5/15): While I enjoyed reading this well-documented article, and appreciated the great lengths to which the designer went to create a weathertight seal, I was a bit concerned with how he designed the sill. The sill flashing details on this project consisted of a single membrane under the window that did not appear to turn or bend up 90 degrees. This means that moisture that might make its way in under the window would have an unobstructed path to the inside.

It's also important to ensure that there is a clear path to allow any moisture that this sill might catch to escape. While the designer did include a sloped sill underneath the membrane, which should help, the real problem I had with this installation was a second membrane that appeared to act as a seal between the face frame of the window and the sill flashing membrane. This seemed less than desirable because it means that once the adhesive on the membrane fails, it might actually start to catch water and redirect it toward the exposed interior side of the sill.

While this design may hold up for a long time, it seems like it would have been much more sound to simply install a dam on the inside of the window pocket, flash the pocket from the top of the dam to the outside of the sill with a membrane, and then set the window in the sill on the outside of the dam. This would make the second flashing tape obsolete from a waterproofing standpoint. If one wanted to air-seal it, one could do so and it wouldn't undermine the sill.

Steve Baczek responds: First, let me say thank you for your in-depth interest and your very good analysis of the window-installation article. While in some instances, I may choose to align with your thoughts, in this specific case, I stand by our decisions. Let me explain how we got where we did.

When you're installing windows, the first fork in the road is to establish your approach to the window install—a water-managed system (as you suggest) *or* a face-sealed system. If the decision is to develop a water-managed system, then your outline of a window install makes perfect sense, and I would align with your thoughts. However, because the house these windows were being installed in is a Passive House (with an airtightness target of .60 ACH 50Pa), we developed a "face-sealed system"—a barrier system designed to combat both water infiltration *and* air infiltration, aiming for zero-tolerance for failure on both fronts.

The components that specifically keep water at bay include the continuous cleat, which the windows bear on, the sloping front edge of the opening, and the tape closure around the exterior perimeter.

If we installed the window in a "pan" as you suggest, we couldn't have any holes to drain the water out. Keep in mind the .60 airtightness spec doesn't allow for much air leakage. If water did get in, I am not sure I want it puddling under my finished sill.

Instead of using the interior dam you suggest, we chose to install the window on a cleat that was a bit higher than the sloping exterior sill. This provides the "dam" action you speak of; it just does it under the window. The flashing and tape we used on the project is the very best available today. Once installed, and installed

properly, it does not release. While I can't provide you evidence of a 200-year-old successful tape, I am willing to bet on these.

Based on my experience working on window installations with some of the nation's top manufacturers and their engineering staffs, I know that when a window fails, it is most likely a head-flashing issue. On rare occasions, it is a sill failure, but usually at a sill with no pan and no slope (or a negative slope). Understanding that the head is a critical issue becomes a key design point for me; the most important goal is to ensure the window head does not see any water. On this particular home, the windows are placed in a 14-inch-thick double-wall assembly. This allowed me to slide the window in 6 inches to protect the window head—a luxury afforded by a superinsulated home.

Also, because these windows are installed in a wall system with very little energy to dry the system out, keeping water out becomes an even greater imperative. I typically water-test all the window installations prior to insulation. This allows us to find any inadequacies and make the necessary corrections.

"COMMON SIDING FAILURES," BY MARK PARLEE (OCT/15)

rcgrimsh (online, 10/25/15): I frequently look at siding problems, but am not always sure who manufactured the siding I'm looking at. Do you have any suggestions for distinguishing between the different brands of fiber-cement siding?

Mark Parlee responds: Thanks for reading the article and the comments. Sometimes, the siding is identified on the back side. We generally know who the builder was on the job, so a phone call can go a long way toward making a positive identification on the products used on the home.

The installation details are similar for all fiber-cement siding, regardless of brand. The big ones are: Do not overdrive the fasteners, and provide clearance at rooflines and at grade (although the clearance distance can differ slightly by brand). Generally failures of the products are due to installation details that are *not* being followed, rather than to actual material differences.

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Q On a jobsite the other day, an old-timer was using a curved-claw hammer. Does that style of hammer have advantages over the ubiquitous straight-claw hammer?

A Carl Hagstrom, editor of WoodWeb.com, in Montrose, Pa., responds: Though once a staple in every carpenter's toolbox, hammers have, for the most part, become old school, with the wide variety of air nailers that are available now. Given that today's finish nailers can set nails with no danger of leaving "paw prints," I'm not sure anyone even needs a finish hammer. Regardless, here's the perspective from this old-timer—I've been swinging a straight-claw hammer since 1972.

Curved-claw hammers do have some advantages over straight-claw hammers. For one, curved-claw finish hammers weigh less than straight-claw framing hammers: typically 16 ounces as opposed to 20 ounces or more. Also, a curved claw lets you pull a nail with minimum damage to the board—a plus for finish carpentry (see photo, below). Finally, curved-claw hammers don't have the "accidental scar" potential that a straight claw has. Think about backing into a cabinet with your tool belt on: Would you rather have a curved surface or the end of a straight claw touch the cab?

But with the titanium-headed hammers weighing in at a mere 16 ounces, weight isn't as big a deal anymore. And a straight-claw hammer is still a must for framing and demo work—it has more leverage and more punch for sinking large nails quickly than a finish hammer does. Also, if you keep its claws relatively sharp, it can serve purposes beyond nail pulling. You can hack away material, "spear" the end of a joist to lift it, and as the job lore goes, save yourself from taking a ride off a roof by burying the claw in the sheathing on the way down.

Thankfully, I've never enjoyed the opportunity to test that last attribute, but on many occasions, I have hooked the claw over the edge of the most recent course of roof sheathing to pull myself up for setting the next course. Then there's the hammer toss—try that with a curved claw! And most importantly, it's much easier to open a bottle of beer with a straight claw then a curved one.

Bottom line, curved claws should be considered just for finished interior work, and straight-claw hammers for the rest. If you have to pick just one, though, the straight claw wins every time.

Q In a recent *JLC Update* newsletter, an author provided a "rule of thumb" for sizing joists. Is there a similar rule for sizing headers?

A Darren Tracy, P.E., owner of West Branch Engineering, in Saratoga Springs, N.Y., responds: Before becoming a licensed professional engineer, I was a contractor. When I had just started my business, I did any kind of job I could find in order to make a living, often working on small remodeling jobs or additions.

Back then, I used a rule of thumb for sizing headers that either someone had told me about or I'd read about somewhere. It went like this: Measure the span in feet and add 2 to that number. The sum will be the height of your double header in inches. For example, if the

span is 4 feet, add 2 to 4 for a sum of 6. Therefore, the header would need to be made from doubled 2x6s. For odd numbers, round up.

This rule of thumb seemed to be consistent with what I had observed as a contractor as being typical of header details in the industry—and the rule had a certain jobsite eloquence to it. But from a professional engineer's perspective, the problem is that the rule is not comprehensive; it may work for a single-story home with an average snow load, but it doesn't work for every situation.

So the short answer is, there is no comprehensive "rule of thumb" that is useful (and safe) for designing headers.

Consider how a header functions. Simply put, a header (in this case) is a horizontal member that spans a wall opening such as a door or window to transfer loads from above down and around that opening. There are too many "load" variables to consider in one simple formula or rule. Snow loads can vary tremendously, as can roof, ceiling, and floor loads and the various combinations and permutations of those loads—all of which can vary depending on the width of the building.

Additionally, advanced framing techniques that maximize energy efficiency are becoming commonplace. Many of these framing strategies call for single-member headers, and plans that incorporate these headers should always be reviewed by a professional engineer.

You could probably devise rules of thumb for designing headers for the particular range of scenarios you are likely to encounter, but that seems like a lot of work and a lot to remember. An easier solution would be to look up the prescriptive spans from Table R502.5 in the IRC, which can be found free online at codes.iccsafe.org.

Or you can use software, some of which is free (Forte by Trus Joist , for example, lets you design using its engineered products, but with the option of using dimensional lumber as well). This software isn't difficult to use, once you get past the learning curve, if you have some technical background.

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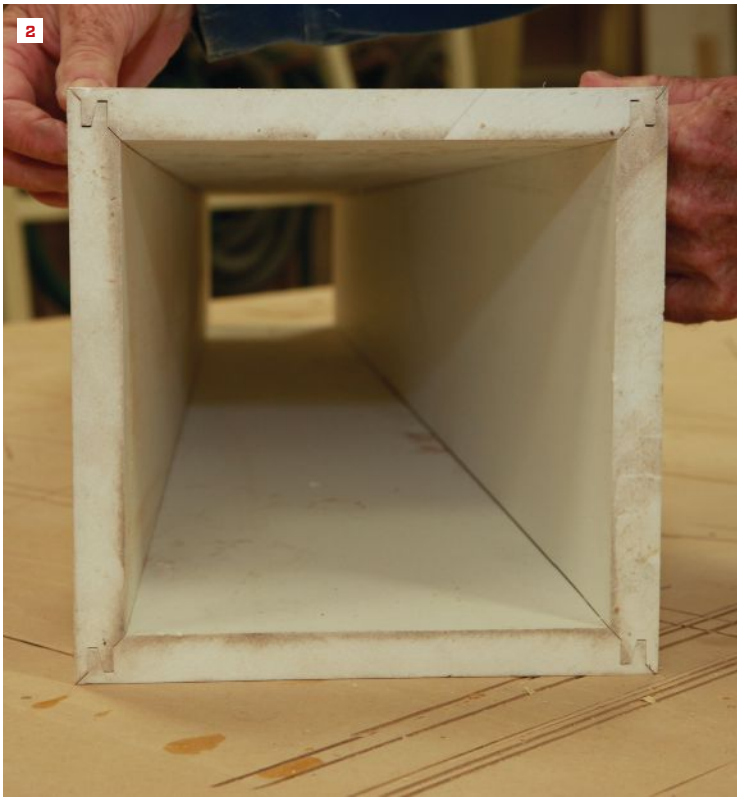


Tapered Columns With Lock Miters

Most of the really cool carpentry tricks that I know how to do I've learned from other carpenters, like my brother and the guys at Roadshows and JLC Live events, and I've learned a bunch from Jed Dixon. One thing Jed taught me is how to cut lock-miter joints. He uses lock miters on all of his newel posts and columns—whether they're installed indoors or out and whether they're tapered or not. He believes the lock-miter joint is simply the strongest corner joint possible.

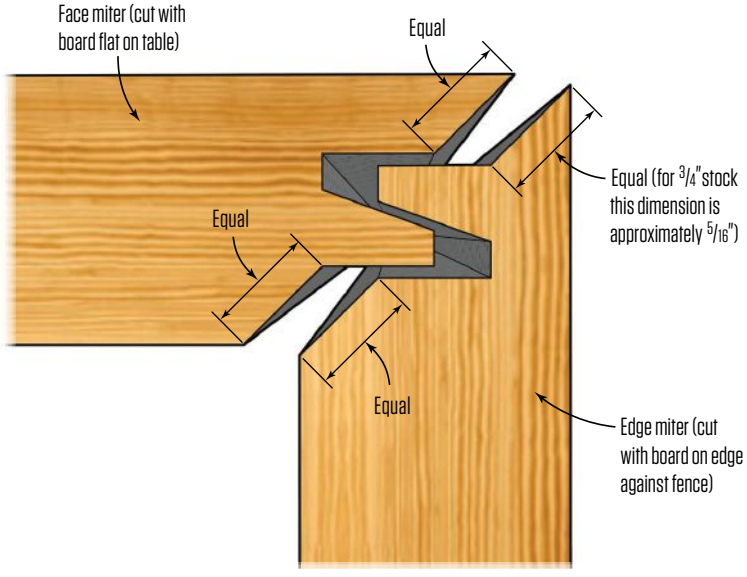
Lock miters can be cut quickly—they can cut assembly time in half—and all the pieces are easy to keep track of, so it's tough to make a mistake. Jed cuts his lock miters with a shaper, using a power feeder so all the pieces are cut precisely the same way **(1)**. All four sides of every column are cut the same width—there's no wide side or narrow side, as with butt joints or rabbet joints, to confuse you. Cutting different widths can really complicate matters when you're making tapered columns.

LOCK-MITER JOINTS ON TAPERED COLUMNS?

I've had folks at my demonstrations argue that lock-miter joints cannot be used on a tapered column. One attendee wouldn't believe me even after I cut and assembled the joints right in front of him. OK, the joint isn't perfect—the outside edge stays slightly open—but it's close **(2)**. For a column with a taper angle of 2 to 3 degrees, the angle on a lock-miter bit works just fine. But be aware that if the taper angle of a column is much more than 7 degrees, the mating surfaces of the lock miter misalign to the point that the joints don't come together. Here's why: Once a column starts to taper, its sides no longer meet at a 90-degree angle. And the greater the taper angle, the further away from 90 degrees

Photos by Gary Katz

Lock-Miter Intersection



the corner gets. Roof cutters call this the "dihedral" angle.

Most tapered columns angle at just a few degrees, so lock miters are absolutely the best joint for the job because the angle across the joint is so close to 90 degrees. With a 2-degree pitch, that angle is 90.07 degrees (for readers who only trust math). That's pretty darn close to a perfect 90-degree corner.

LOCK-MITER SETUP

The biggest drawback to lock miters is the time it takes—especially the first time around—to set up your router or shaper. The bit and the fence must be set up precisely. However, there are a few things you can do to work more efficiently. First cut a bunch of set-up blocks and save them. You'll probably need between six and eight pieces of 1x6 about 8 inches long. These blocks are for making test cuts as you slowly adjust the height of the bit and the location of the fence. Once you've set up the bit and the fence perfectly, label the final test blocks and keep them in a safe place. In the future, using those test blocks to dial in the settings will be a lot easier than starting from scratch.

A lock miter is a good example of something that looks complicated but is pretty simple once you understand how it works. One thing that makes it simple is that the same setup is used for cutting all the corner joints, but you cut two of the boards lying flat on the router table (face miters), and you cut the other two boards standing on edge against the fence (edge miters). Once the bit height and the fence location are set, you don't need to touch the router table except to push material through.

Let's start by setting the height of the router bit for cutting the face miters. In the simplest terms, the lock-miter profile consists of two short miters with a tongue-and-groove section in between. For the joint to fit perfectly, the cutter must be centered vertically in the workpiece and the two miters must be exactly the same length (see Lock-Miter Intersection, left). If you're starting from scratch—that is, without a precut test block—you can lay out the length of the miters with a sharp pencil or pen and get pretty close on the first few tries **(3)**. I like to make a few quick adjustments to get the setup close, and then micro-adjust the final height with a router lift. A sensitive lift mechanism on your router makes this part much easier to do.

The next step is positioning the fence. This time, the miters of the bit profile have to be perfectly centered on the workpiece when it's run through on edge (vertically). Again, I get it close and then dial the fence to the precise location using test blocks. At this point, the machine should be ready for both the edge cuts and the face cuts.

SAFE CUTTING

When making cuts like these on a router table, I always use hold-down clamps and feather boards to apply consistent pressure against the fence and the table. For cutting the face miters—when the board is lying flat on the table as it's cut—the hold-down device on my CMS stand works perfectly **(4)**. The CMS hold-down applies plenty of pressure to secure the material, and it's also easy to flip up out of the way if you have to make minor adjustments. But I still use push blocks to move the work while holding it tight against the fence.

Illustration: Todd Murdock

When you cut the edge miters, the board must be standing on edge against the fence, so that the miters are cut into the bottom edge of the board. The CMS hold-down device won't work in this situation, so I use a custom feather board. I first make a mounting board from ¾-inch plywood for my CMS router table, and secure the board to the router table with a couple of Fast Clamps. A dado in the mounting board allows me to adjust the feather board **(5)**. I've even used two feather boards in the same mounting board. Trust me, when you're cutting lock-miter joints, you don't want anything to move once you start up the router.

When I run a board on edge through the router, I hold on to the top of the board. Moving my hands as they get near the bit, I apply consistent pressure down toward the table top, while the feather boards apply pressure against the fence. Although I didn't use work gloves in these photos, I recommend wearing a thin pair, such as FastCap Skins, to protect your hands from getting cut up by the sharp miters.

Cutting lock miters generates a lot of saw dust, so good dust collection is very important, both to keep the cutter sharp and to let you run boards through the machine more quickly without dust being trapped between the fence or table and the boards. The CMS router table has a great dust extraction port, but it doesn't work once you lift the hold-down to cut edge miters. So I made a small baffle out of ¾-inch stock that lets the port work even when the hold-down is lifted out of the way **(6)**.

ASSEMBLY

Over the years, I've tried just about every technique for joining the corners of newel posts. And lock miters are not only the strongest, but they are the easiest to assemble as well. (Dominos, Festool's version of a mortise and tenon, also work extremely well).

I start by laying one of the face boards on my workbench, and then I run a bead of glue in the lock miter. It isn't necessary to apply glue to both boards. Glue applied to one side spreads easily onto the mating piece, and I get less squeeze-out with glue on just one side. (With PVC, it's especially important to glue only one side for the strongest and longest-lasting glue joint.)

Next I set the two edge-mitered boards into the face board, letting their miters interlock. Then I run beads of glue in the lock miters of the last face board, flip the board over, and drop it onto the edge boards **(7)**.

Lock-miter joints seem to close up nicely no matter what direction you clamp from, but for the best results, I apply clamping pressure to the face boards—the boards that are milled flat in the shaper or router table—rather than to the edge boards. However, I've found that the joints close even if I clamp on the edge boards instead. Most often, I secure the edges with 23-gauge or 21-gauge pins **(8)**.

Gary Katz is a frequent contributor to JLC *and a presenter at JLC Live. He produces the Katz Roadshow and publishes THISisCarpentry.com.*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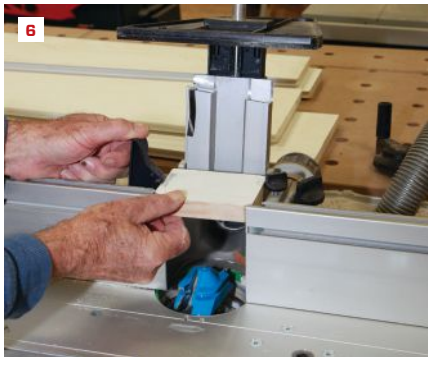
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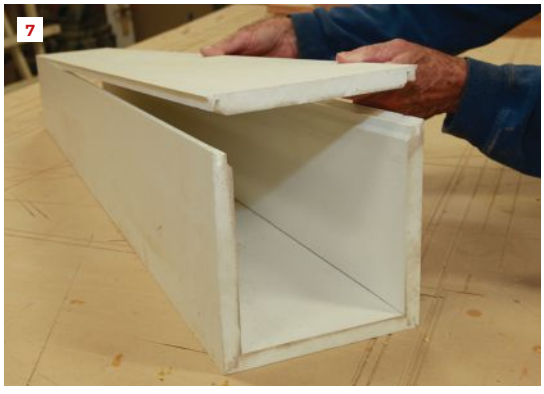
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New Columns for an Old Porch

BY EMANUEL SILVA

Living in the Boston area, I work on many houses with traditional exterior wood millwork, which at the time these homes were built was typically milled from eastern white pine. The pine looks great, but I'm often asked to repair or replace damaged trim with a material that won't rot and that requires less maintenance. That was the case recently for a pair of porch columns on a 1930s home. With plans to sell their house within a few years, the homeowners had hired me previously to repair or replace a number of other exterior details, and the front porch was the next item on their to-do list **(1)**.

WOOD AND MASONRY DON'T MIX

The existing turned columns seemed to be in good shape—until I took a closer look. The bottoms of the columns were crushed, and the wood bases that supported the columns were rotted beyond repair. Also, the porch was missing bricks, and some of the remaining ones were damaged. The first step was to temporarily support the porch roof and remove the columns. Then I called a mason to repair the brickwork.

After removing the columns, I discovered water damage in the porch structure above them as well. The crown molding used to finish the fascia on the eaves had doubled as a gutter. Though the top of the molding was capped with metal flashing where it wrapped around the porch, it looked like water had still managed to collect and leak into the short box beams that sat on top of the columns and supported the porch roof framing.

To fix the problem, I first removed the old beams—which had been framed like short knee walls and clad with board sheathing. I framed the new "knee wall" beams with PT lumber and clad them with PVC trim.

Photos by Emanuel Silva

Next, I assembled U-shaped PVC soffit-fascia assemblies and slipped them into place **(2)**.

STRUCTURAL COMPOSITE COLUMNS

The pair of 8-foot-tall PermaCast columns (hbgcolumns.com) that I used on this project are stocked by my local lumberyard. These are load-bearing columns cast from a proprietary composite material similar to fiberglass. To match the existing columns, I bought 10-inch-diameter Tuscan columns, which taper slightly to a diameter of 9 ¼ inches at the top (non-tapered columns are also available). Matching PermaCast bases and capitals, the flashing caps, and the installation kit brought my total cost to about $175 per column.

While the new columns are well-made and closely match the existing ones, they have one small flaw: an ornamental ring that seems too close to the top of the column. My solution was to lower the position of the ring by adding a PVC extension to the top of the column. This patch would then be covered by the capital.

I started by gluing together 1-foot-square sections of ¾-inch-thick PVC trim to make 1 ½-inch-thick stock. Then I used a jigsaw to cut out a pair of round plugs that matched the inside diameter of the top of the columns, and I screwed the plugs to the columns **(3)**.

Next, I cut a pair of slightly larger plugs to match the outside diameter of the columns and act as column extensions. Because these extensions needed to fit into the flashing cap (which prevents water and debris from getting into the column), I routed out a channel and center hole to match the flashing cap profile **(4)**. Then I screwed the extensions to the plugs with stainless steel screws.

INSTALLING THE POSTS

After shimming the porch roof assembly level, I located the column centers and used a Tajima plumb bob to transfer the centers down to the brick porch. Because the floor was fairly level, I measured the distances between the porch and the eaves at each column location and marked the lengths on the columns.

To mark cut lines that were parallel to the base of the columns, I wrapped a length of 4-inch-wide aluminum coil stock around the


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column as a guide. The company says that PermaCast columns can be cut with a carbide blade in a circular saw, but that seems to leave a pretty rough edge. Instead, I make the cuts with a 4½-inch angle grinder equipped with a diamond masonry blade, which results in a smoother and more controllable cut **(5)**.

The installation kits for the columns included a pair of galvanized metal installation clips, along with screws to connect the clips to the columns. But I was concerned about the screws eventually corroding or working loose, so I used stainless steel bolts and nuts. That allowed me to bolt rather than screw the clips to the bases of the columns **(6)**.

Before I fit the columns in place, I jacked up the porch roof assembly slightly so that they would slide easily into position. After screwing the flashing caps to the underside of the beams **(7)**, I slipped the columns into place, and removed the shims and temporary supports so that the roof was fully supported by the columns. In this installation, I wasn't concerned with wind uplift, so I didn't reinforce the connection to the roof framing with additional clips or long structural screws.

When I was satisfied that the columns were plumb, I drilled pilot holes into the brickwork, then fastened the brackets to the porch with 5/16-inch-diameter by 2⅜-inch-long Tapcon masonry screws **(8)**.

FINISHING UP

To block moisture and insects, I filled the gaps between the column bases and the uneven masonry with a generous bead of OSI Quad Max, an extremely flexible window and door sealant. Then I applied a glop of sealant at each corner and set the column bases in place, tweaking them slightly until they looked square and level. I glued the capitals to the flashing caps with the same sealant, using masking tape to hold the capitals in place until the sealant cured **(9)**.

The columns were pre-primed, so once they were installed, the only thing left to do was to apply a couple of coats of acrylic latex paint on the new millwork.

Emanuel Silva owns Silva Lightning Builders, a remodeling company in North Andover, Mass. This article originally appeared in Professional Deck Builder.

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BY MELANIE HODGDON

Are You Part of Your Own Problem?

Contractors who approach me typically feel that their businesses are doing one or more of the following: making inadequate profit, running inefficiently, or relying too much on the owner (that is, my clients would like to take off several of the innumerable hats they've been wearing). Regardless of how these contractors perceive their problems, the solution always depends on how committed each business owner is to improvement. My clients generally fall into one of two categories: those who accept their role in creating the current problems and those who simply want things to be better without having to actually do anything differently.

YOU MIGHT BE PART OF THE PROBLEM

Those who recognize that it is their responsibility to lead the process are (with varying degrees of eagerness) willing to examine how their knowledge, personality, and inclinations have created current problems. If they are willing to admit to that, they're usually committed to changing the manner in which they interact with the business.

How is a contractor part of the problem? Often it is some variation on a controlling personality. The owner who insists on making every decision, large or small, inevitably creates a bottleneck that bogs down processes, both at the jobsite and in the office. Until, and unless, that owner can commit to creating systems, assigning authority to others, and learning to monitor instead of control, there can be no real improvement to a business's bottom line.

BLAMING SOMETHING OR SOMEONE ELSE

Those who are too impatient or resistant to acknowledge they may be part of the problem often attempt to buy a solution. Typically, this approach takes one or both of the following forms:

Buy bigger software. The problem with this is that if you don't have clear objectives and haven't identified precisely what you want, buying bigger software may only put you in deeper trouble more quickly. Think about an unskilled do-it-yourselfer. Can he get into trouble faster with a hand saw or with a Sawzall?

Buy better employees. Because I work closely with office staff, I'm going to focus on them rather than on production workers. Often I hear complaints about "incompetent" office personnel. Typically, this personnel is the bookkeeper, who never provides the "right" financial or job-cost reports, or it is a person in any role who can't seem to keep data current.

WHAT LIES BENEATH

When I dig deeper, the facts almost always reveal some or all of these situations:

- Production workers aren't required to keep (and turn in) time-sheet information regularly.
- Multiple employees have credit-card authority but aren't required to report purchases as they're made.
- Workers are allowed to order materials from multiple suppliers, charge to the company account, and not report the purchase to the office.
- The owner makes frequent cash transfers without informing the office.
- Customer payment checks are deposited right into the bank without being run through the office.
- Coding of bills is left to the bookkeeper (who generally doesn't know a lintel from a lentil).
- Purchase slips and time sheets don't identify the job to which they belong.
- "Deals" (such as bartering) are made without advising the office.
- Estimates, if provided to the office at all, simply contain a sale price and do not include costs by category.

Owners of companies in which these practices are permitted believe that if they simply buy a CFO (at $95,000) instead of a bookkeeper (at $55,000), the sought-after reports will magically appear. But as the saying goes, you can't get blood from a turnip. You certainly can't get complete or useful reports when the data upon which they rely is missing, incomplete, or delayed.

If you think your company could stand improvement, look close to home first. Are your actions and attitude contributing to the problem? This is not to say that some employees don't deserve to get sacked, or that your business wouldn't be well served by a new, skilled hire if it can be justified. But before you look to such solutions, first ask whether your "underperforming" employees are getting what they need to do their jobs.

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

BY GLENN MATHEWSON

Replacement Windows and the Code

The IRC and the window replacement industry have not been friendly to each other or to building officials, contractors, and homeowners for quite a long time. Besides the codes that govern installation practices, the reason for this animosity has to do with the four major aspects of code compliance that deal with windows: energy conservation, safety glazing, fall protection, and emergency escape/rescue.

For the first two aspects, the requirements for replacement windows in existing framing are the same as those for new windows in new framing. That is, energy codes limit the U-factor and solar-heat-gain coefficient, and if the window is located in one of seven locations deemed "hazardous" by the IRC, then it must be safety glazed, typically using either tempered glass or security film. These both impact the consumer mainly in the cost of the window itself.

Code compliance surrounding the latter two aspects—fall protection and emergency egress—involves the openings in the wall, however, and not just the windows. The code is vague as to how best to apply new provisions in existing homes built under less-stringent code regulations. Lacking clear guidance from the IRC, many jurisdictions are reluctant to take into consideration much beyond these two safety issues. As a result, many homeowners are stunned to discover that updating to more energy-efficient windows will require complete wall remodeling to meet egress requirements as well, something that their budgets might not allow for.

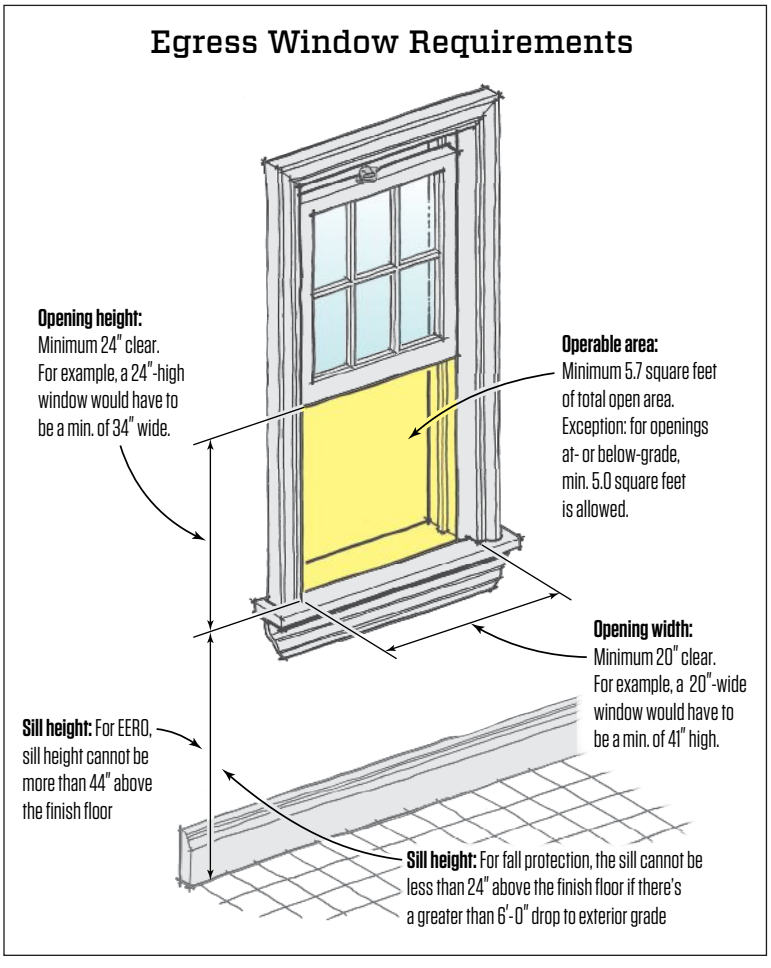


Illustration by Tim Healey

EMERGENCY ESCAPE AND RESCUE OPENINGS

Provisions for emergency escape and rescue openings (EERO) entered as a minimum code standard in the 1960s and have evolved since then. In the latest version (2015 IRC), EERO finished sill heights cannot be more than 44 inches above the finished floor. In addition, windows must open no less than 20 inches wide or 24 inches high, with no less than 5.7 square feet of total open area (although an exception is made for at-grade or below-grade openings: Total open area must be at least 5 square feet).

It's important to note that an opening cannot be *both* the minimum width and the minimum height—and still meet the minimum area requirement. For a replacement window in homes built prior to enactment of these minimum dimensions, many building officials will not allow installations that don't meet today's code for an EERO. The only way to install new windows is to completely remodel (enlarge or lower) the opening in the wall. This could mean structural work such as enlarging the header, drywall finish work on the inside, and modification of the exterior siding or perhaps brick—work that can cost more than the windows themselves.

For owners with limited budgets, this means being stuck with their old, inefficient windows. The

unfortunate irony (discussed at a recent code hearing) is that older windows may not be operable at all, because they're damaged or painted shut. In those cases, even a noncompliant new window would be safer than what's there.

FALL PROTECTION

Another provision affecting window sill height corrects a problem that arose with the 2009 IRC: That version of the code required that an operable window with a sill height of less than 24 inches above the floor be no greater than 6 feet above the grade outside the window. The purpose of this provision is to protect young children (under 5 years old) from severe injury if they fall through an open window with a low sill. When applied to replacing a low operable window in an older home, this requirement begged the question of what should be "grandfathered in."

Recognizing the problem, the 2015 IRC offers some relief. The only catch is that the provisions are located in Appendix J, titled "Existing Buildings and Structures," and must be adopted specifically into the governing ordinance. Though not yet in primary chapters of the IRC, Appendix J is still a major step in the right direction as a recalibration of the balance between ideal life safety and the reality of our varied existing-home stock.

ENTER "APPENDIX J"

Under the provisions of Appendix J, a replacement window functioning as an EERO does not have to comply with the maximum 44-inch sill height or the minimum-opening-size requirements, but with some strict caveats. First, this doesn't mean that a smaller window can be installed; rather, it means that if the existing windows are not low enough, the wall does not need to be modified to set the new window at a lower sill height.

Also this rule applies only if there is no change in occupancy of the space. If you remodel a dining room into a bedroom, you are changing the intended occupancy of the space, and a fully-compliant EERO window must be installed. If you build a bedroom in an unfinished basement, you are changing its use, and the new code applies. But if you remodel an existing bedroom, and it stays a bedroom, then the windows do not need to be enlarged.

WINDOW STYLE AND MATERIAL

Window material or style can also have an impact on what's allowed. Replacing an old aluminum-frame window with a vinyl window of the same size and style often results in a smaller opening because of the thicker vinyl frame and mullion. Many code authorities have addressed this issue by requiring a different style window to increase the opening size, such as a casement window in place of a slider. While this may satisfy the opening requirements of the building code, it is often at odds with planning commissions, zoning boards, or homeowner associations that require matching window types.

The 2015 Appendix J addresses this issue by allowing use of the chosen manufacturer's largest standard-size window (largest openable area) that fits an existing wall

It's important to note that an opening cannot be both the minimum width and the minimum height—and still meet the minimum area requirement.

opening. That window can be either the same style or a different style. No longer must remodelers stress over the size difference between an aluminum frame and a vinyl frame, or over having to install a casement window or slider in place of a double-hung.

EERO VS. FALL PROTECTION

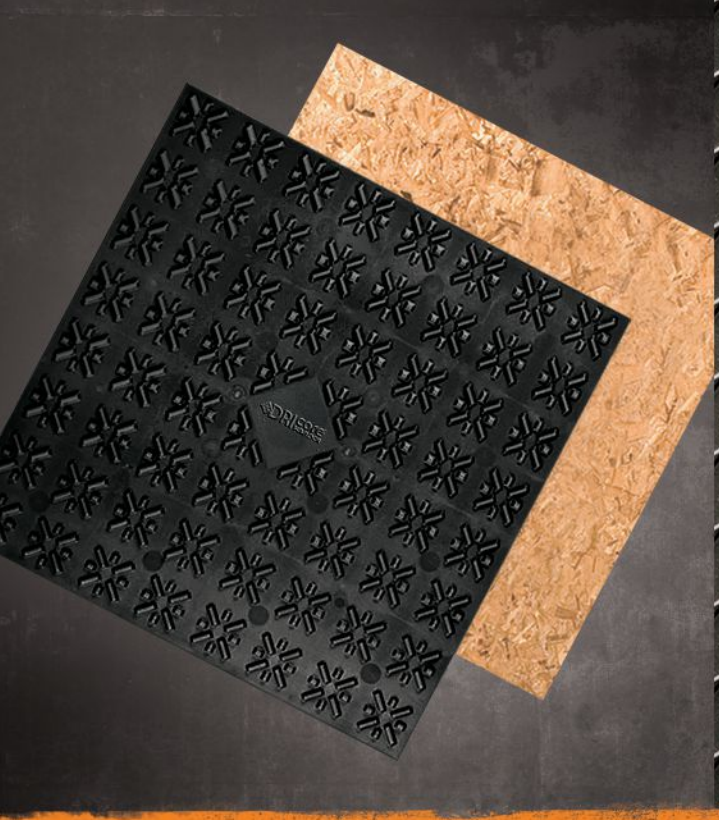
In contrast to the need to lower the sill height of a window opening for an EERO, sometimes the need is to raise it for fall protection. In an existing home, operable windows that have finished-sill heights less than 24 inches and have more than a 6-foot drop outside are now in violation of the code. This provision is intended to keep children 5 years old and younger from falling out an open window while they are standing on the floor.

In this case, Appendix J offers relief in the form of fall-prevention devices—such as screens or gates that meet ASTM test standard F 2090—placed in front of an opening. The provision also allows control devices that prevent windows from opening more than 4 inches. Approved devices can block the fall of a child under 5, yet can also be removed easily for egress by someone smarter than a 5 year old. They are the only code-compliant methods—that is, short of building a new deck outside the window to reduce the fall height to less than the 6-foot maximum allowed by the IRC for windows (replacement or new) with open sill heights below 24 inches.

These new provisions should have a positive effect on the window replacement industry and on owners in jurisdictions that adopt them.

I encourage window replacement contractors to prepare in two ways. First, take part in your local HBA or other industry association represented in local politics and legislation, calling for them to adopt Appendix J. Second, become familiar with fall-protection options and be prepared to educate and offer your customer these code-required devices for the windows that need them.

Glenn Mathewson is a certified code professional and a building inspector for the City of Westminster, Colo., and a frequent presenter at JLC Live.



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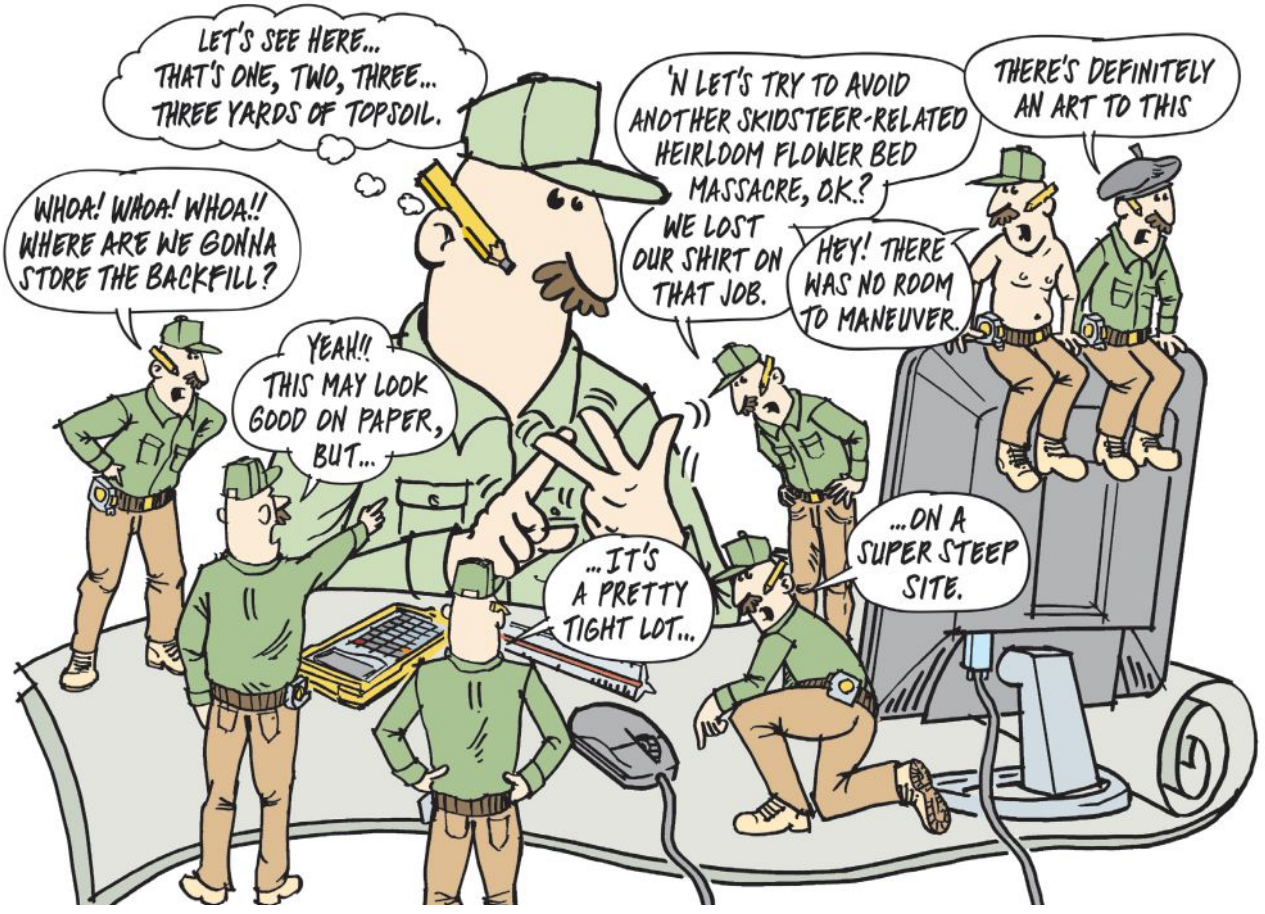


Illustrations by Tim Healey

The Artful Side of Estimating

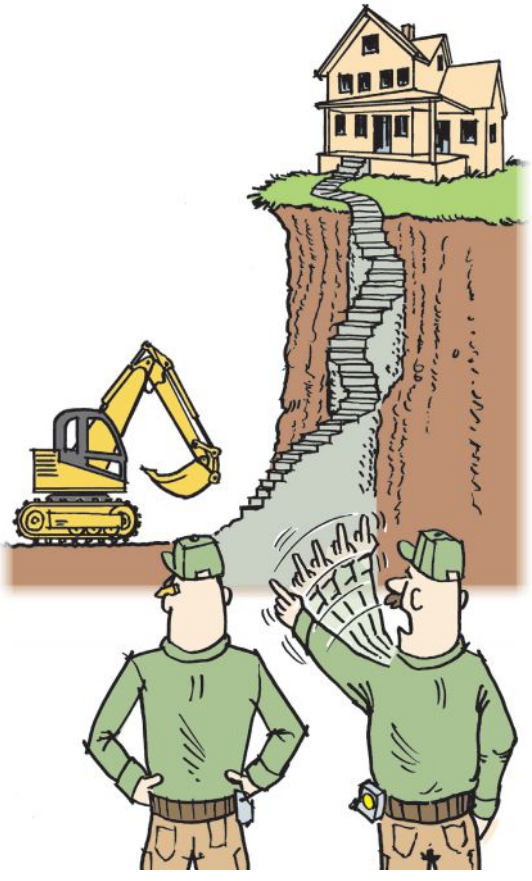
Staying profitable requires more than just counting sticks

BY BOB KOVACS

It's been said that estimating is more of an "art" than a "science," and I tend to agree. The "science" side of estimating is the quantity takeoff—counting the number of doors on the plan, measuring the linear footage of baseboard or the area of hardwood floor, or calculating the volume of concrete in the footings. The "art" side takes more thought and requires the person putting the estimate together to consider all the factors that will affect productivity, which will ultimately affect the cost of the work. I can quickly teach anyone how to do a quantity takeoff—I've even had my 12-year-old daughter help me with counting doors or light fixtures, and she has done a great job. The "art" part, though, takes more time to learn and usually comes only with experience. The goal of this article is to shorten the learning curve on the "art" side by highlighting some of the things you need to consider when you're putting a price together.

SITE ACCESS AND LOGISTICS

Let's say you have two clients, both of whom want you to build a 12-foot-by-40-foot addition on the back of an existing house, with an extension of the basement below the addition. The first house sits in the middle of a flat, 2-acre piece of property, with at least 50 feet of clear space on each side, 100 feet behind the house, and



easy access from the road up the driveway to the backyard. The other house is in a neighborhood of 100-year-old houses, with 10 feet between houses, 30 feet to the back property line, dense landscaping all over the property, and a road in front of the house that's barely wide enough for two cars to pass each other.

The additions that are planned for these two houses are exactly the same, but will the prices for the projects be the same? Well, it's likely that the volume of dirt you need to excavate for the basement can be calculated easily enough, and it's probably about the same amount for both additions. The amounts of concrete block, framing lumber, roofing, and other materials will be similar as well—but that's where the similarities will end.

For the first house, you've got plenty of room to get whatever equipment you need into the backyard for digging the basement, as well as to get dump trucks in to haul off soil. You've also got room to stockpile soil for backfilling the foundation; bring in trucks delivering lumber, drywall, roofing, and other materials; and set up your saws and other tools while you're on the job.

The second house does not allow for any of this, however, so the cost to build its addition will be higher. For instance, you're going to have to remove existing landscaping to gain access to the backyard, and you'll have to either include money in your bid to replace it, or exclude the replacement of landscaping in your bid. In the latter case, the homeowner will have to pay for that work separately. How you choose to handle that will depend on your clients and your business model: If your clients expect a turn-key project and don't want to deal with paying a landscaper to repair the yard, you'd be better off including the restoration cost in your pricing.

Since you may have only 5 feet between the house and the property line, you'll have to excavate the basement with a smaller machine, or get permission from the neighbor to cross the property line with your excavator and trucks. In that case, you can be pretty sure that you'll be paying to restore the landscaping on the neighbor's side of the property line, so you'd better include that cost in your bid.

Let's assume the neighbor won't allow you on his property. You're now stuck with that small excavator and no way to get trucks into the backyard to get the dirt out, so not only are you digging with a smaller machine that takes longer (and costs more), you've also got to take all the excavated dirt to trucks that are parked in the street, which adds even more time and cost and makes a mess at the street that will require daily cleanup. Wait, there's more. You'll also have limited room in the backyard for material to backfill the foundation with, so you'll be hauling that material away, and then paying to bring material back (and moving it to the backyard to backfill with).

All of this must be factored into the cost of the project (and the schedule will have to be adjusted, as well). And bear in mind these complications will carry through the entire rest of the project: You'll have to pump concrete from the street, hand-carry all of your material to the backyard from the street, and time deliveries precisely since there won't be much room to have material arrive early and be stored on the site.

ROOM DIMENSIONS AND SHAPE

While they may not have as dramatic an impact as the site-access issues discussed above, room dimensions and shape can affect the cost of a project as well. As an example, consider two rooms that have the same perimeter, but one is a simple rectangle with four inside corners and the other has several bump-outs and includes seven inside corners and three outside corners. If you're installing baseboard in the simple rectangular room, you have to cut and handle four pieces and fit four corners. If you're installing the same trim in the other room, you have to cut and handle 10 pieces and fit a total of 10 corners. The labor cost (time) of installing baseboard, crown, chair rail, or wainscot isn't affected much by the length of the pieces. The time is all in cutting the pieces and coping and fitting the corners, so the more complex room can easily take twice as long to trim as the simple rectangular room.

When putting an estimate together, you start, of course, by measuring the total linear footage to determine the material cost. But the more critical part of the overall cost will be the labor, which you need to determine based on the number of corners you're going to

Be careful with the term "match existing" in your proposal unless you're truly able to "match" the existing materials. Often it's more prudent to add a clarification in the proposal stating there may be differences in finishes.

have to fit. Depending on the size of the base or crown, the type of material, and how square and level the room is, each corner could take anywhere from 15 to 30 minutes (or more) to fit. When you have 10 corners, that can add quite a bit of time to your day and quite a bit of cost to the project.

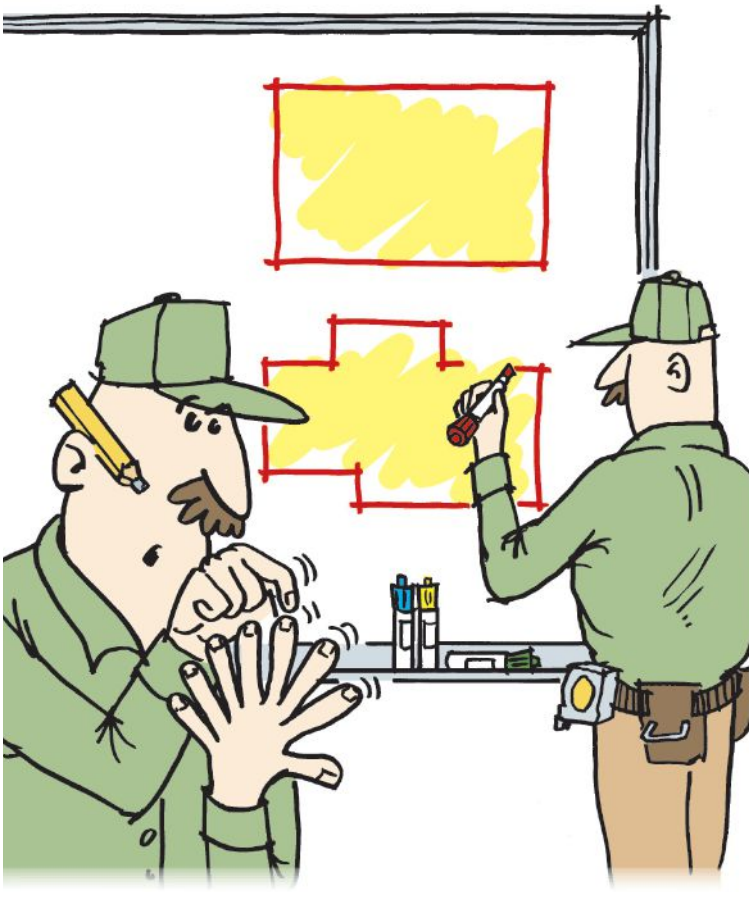
Here again, actual room dimensions play a role, and when paired with standard sizes of material, they can seriously mess with costs. For example, if the longest length of crown molding you can get is 16 feet, and you're putting crown in an 18-foot-by-18-foot room, you'll have four joints to deal with, since the walls are longer than the pieces of material you can get. If you just do a quick linear-foot takeoff around the room and don't consider this, you might charge enough for the material itself, but you won't have factored in enough time and labor cost to cut and fit scarf joints on all the walls.

The available length not only affects labor cost, but it can affect material costs, as well. For example, if you're trimming a small, 9-foot-by-9-foot bedroom, and you can get crown molding only in 12-foot lengths, you'll be cutting off 3 feet from each stick, basically "wasting" 25% of your material. This may not be a big deal when you're installing 3 $^{5}/_{8}$-inch primed MDF crown that costs less than $1 per foot (although $12 is still $12 and should be accounted for in your estimate), but it is when you're installing custom-milled 6-inch cherry crown that costs $8 per foot. Now, if you were installing crown throughout the house, you'd probably have some short walls somewhere that you could use the cutoffs on, but if it's a one-room job, you must consider this, as it can quickly eat into your profits.

LOCATION WITHIN THE HOUSE

You need to consider where in the home you're working, and also where you'll be setting up your work area. Working in a ranch house with your saw set up right outside the front door will be far easier than working on the third floor of an old Victorian home with narrow, winding staircases and having your tools and equipment down on the first floor. Not only will you have to factor in the time to travel up and down two flights of stairs for every cut, every forgotten tool, and every piece of material, but you'll also likely get tired from all the up and down as the day goes on, which will further reduce your productivity. While I've picked an extreme comparison, it's not outside of the realm of possibility when you deal with clients with widely divergent demands for where you can set up.

You'll also need to develop a plan for getting material to the work area. Finishing the attic of a house may require you to remove a window to have drywall boomed in. That removed window could also come in handy for other large items, like a one-piece tub enclosure, or heavy items, like large quantities of tile. You'll have to include money in your price to cover the removal and reinstallation of the window, as well as any special handling costs for boom trucks, cranes, or lifts, but in the end, this will probably cost less than carrying all of that stuff up through the house (if that would even be possible).



AGE AND CONDITION OF THE HOUSE

Working in older homes often takes more time and effort than working in newer homes, since over time walls and floors have settled, resulting in out-of-square corners and floors that are out of level. Making, or adjusting, new doors, cabinets, and trim to fit and work correctly in older homes can take considerable time, since you often need to trim and scribe new materials to work with the old materials you're tying into.

It's of paramount importance when visiting an older house for the initial estimate to bring a level and a square with you so you can determine how bad things are. Be sure to factor in adequate time for all the trimming, tweaking, and adjusting that will be required, and for any conditions that you think will be difficult or impossible to make "right." Hanging cabinets on a wall that's an inch out of plumb, for instance, will require a lot of shims and scribe molding, or you'll end up with doors that don't stay closed without catches. Be sure to bring these items to the client's attention in writing prior to starting the work, and be sure to have the client sign off on them.

Another thing to consider when working in older homes is your ability to match existing finishes. If the existing house is all plaster on wood lath, how will you be making repairs and patches in the areas you're working in? If you're planning to use drywall and joint compound, will you be able to match the texture of the existing walls and ceilings? If not, include a clarification in your proposal stating that there may be differences in the finish, so your customers understand what the finished product will look like.

The same applies to matching trim profiles, flooring materials, stain colors, and other existing finishes. If you're extending an existing wood floor into an addition, will you be able to match the flooring material? If you can match the material, will you be able to get away with just toothing in the wood and blending the stain and finish into the existing floor, or will you need to sand and refinish the entire first floor to get it all to match? If you're adding crown molding in the addition, will you be able to match the profile with off-the-shelf materials, or will you need to get a custom knife ground and have the new crown milled to match the existing?

Be very careful with using the term "match existing" in your proposal unless you're truly able to "match" the existing materials and have included the cost of doing so in your proposal.

OCCUPIED OR VACANT

Finally, you need to consider whether you'll be working in an occupied space or in a vacant space. If the majority of your work has been in new homes that have not been moved into yet, and you're now pricing a significant renovation in an occupied house, you'll be in for a rude awakening if you don't price the work accordingly. You need to include the cost of installing temporary walls for dust protection, fans to draw dust out while you're doing demolition work, and protection for the existing floors and walls in the areas you'll be walking through to access the area you're renovating. You may need to install a temporary toilet if you're renovating the only bathroom in the house, install a temporary kitchen sink for your clients to use while you renovate their kitchen, or provide temporary air conditioning while you replace an HVAC system. You also have to be much neater when working in an occupied home—you can't leave trash, boards with nails sticking out, or tools laying around at the end of the day, and time needs to be allotted to every day for cleanup.

BOTTOM LINE

While it would be impossible to cover everything you may encounter in the process of pricing a project, hopefully you have a better understanding of the big-picture items and a new appreciation for what goes into preparing an accurate estimate. The issues discussed here can make the difference between a successful project and one that ends up either robbing you of whatever profit you would have had at the end of the day, or (far worse) costing you money to complete.

Bob Kovacs, based in Canton, Ga., has more than 25 years of experience managing and estimating residential and commercial construction projects.

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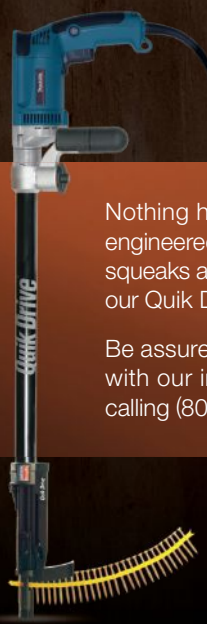

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Photos by Gene Summy

Installing Flanged Windows: Two Strategies Compared

Solving a mystery that pits the East Coast against the West

BY GENE SUMMY

I have been installing, inspecting, and field-testing windows and doors for more than 20 years. My job is to water-test and inspect windows and analyze the results, looking at the impacts of leaks and other performance issues. I do this to provide guidance for professional builders and attorneys, either to help them avoid litigation or to resolve disputes that have already found their way into court. The important thing to understand, though, is that I don't have a stake in how the flashing is applied, as long as it works to repel water away from the home.

After performing thousands of window tests in the field in California and across the U.S., I still am unable to solve one mystery: Why does the eastern half of the U.S. install windows using the American Architectural Manufacturers Association (AAMA) "A" methods, when the western states generally use the AAMA "B" methods?

AAMA "A" methods (A and A1) apply the side flashing on top of the side nailing flanges. The "B" methods install the side flashing on the rough opening *before* the window is set in place, resulting in side flashing under the nailing flanges. These may seem like very minor details, but they have important consequences. On a set of drawings, the differences may not be recognized. However, on a jobsite, where humans are involved, the "B" methods are more robust, reliable, and durable.


1
RAIN BUSTER 440 SUB ZERO
Flashing Tape


2
WINTeQ System
TeQ::Flash
TeQ::Seal
TeQ::Foam
TeQ::Flash


3


4
RAIN BUSTER 440 SUB ZERO
Flashing Tape


5
DuPont Flashing Systems


6

7

Here's why I prefer method "B." Sealant under the nailing flange is a critical detail for keeping water out. But with the "A" methods, this detail is covered up when the flange is flashed, and so is difficult to inspect **(1)**. The "B" methods allow for a more complete inspection by superintendents, who look for "squeeze-out" to verify that the sealant has been correctly applied **(2)**.

I have worked on countless projects where window-installation failures were caused by installers doing a poor job applying sealant under the nailing flanges. In a way, it's understandable why this happens so frequently: Installers want to work as fast as they can in order to finish as early as possible and to make as much money as possible, especially when they are hired for piecework.

Think about it: How much sealant can an installer carry around? Say the installer leaves the bin carrying 24 tubes. After he has installed about seven windows, he will start to run low on sealant. And when he's on scaffolding at the other side of the house from the bin, it's only natural that he will try to make his supply of sealant stretch as far as possible. He begins to use less sealant and rationalizes it by thinking, "The flashing goes on top, so I don't have to worry about it."

Next comes the peel-and-stick side flashing (often officially referred to as self-adhered flashing, or SAF), which creates additional problems. Window nailing flanges are not straight and flush; they are dimpled everywhere there's a fastener **(3)**. This means the flashing does not have an even, flat surface to stick to. Air gaps and wrinkles develop under the flashing **(4)**. If the weather is cold or wet, adhesion problems develop as well. These can lead to even worse problems if the flashing has not been shingled properly **(5)**.

After the SAF is applied to the sides and the head, the window needs to be water resistant. But many windows have prepunched nail holes in the nailing flanges, and often the flanges do not connect at the corners. When the flanges are vinyl, cracks are also common. When there are adhesion problems after the nailing flange has been covered with the peel-and-stick, there is a strong likelihood that water will migrate to the cracks and holes, and then enter the building. I've seen this frequently when performing water tests **(6)**.

SEALANT SOLUTION

Sealant is often denigrated as a temporary solution that will dry up and fall out. In the past, that might have been true. But the exterior-grade sealants used today will probably hold up just as long as any of the other exterior water-barrier materials. And the fact is, you can't leave sealant out of the assembly—it's required by every window manufacturer out there. This means sealant is part of the building code, and for good reason: Sealant is a necessary fluid material that fills in the imperfections and deviations created when the different materials in the window assembly join one another.

Once you own the fact that sealant is integral to the assembly, I contend that the real benefit of a B-method installation is that this method takes into account the less-than-perfect conditions that


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HomeWrap


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RAIN BUSTER 25 MIL
FLASHING
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RAIN BUSTER 25 MIL
Tyvek
HomeWrap


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DUPONT

exist on jobsites—dimpled, cracked, dirty, and wet nail fins and wall surfaces are a given on the jobsite, and the "B" methods go a long way toward accommodating them.

A typical sealant installation starts with a bead of sealant along the edges of the rough opening. This gets applied over the SAF in a continuous bead along the sides and top, but usually not along the bottom of the opening, so any trapped water can drain away. When you install the window, be sure all prepunched holes in the nail fin have sealant oozing through them when the fasteners are placed, as shown previously in photo 2.

Buttered sealant. You can "enhance" this method with a "buttered sealant" application. Before the squeeze-out from under the nailing flange has set up, apply an additional "cap bead" of sealant on top of the nailing flange, and butter it flat with a putty knife **(7)**. A 2-inch-wide swath of sealant will help ensure that any cracks and prepunched holes in the nailing flange are covered. Be sure to keep the cap smooth. If you've applied it correctly, it won't have dimples at fastener locations or excessive build-up at corners.

TRAINING IS CRITICAL

Builders need to adopt a method for installing windows and doors and own it. Taking ownership means everyone involved in the process understands every step. And by "everyone," I don't mean just field managers, but also the assistant field managers, the window installers, even suppliers. And this involves training.

Training should not be a one-time event. It needs to be on-going until it becomes routine. Our special forces in the military have the right idea: When they train for an operation, they immerse themselves in the procedures until they become natural. I subscribe to the old saying that "amateurs train until they get it right; professionals train until they can't get it wrong."

"B" METHOD STEP-BY-STEP

When I train people, the following are the procedures I keep everyone focused on. They assume you're using plastic housewrap, such as Tyvek, Typar, and the like; if black paper or a liquid-applied membrane is involved, the procedures will be different. For the SAF material, it's imperative to choose a flashing product that's compatible with the sealant product. I suggest using the same manufacturer for both the sealant and the flashing. Or use a butyl-based membrane, which is compatible with a wide range of sealants.

1. Correctly cut the housewrap at each window rough opening. This is an "I-cut," with straight cuts along the top and the bottom of the opening and a vertical cut down the center. It's more foolproof to turn the flaps into the opening **(8)**. In the real world, when installers are in a rush, it's too easy to overcut the housewrap when cutting the sides flush to the opening.

2. Cut a flap in the housewrap at the head as shown in photo 3 and temporarily hold it up with tape. But do not use a nail to hold the wrap up. This will only create an unnecessary penetration.

3. Install pan flashing **(9)** followed by the side flashing **(10)**, using 9-inch SAF as a minimum. Roll the material flat with a J-roller, being be careful not to create wrinkles. I don't often see installers actually use a J-roller, but this tool helps improve adhesion of SAF, even in cold and wet conditions.

Each end of the sill flashing should extend at least 9 inches (the width of the flashing material) beyond the opening so the side flashing can fully lap over it. If a second layer of the envelope, such as stucco, or brick or stone veneer, will be applied, install a bib or apron under the window pan flashing so this second layer can be tucked under it. This will ensure that water drains to the exterior.

4. Install the head flashing last, being sure each end extends past the side flashing **(11)**.

5. Apply a plump, $^{3}/_{8}$- to $^{1}/_{2}$-inch bead of sealant along the edges of the window opening, then install the window level, square, and plumb. Ensure that squeeze-out exists everywhere sealant is used. Sealant is typically not recommended along the bottom, though some do apply it there, leaving gaps at the corners so any water that gets in can drain out. Either strategy is fine if it is correctly implemented.

6. Butter the squeeze-out flat, being sure to cover prepunched holes and cracks in the nailing flange **(12)**. If severe damage to the window is discovered, now is the time to alert field managers so they can process a replacement.

7. Next, add the enhancement. I recommend the "buttered sealant" technique—an enhancement to Methods B and B1 that has been used on the West Coast for more than 10 years by large production builders with spectacular results. Since the time it was first implemented, warranty claims from leaking windows have fallen dramatically.

However, many builders cannot let go of applying SAF over the nail fin. If you insist on adding this, be sure to butter the squeeze-out flat before it hardens. You want as flat a surface as possible so there won't be any voids or any build-up that might interfere with cladding materials. Also, if you use a second-layer SAF, be sure to use a butyl-based flexible flashing product. After the additional side flashings are correctly applied on top of the nail fins and J-rolled flat, apply a final, small bead of sealant to the edge of the membrane against the window frame. Tool this into place to eliminate all wrinkles and gaps. You want to do this up each side and across the top of the window.

8. As a final step, drop the flap of housewrap down and tape it closed at the ends **(13)**. If the flap needs to be taped along the bottom edge, use short pieces with gaps between them so if any water gets behind there, it can drain out.

Notice I have not wasted time telling you how to clean the nailing flanges. If you want to, please do. But here I am prescribing a method that accounts for normal jobsite conditions. I believe the "B" methods provide the greatest level of redundancy, which is necessary to overcome real-world job conditions and human error. Chris Yount, of the Fortifiber Building Systems Group, sums it up best: "Successful waterproofing is a series of redundant steps to manage water away."

Gene Summy is a contractor and building inspector in Laguna Niguel, Calif. His company, TLS Laboratories, specializes in solving exterior problems.

Photo: Dennis Purinton

Advances in Cold-Weather Concrete Work

Rules are evolving as skill and technology improve

BY TED CUSHMAN

On a 9°F day in December 2014, Connecticut concrete contractor Dennis Purinton was pouring a slab on grade. It was the kind of work Purinton had done often enough before. But this time, he had a small audience of experts and supplier representatives from around the concrete industry—some of them, like Purinton himself, members of the consensus committee that creates ACI 306, the American Concrete Institute's *Guide to Cold Weather Concrete*.

Purinton's goal was to demonstrate for his audience—and, by extension, for the full ACI 306 committee—something that he already knew from decades of experience working in New England conditions: "Concrete performs very, very well in cold weather."

ACI 306 isn't a code, or even a standard. It's an advisory document that helps professionals in the concrete industry understand how to accomplish their goals when the outside temperature drops toward freezing. Committee insiders say the 2010 edition of the document, which incorporates advances in concrete technology and practice that have evolved since the previous update, in 1988, was a significant upgrade. Recommendations from the 1988 version remain in the book to provide grounding in the basics. But current practice continues to advance, and even the 2010 document doesn't incorporate all of the latest industry research. So the ACI 306 committee is working on yet another update. After a formal ACI review process, a new edition is likely to be released in 2016 or 2017.

Photos: 1,2, Concrete Foundations Association; 3, Dennis Purinton

COLD-WEATHER BASEMENT WALLS

Dennis Purinton's work with cold-weather slab placement follows in the footsteps of an earlier program carried out by the Concrete Foundations Association (CFA), a trade group with headquarters in Mount Vernon, Iowa (cfawalls.org). From 2001 to 2004, CFA contractors studied the practical limits of concrete basement-wall placement in winter. The association developed dozens of concrete mixes using different cements and admixtures, and tested the concrete's performance in cold conditions.

For each mix, CFA researchers developed what's called a "maturity curve"—a mathematical relationship between concrete temperature, time, and strength development—that allows a contractor to follow the strength gain of any concrete placement over time simply by observing its temperature as measured by a sensor placed into the concrete when it's poured. So rather than relying on code-mandated general rules of thumb, a contractor using the "maturity method" can gauge the strength gain of his material in real time. Contractors who understand the method, and know their concrete mixes well, may be able to place concrete in cold weather without costly measures such as tenting, heating, or even insulating. And by knowing the strength of the concrete from hour to hour, they can know to within the hour whether the concrete has reached the minimum strength required to allow the crew to strip forms, or even backfill the basement wall. This can save days on the construction schedule.

The CFA's findings helped to shape another ACI document, ACI 332 (*Residential Code Requirements for Structural Concrete and Commentary*). Unlike ACI 306, ACI 332 is written in code language, and can be referenced directly in construction contracts. On the strength of the CFA's research, ACI 332 contains language supporting the use of the maturity method during cold-weather placements as an alternative to following protection requirements that don't reflect real-time strength predictions.

But the data developed in CFA's research, and the lessons learned, don't automatically apply to the placement of flatwork—such as foundation slabs or sidewalks—because the conditions, obviously, are different. Unlike a basement wall, a slab doesn't have the protection of a wall form. When it's cold outside, a cold subbase can "suck" heat out of the fresh concrete, slowing the hardening process. And slabs have a large surface area that's exposed

to cold winter air, posing a major risk of damage due to early-age freezing. So research is ongoing to justify the application of maturity methods to exposed flatwork in cold weather conditions.

Dennis Purinton's Connecticut demonstration is a good start. But Purinton's work hasn't been published or replicated, and by itself, his data probably won't be enough to spur any further revisions of ACI 306. But other researchers are studying ways to improve cold-weather placement. And in the meantime, contractors in the field can already take advantage of the maturity method. In principle, said Purinton, "if you own a cellphone, and you own a laptop, you have the ability to do this—for a very minor amount of money."

UNDERSTANDING MATURITY

Concrete is a mixture of sand, gravel (stone), water, and cement (see "Concrete Basics," Jun/00). Some concrete mixes also include supplementary cementitious materials (such as fly ash and ground granular blast-furnace slag) and chemical admixtures. Concrete generates heat during hardening as a result of the chemical process by which cement reacts with water to form a hard,

Facing page: Concrete Foundations Association members strip forms from test walls in 2003 during experiments to verify the strength of concrete poured in sub-freezing temperatures **(1)**. The researchers took core samples from the walls **(2)** to correlate in-place strengths with the values predicted by maturity formulas. The results validated the approach used by contractors like Dennis Purinton, whose Connecticut crew is shown pouring a basement wall on a typical New England winter day **(3)**.

Above: Dennis Purinton organized a field demonstration of concrete placement under cold winter conditions in 2014 **(4)**. Instruments supplied by Con-Cure **(5, 6)** recorded the temperature of the concrete as it set and hardened despite the sub-freezing ambient temperatures and frozen sub-base.

Photos: John Gnaedinger/Con-Cure

stable paste. The heat generated is called "heat of hydration."

A key objective for cold-weather concreting is preventing damage to the concrete from early-age freezing. Concrete protected from freezing until it attains a compressive strength of at least 500 psi will not be damaged by exposure to a single freezing cycle. But if freezing occurs before 500 psi is reached, the final strength of the concrete could be cut in half.

Cement hydration. Science doesn't have a complete explanation for the chemical process of hydration, or a complete description of concrete's final structure. But experts do have a good working model. Cement hydration happens in stages, proceeding from "stiffening" (loss of workability) to "setting" (solidification), and on to "hardening" (strength gain). Throughout the process, water gets used up—broken into hydrogen and oxygen, which get locked into the developing compounds that form solid concrete.

But during the early stiffening and setting stages, the solidifying material is fragile, and lots of free water remains. If ice forms during that early period—before the concrete has reached about 500 psi of compressive strength—the expanding ice will fracture the weak cement, degrading the concrete's quality.

As the reaction proceeds, the free water is consumed, the concrete gets stronger, and air voids form in the concrete, so that any ice that does form will have a space to expand into. From then on, the concrete can drop below freezing temperatures, and it won't be damaged. So in winter, the key goal is to keep concrete above the freezing point until its compressive strength exceeds about 500 psi. After that, it's safe to remove the curing blankets, the heat, the shelter, and so on.

In the past, there was no way to be sure when the concrete had become hard enough in the hours or days after the pour. So the rules erred on the side of caution: You had to keep the protection in place for a set period of days, which included a healthy margin of safety.

Measuring temperature. But the modern maturity method lets contractors observe the concrete directly to know how far the hydration reaction has progressed. That's because the rate of the hydration reaction is directly related to the material's temperature: the hotter the temperature, the faster the reaction proceeds. If you measure and record the temperature over time, you can estimate how far the reaction has progressed. And for any particular mix, you can know with a fair degree of accuracy how strong the concrete has become.

To learn more about the use of maturity to guide decision-making in concrete work, *JLC* turned to John Gnaedinger, director of engineering services at Con-Cure Premiere (con-cure.com). Con-Cure manufactures the temperature probes, electronic devices, and software packages that concrete contractors use to track concrete maturity in the field.

Gnaedinger provides training and tech support for contractors who use Con-Cure's maturity system. His customers include ready-mix suppliers, precast concrete manufacturers, and post-tensioned concrete companies, as well as contractors like Dennis Purinton who work mainly in residential construction. Gnaedinger is also a member of the ACI 306 committee, and he helped Purinton with his winter demonstration program in 2014.

"First of all," explained Gnaedinger, "any maturity system has to record temperatures over time. You have to be able to look at that data and correlate it with a maturity curve that you establish ahead of time, in the laboratory."

But there's an art to applying the maturity method in the field, said Gnaedinger. "The location where you put the sensor is important," he explained. "You choose areas that you expect to be the coldest, and areas where you expect the most exposure to the elements."

In Con-Cure's "ZoneCure" maturity system, the temperature probe is protected by a plastic sleeve, so the sensor can be recovered and used multiple times. The sensor sends data to an electronic monitor that records the information on site, and also sends it wirelessly to a laptop computer. The system creates a temperature history that describes the concrete's experience and simultaneously calculates the material's maturity, supplying a real-time estimate of the concrete's in-place strength.

Cylinders. Contractors typically don't use the maturity system to determine the concrete's final strength, said Gnaedinger. For that, they use the old-fashioned method: They pour test cylinders and fracture them in the lab after a 28-day cure. But they use maturity data earlier in the job, to make daily production decisions.

Cylinders often cure in different conditions than the actual structure, and cylinder strength can lag behind the strength of the in-place concrete. "With the maturity system, you can actually know what that strength is in the structure, at any moment, without having to break a cylinder," said Gnaedinger, "and you know that the structure itself passes the strength so that you can strip forms. I've been on jobs where that time difference is three days."

Controlling costs. Connecticut contractor Dennis Purinton doesn't put maturity sensors in every slab he pours. But he does use the system often, he said—especially if he needs to document the quality of his work for a customer or a third party.

With experience, Purinton has learned how to use maturity information to manage costs. "ACI 306 gives you options of what to do in the winter," he said. "Do you use hot water, do you use accelerators, do you use blankets, do you use heating units? What do you do? By monitoring the strength gain and the temperature of the concrete as the season goes on, you know how your concrete is performing. Then as it gets colder, you add some sort of performance enhancer to the concrete. But you can put a cost on every one of these enhancers. So as time goes by, you can make yourself much more cost-effective by using a maturity meter system."

ARCTIC CONCRETE

There's another organization interested in cold-weather concrete: the U.S. military. In cooperation with several state highway departments (who have their own interest in extending the concrete season and shortening the time it takes to get pavements into service), researchers at the Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL) in New

Hampshire have been studying ways to push the freezing point of concrete lower using off-the-shelf admixtures that contain calcium nitrate, calcium nitrite, and sodium thiocyanate.

Unlike calcium chloride, the admixture that's typically used to accelerate concrete set in cold weather, these alternatives don't corrode rebar—and in fact, may provide some protection against steel corrosion.

Also, the "antifreeze" method CRREL is evaluating doesn't depend on heating up the concrete during early set; instead, the focus is on preventing freezing of the water even at cold temperatures. When the concrete sets and cures at lower temperatures (but doesn't freeze), its long-term strength is improved.

CRREL's "antifreeze concrete" has shown itself to be a practical approach to placing concrete in cold weather without heated enclosures or insulating blankets. For a 2010 demonstration near Fairbanks, Alaska, CRREL poured five sections of parking slab using its recipe and watched the fresh concrete temperatures drop below 30°F without any damage to the finished slabs (which eventually reached compressive strengths of 7,000 psi, after a 28-day cure).

In the testing of small samples to identify the freezing point, one of CRREL's mixes reached 23°F before water in the mix froze. "If the minimum concrete temperature was lowered to 23°F, instead of the current limit of 40°F," a CRREL report on the testing noted, "it is estimated that an additional 3 to 4 months could be added to the construction season within the continental United States."

But you don't have to max out the antifreeze method in order to apply it, CRREL engineer Lynette Barna told *JLC*. "There are five test slabs at the site," Barna explained. "The dosages we are using are all within the manufacturer's recommendations, but one of the slabs was at the higher dosage range. At the other end of the site, we put a slab in at the lowest dosage rate. Even at the lowest dosage, we are still getting very good performance out of that slab."

Barna said that antifreeze concrete also appears to be more durable than concrete placed in a heated enclosure. "Being able to lower the temperature and not have to heat it, you're creating more uniform conditions for the concrete to cure," said Barna. "We did a side-by-side comparison of curb repair in New Hampshire. On the west side we used the antifreeze approach, and on the east side they did a tent and heat. The conventional side is now starting to spall and crack after 10 years. On the antifreeze side, the condition is still very good, and any cracks are narrow and there is no spalling. So by being able to have a more uniform condition, we've created a more durable concrete."

CRREL researchers also suspect that the antifreeze concrete has a better internal void structure that offers greater protection against freeze-thaw damage in service. The antifreeze admixture becomes more concentrated as water in the mix is consumed during setting and hardening; CRREL engineers think that some antifreeze may stay available in the cured concrete in service, providing ongoing freeze-thaw protection for many years. These ideas, said Barna, are matters for future study.

Ted Cushman is a senior editor at JLC.

Above: A crew from a local concrete contractor in Fairbanks, Alaska, places concrete slabs in freezing weather at nearby Fort Wainwright, raking out the concrete **(7)** and bull-floating it **(8)**, just as they would in summer weather. CRREL researchers report they have designed freeze-resistant concrete mixes that can be handled, placed, and finished just like typical mixes, even in very cold weather.

Photos: USACE

Low-Slope Roofing: Troubleshooting in Advance

A remodeler shares the lessons of experience

BY DOUG HORGAN

We're remodeling contractors working in Washington, D.C., and vicinity. After 20 years in business doing dozens of projects a year, we now have several hundred clients who call us for repairs and updates on their houses. At our company, I'm tasked with educating all our crews and trade contractors based on the lessons learned across all our projects. Here's some information on what we've learned about what works and what fails on low-slope roofs ("flat roofs," with a pitch lower than 3/12), and what materials are practical options for low-slope jobs.

All of the materials we commonly use are reliable in the field. When we see problems, they are mostly related to construction details rather than to materials. In previous articles, I've covered details for transitions to steeper-slope roofing ("Steep-Slope to Low-Slope Transitions," Apr/14) and explained why I prefer not to use drains or scuppers, instead opting for one edge of the roof being completely open ("Draining Low-Slope Roofs," Oct/15).

Other areas where we see failures are edge details, including parapets and skylight curbs; wall connections where roofs meet dormers or upper stories; and penetrations for vent stacks or hardware mounts. Roofing-material manufacturers and suppliers publish details for these potentially tricky situations that address the most common issues. Their manuals and websites are a great resource, and most of my recommendations that follow are drawn more or less from the manufacturers' published guidance.

Photos by Doug Horgan


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SLOPE

Slope is very important! One-quarter inch per foot is the code minimum, and it's a very good idea. Any less, and ponding is inevitable—and with it, freeze/thaw, biological growth, and a ready reservoir of water waiting for the tiniest opening to pour through.

In remodeling situations, it can be hard to provide sufficient slope. We are often trying to fit a roof between a second-story door and a first-story ceiling height. It can be tempting to reduce clearance at the door sill, or to use less than 1/4-inch-per-foot slope. While the commercial "by the book" clearance at doors is 8 inches above the roofing, in my experience less than 4 inches is where it seems to cause problems in our climate. Four inches is also close to the minimum for good working room between the threshold and the roof plane. So, start with a 4-inch drop at any doors or windows, and slope down at 1/4 inch minimum.

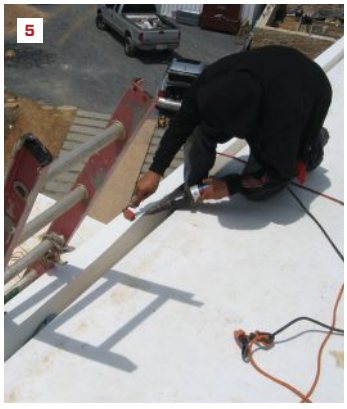
We like to buy "slope kit" foam boards from a roofing supplier. These tapered pieces of insulation can give flat framing a perfect slope. The expense compares favorably to our standard closed-cell spray foam, so it may not even add cost.

MATERIALS

Metals. Metal roofs have turned out to be problematic in our area. While a low-slope metal roof could in principle be properly built in the situations we encounter, that seems to be the exception.

For a slope below about 3/12, metal must be fully soldered in places that get snow and ice. This rules out steel and aluminum roofing. (There are some published directions for roofs as shallow as 1/12 slope for these metals, but the assemblies rely on the adhesion of peel-and-stick eaves membrane, and the details are expensive, labor-intensive, and kind of fiddly. We built one such roof and it hasn't leaked, but we decided it was a questionable idea.)

Copper and stainless steel can be used for low-slope roofs, but a fair amount of planning is involved. First, the metal must be cut down to pans no larger than 18 by 24 inches, so thermal expansion and contraction won't overstress the solder joints. Second, the solder joints require a fair amount of expert care to do properly. Pre-tinning the pan edges is recommended. Most importantly, all the connecting edge and valley metal is at risk of cracked solder joints (because these pieces are normally fairly long and will stress the joints), which means the roof will always require regular main-



Facing page: Tapered foam boards supplied as a "slope kit" **(1)** let the author's crews achieve a 1/4-inch-in-1-foot slope cost-effectively. Lesser slopes can allow ponding of water **(2)**, which causes leaks because of freeze-thaw damage and biological growth, and makes leaks worse when they do happen. Low-slope copper roofs **(3)** must be fully soldered, with pans sized no larger than 18 by 24 inches. Movement joints (seen to the rear of the carpenter) are necessary on larger roofs.

Left: A special heat gun melts both pieces of a TPO roof joint **(4)**; they are then pressed together to form a watertight seam. An installer applies pressure with a hand roller to form a heat weld in a PVC roof **(5)**. TPO makes a neat, attractive roof that clients often prefer to EPDM. In the roof edge shown here **(6)**, the TPO has been turned down over the face of the trim about 2 inches, then the metal drip edge has been applied over the membrane. Finally, a strip of TPO has been welded on top to cover the metal. This prevents leaks at the joints in the metal.

tenance. That's a problem in our market: On a cathedral, you can count on there being a staff to look after these joints; on a house, not so much.

Another common flaw we find in metal roofs is "unplanned expansion joints"—places where the metal rips apart in cold weather because planners didn't make any provision for metal movement. In our climate, we can expect copper to move about 3/8 inch in 10 feet, so a 30-foot roof should have a movement joint partway across. The Copper Development Association, SMACNA, and the Revere Company all publish guides and details for metal movement. Since the entire visual look of the roof, the gutter and downspout locations, and any penetrations need to be planned to work with metal movement, we've found metals to be somewhat impractical for remodeling projects, where many of those aspects are dictated by the existing situation.

Membranes. Instead of metals, we usually work with single-ply membranes. Our experience with these has been good overall. Of course mistakes can be made, but at least membranes won't rip themselves open from thermal stress, as I've seen with metal roofs.

EPDM, the black "inner tube" type of rubber, was the most common material in our area until recently. The sheets are strong and durable, especially in the .060 thickness we normally use (they come in .045 and .090 as well). EPDM is said to last well over 20 years, even in full sun. I have seen a hole poked in it once, but that's the only failure in the field of a sheet I've ever seen. Seams, on the other hand, had been a problem until we stopped using glue and started using "seam tape," a roll of adhesive that makes much better joints. We also cap seams with "lap sealant." EPDM seams require maintenance; the lap seal will fail. It needs to be replaced, or freeze-thaw can push open the seams over time.

TPO is another single-ply membrane, and we've been using it more and more. TPO seams are heat-welded: The installer warms up both sheets with a special heat gun and hand-rolls the layers together. The sheets become one in the process, and these seams don't require maintenance. For that reason, TPO is a better choice under decking or pavers, where access to maintain seams may be limited. Some clients also prefer the white, beige, or gray colors of TPO to the black EPDM. When we put decking over TPO, though, we often lay a sheet of EPDM on top first, because the black rubber is less noticeable.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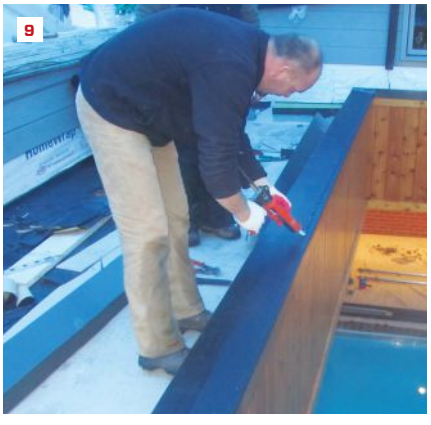
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We have used flexible PVC membranes on a couple of roofs, and they've worked fine. Like TPO, PVC is also heat-welded, so the seams should be durable. I have heard that raw PVC is not very flexible and that roofing is made with softeners, which eventually leave the material, leading to failure. Because we have a good track record with TPO (which does not have this problem), we've been using that unless something else is specified by a designer.

Occasionally we install a modified bitumen "torch down" roof. Double-layer "mod bit" was once considered to be the gold standard of low-slope roofs, and once installed it provides peace of mind. However the open-flame process required is nerve-wracking. I remember a few years when this type of roofing was basically not available because—after a few too many fires—insurance companies were refusing to cover roofers who installed it. New protocols were developed and we can get it nowadays, but it's expensive and not very pretty to look at so it's used selectively.

One place it's perfect for, however, is where old asphalt roofing residue remains on a building. "Mod bit" is compatible with old asphalt and roof cement, where TPO, EPDM, and especially PVC are not compatible.

EDGE CONNECTIONS

The main issue I've seen on edges is that metal always leaks at joints. We've been brought in to repair leaks at metal drip edges, parapet caps, and even skylight flashings. As we know from metal roofs, metal changes size significantly over the seasons. This puts a lot of stress on the joints between pieces. Two 10-foot-long drip-edge flashings will move a lot, breaking any seal between them and allowing water to work its way through the joint.

The general principles for keeping water out are to slope things well below the metal and to run flexible roofing materials under the metal and down the vertical surface. The first reduces the leaks; the second sends any leaking water out of the building.

On a drip-edge situation, choose a detail where the membrane runs over the edge and down the fascia. The edge metal is applied over the membrane, and flashing tape is applied on top. Any minor leaks between metal pieces are handled by the first layer of membrane. Firestone has a good published detail for this situation.

For parapet walls and skylight curbs, run the roof membrane all the way up over the top of the curb and down the other side. The metal parapet cap covers the last bit on a parapet, but for a

Facing page: The edge metal on this roof **(7)** was applied before the roofing. Water leaking at this point will go into the building. Metal drip edge moves almost 3/8 inch in 10 feet as temperatures change between summer and winter—too much to effectively seal. The large gap shown here **(8)** illustrates how far this kind of joint can open up. For a pool shelter **(9)**, we were able to wrap the EPDM roof all the way over the skylight curb, which is sloped to the outside. A bead of sealant at the inner edge will help prevent leaks, but if a leak does develop, the water will simply drip into the pool.

Left: This EPDM roof **(10)** turns about 10 inches up the wall (8 inches is our normal requirement), and a termination bar holds it firmly in place. Sealant at the top edge prevents water from leaking behind it. Finally, the WRB on the wall is pulled out in front of the roofing material. A tall stainless steel Z-flashing **(11)** connects a PVC roof to the stucco we'll install later. This maintains clearance and allows the roof to be reworked later. A termination bar fastened to brick at the top edge of an EPDM roof **(12)** will be covered by a metal flashing cut in to the joint above in this solid masonry wall.

skylight, you may need to get creative with finishes on the inside. Curb-mount skylights often include or require aluminum "pans" with a turned-up inner edge. If the skylight curb has a slight slope to the outside, and the metal is sealed well to the membrane at the innermost edge, then almost any leaks between pan segments will run down the slope and outside. On a job with an indoor pool, we ran the membrane all the way to the inside of the trim so any water leaking through would drip into the pool, but most skylights don't offer such a convenient option.

WALL CONNECTIONS

The key at walls is to prevent water from getting behind the roofing material. It seems obvious, but don't forget there's usually a drainage plane buried behind the wall finishes, and if it can't drain out onto the roof, you'll have a leak.

It's common to find brick or stucco on a wall we're tying a roof into. If we want to be sure there will be no leaks in windy rainstorms, we need to remove the finish and install a through-flashing above the roofing tie-in. The same is true for siding. All of these claddings should have felt or housewrap behind them. We pull this layer out in front of the through-flashing or the roofing, so any water running down it lands on the roof.

The roof tie-in is fairly straightforward. In our area, it's common to glue the membrane to the wall and install an aluminum flashing to cover the top edge. We've seen a fair number of leaks where this technique has been used, though, so following the manufacturer's details, we normally use a "termination bar"—an aluminum extrusion that's nailed to the wall and pinches the roofing in place. The top of the joint is caulked, and then a flashing is applied to cover all of that. When water makes it past the flashing, the caulk and the bar keep it out of the roof.

When we work on an older building with solid masonry walls, we cut a horizontal slot into the masonry just above the roofing and slide the flashing into the kerf. We've found that 3/4 inch is the "right" number. Any deeper, and you can be opening a pathway for water into brick cores or poor head joints; any shallower, and the roofer may not get enough metal into the kerf. When we used to ask for 1/2 inch, sometimes the slot would be only 1/4 inch deep—then on a hot day, the metal would be prone to "oil can" itself out of the slot, leading to a leak.

Left: This site-made metal flashing **(13)** is less reliable than a factory-built one. Factory boots for these vent pipes **(14)** are reliable and easy to install. A factory EPDM collar for this plumbing vent **(15)** is more reliable than a site-made flashing. Rectangular penetrations **(16)** are flashed using skylight details, with overlapping layers of flexible flashing tape.

One thing we won't allow is metal applied only to the face of the masonry without cutting in. This does not work in our climate—hot days invariably push the metal off the wall, no matter how great your preferred brand of caulking is.

We also insist on stopping cladding materials well above the roof surface. For splashing, snow and ice, and wind, we want 8 vertical inches on the roofing material that turns up the wall. In addition, many claddings require clearance above a flat surface. While 2 inches is the normal distance for roof clearance (with fiber cement and wood siding or stucco, for example), often the recommendation is 4 inches or 6 inches from a deck or paved area. It's safer to use the larger clearance, to avoid splash staining and the added wetness that comes with proximity to a horizontal surface.

Another reason to leave ample clearance becomes evident down the road, when it's time to re-roof. If we've left only a couple of inches of clearance above the roof, it's hard to get the new roofing material turned up the wall properly. Taking a page from a Hardie install guide, we often bend up a piece of metal to visually fill the space between the roof and the cladding while leaving room for later repair or replacement.

PENETRATIONS

The best way to handle penetrations is with factory-made "boots." These are flexible, reliable, and easy to install. It's often best to plan penetrations so these can be used; for example, by using round steel posts to mount solar panels and satellite dishes. Trying to use square or I-section bars creates extra sealing work and more chances for a leak to form. Of course sometimes we have a shape there is no boot for. Roof manuals include details for larger round shapes, and rectangular ducts can be treated the same as skylight curbs.

Another method for penetrations is a "pitch pocket." A small curb is formed up around the penetration using roof membrane or flashing tape and filled with a liquid that cures into a watertight barrier. These are a bit expensive to make, and in manuals they're said to be less reliable than a boot. I also find that many roofers aren't aware of details such as priming the surfaces the liquid needs to adhere to, and forming a slope on the top of the liquid as it cures. Still, pitch pockets are useful where a boot can't be installed.

Doug Horgan is a vice president at BOWA, a design/build remodeling firm based in McLean and Middleburg, Va.

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* — In-depth coverage
L — Letter to the editor
Q — Question and answer
P — Product information

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BY LAUREN HUNTER

1. Panoramic View
The Panorama Combo Series from Pavestone brings the look and texture of vintage slate to patios, driveways, pool decks, and elsewhere. Available in three Panorama DemiCombo sizes and three Panorama SupraCombo sizes, the pavers are made from a no-slump concrete mix that averages 8,000-psi compressive strength and only 5% absorption or less, minimizing the effects of freeze-thaw cycles. Availability of more than 15 natural colorways varies by region. Pricing ranges from $2 to $3 per square foot. pavestone.com

2. Do the Wave
American Standard is entering the touchless-toilet market with Clean ActiVate toilet models featuring a touchless flush sensor. The sensor operates on four AA batteries for up to two years. Users simply wave a hand within 2 inches of the sensor to operate the toilet. The design also incorporates a manual flush button and a power button so the sensor can be turned off when desired, such as during cleaning. Look for pricing around $650. americanstandard.com

3. In the Pocket
As sliding and pocket interior doors gain attention, Cavity Sliders is introducing its CaviLock CL400 Magnetic line of architectural handles with magnetic latching and locking. The design provides both a positive "hold close" for passage hardware and smooth action on locking configurations. The product line includes passage, privacy, key-locking, and bi-parting-door hardware with a choice of finishes. Available in sizes to suit door thicknesses from $1\frac{3}{8}$ inches to $2\frac{1}{4}$ inches, online pricing ranges from $325 to $700. cavilock.com

4. Hot Line
Mendota Hearth has expanded its FullView Modern Linear series with the ML39 MOD, a stylish linear fireplace with a slightly smaller footprint than its 47-inch-wide predecessor. The design offers a 39-inch viewing area, giving designers more flexibility in spaces like living and dining rooms and master suites. Customize the fireplace with a selection of three fronts, five finishes, a variety of detail options, and several base materials. The maker does not publish pricing, but is positioned at the high end of the market. mendotahearth.com

5. Sphere of Influence
Interlocking spheres give Sea Gull Lighting's Alturas collection the feel of the famous Unisphere constructed for the 1964 World's Fair. The full line includes three chandeliers, two pendants, a two-light semiflush fixture that converts to a pendant, and four bath fixtures. All fixtures are brushed nickel with satin etched-glass shades and can accommodate incandescent and fluorescent lamping options. Pricing ranges from $70 for a one-light bath sconce to $850 for a nine-light chandelier. seagulllighting.com

6. Stucco Accessories
New accessories are available for StoTherm and StoQuik Silver wall systems. Sto Corner Bead Standard, priced at 4 cents per linear foot, features a strip of mesh with a 90-degree angle that's reinforced with a plastic rail for creating straight corners that resist chips and cracks. The PVC Sto Drip Edge Profile (shown) is designed for fascia returns, balcony undersides, and other areas that are vulnerable to moisture. Integral reinforcing mesh helps supply crack resistance. The drip-edge profile costs 6 cents per linear foot. stocorp.com

7. Stylish Shale
The launch of Shale marks Merillat's latest Classic line paint offering to capitalize on the popular trend of gray colorways. Designed to offer a strong base around which designers can incorporate other colors and patterns, Shale both serves as a solid neutral and adds a level of individuality. Available on more than 20 door styles, Shale calls for the same 10-day lead time as other Merillat Classic finishes. Check with dealers for pricing. merillat.com

8. Deck Driver
Designed specifically for installing decking clips, the SuperDrive 75G5 fastening tool effectively automates clip installation along joists. Available in a kit that includes the SuperDrive 75G5, a Rocker 4,000-rpm screw gun, and a feed track, the tool helps the installer drive screws at the ideal angle and depth, while offering a compact and lightweight design. The tool can also be configured for top fastening—and an optional SuperDrive extension piece allows for working from a standing position. Each collated strip holds 50 screws. Priced at $380. grabberman.com

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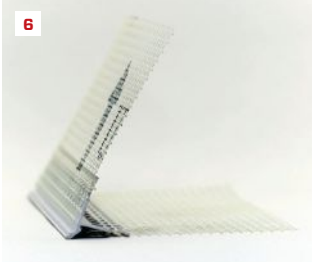

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9. Lush Leather
The Leather Plank Collection is one of several Torlys flooring products that will be newly distributed in the U.S. by Carlisle Wide Plank Floors. Ontario-based Torlys specializes in ecofriendly floating wide-plank designs, in materials such as leather, hardwood, cork, and laminate. All feature a scratch-resistant finish and joints that are designed to guard against cupping, gapping, and warping. The Leather Plank Collection is made from 100% recycled leather. Torlys products available through Carlisle will be priced at $11 per square foot or less, with trade pricing available. wideplankflooring.com

10. Hip New Connector
Simpson Strong-Tie's HHRC Heavy Hip-Ridge Connectors are available in new sizes. The new 12-gauge HHRC can be sloped downward to a maximum of 35 degrees for hips that accommodate a 45-degree roof slope. An open-back ridge connection allows for elevation adjustment, and a field-adjustable hip slope makes installation easier. Both the new and existing hip-ridge connectors can be used with structural composite lumber, glulam, and solid sawn lumber. When installed with Strong-Drive SD10 connector screws (provided), HHRCs provide higher allowable loads than do the HRCs installed with nails. Pricing ranges from $110 to $130 for the heavy-duty connectors. strongtie.com

11. High Five
The unique five-door configuration of the Multi-Door Freestanding Refrigerator was created for a range of food-storage needs. The refrigerator uses two independent cooling systems to keep food fresh longer. In addition to having a main refrigeration compartment, the unit features two soft-close refrigerator drawers—one for produce storage, and the other with five temperature presets for meats, beverages, herbs, cheeses, and thaw/marinate. Priced at $3,700. kitchenaid.com

12. Cure for the Common Tape
Surface Shield's Builder Board Breathable Tape lets crews cover newly installed floors and concrete without risking damaging cure lines. The combination of Builder Board protective boards and breathable tape allows vapor and moisture to escape. Additionally, the tape has a higher adhesion level than similar products on the market without affecting the breathability. Available in 3-inch-by-36-yard rolls for $15, or check with your distributor. surfaceshields.com

BY ROBERT COURTNEY

Metabo's 18-Volt LiHD Impact Wrench

It is not often that a tool can meet the needs of multiple trades. Metabo's SSW18 LTX400BL 18V LTX 3.1 Ah LiHD Cordless ½-Inch Square Brushless Impact Wrench, however, is one of those unique tools. I have the privilege of owning two specialized businesses: one for building custom homes and the other restoring vintage cars and campers. While I have a variety of impact drivers in my building tool arsenal, the mechanical side has been limited to the standard air impact wrench.

One of our specialties in the custom-home building world is building timber-frame houses. Though a lot of what we do involves quite a bit of traditional joinery, more and more engineers are specifying large timber screws to meet more stringent building codes. Some of these fasteners are as long as 16 inches, with diameters up to ⅜ inch. The smaller impact drivers struggle when installing these fasteners, especially in hardwoods and over long periods of time.

When given the chance to try Metabo's SSW18, we were thrilled to put this beast to the test by assembling 6x6 timbers with timber screws. Not only did it have the power necessary to drive long screws through such large timber, it had the stamina to back it up.

One of the tool's best features—other than its lightweight and balanced design—is that the battery pack has a built-in charge meter. Before you find yourself two stories up waiting for the crane to set an 8x16 timber truss cord, you can be sure you have enough battery life to finish the job. One quick push of the built-in LED meter and you know if you're good to go (or not). If not, swap out your pack with the included second battery and throw the spent one on the air-cooled charger that, Metabo claims, will charge the pack in 30% less time than its competitors. I didn't test the proposed charge time—all I can say is that it was fast enough for us on this job.

The driver performed very well for us in the construction world. The real test, however, came in the mechanical world. Any tool can be called a driver, but only the best can be considered a true impact wrench, which is what Metabo calls this model. The SSW18 packs a walloping 295 foot-pounds (3,050 inch-pounds) of torque. I will say that it struggled with some very seized-up large-diameter bolts that gave even my trusty air impact a run for its money.

Photos: Chris Ermides

Where it struggled in brawn, it made up for in brains, though. The Metabo features slow-start technology. While the air impact will strip or break lug nuts without hesitation, the SSW18 works up to speed and strength with 12 torque and speed settings. One of the other neat features is the twin LED head lamps that light up as soon as you pick up the tool.

I frequently take a freshly restored vehicle for an extended test drive, and having the Metabo SSW18 in the tool bag will give me great comfort for any field repairs that may pop up. Nothing says freedom like cutting the cord. Overall, I give it two thumbs up.

SSW18 LTX400BL 2X 3.1AH LIHD IMPACT WRENCH SPECS

Voltage: 18V LiHD
No-load SPM: 0 to 2,150
Maximum torque: 295 foot pounds
Bit retainer: Male square 1/2 inch
Weight: (w/battery pack) 3.7 pounds
COO: Germany
Warranty: 3 year on battery
Price: kit, $330; bare tool, $220
metabo.com

Robert Courtney is a custom home builder, trim carpenter, and mechanic specializing in building and restoring expedition vehicles.

Photos: bottom left, Chris Ermides; top right, Myron Ferguson

Wizard Handle Offers More Control When Taping

BY MYRON FERGUSON

When I coat seams on drywall, I use a box (also called a "flat box") equipped with an adjustable pole-style handle that I extend when coating seams on ceilings. I also have a 32-inch pole-style handle that I have been using when I am taping walls with only horizontal seams.

The typical pole-style handle has a brake that's engaged by pressing a lever at the far end of the handle. The brake holds the box in the desired position over a wall or ceiling seam. You need to keep the brake engaged as you lift the box off the drywall surface and until you reposition the box over the next seam, and then you need to release the brake when applying the compound to the seam.

The box is filled with joint compound and once it's positioned over a seam, the user applies pressure through the pole-style handle, which is attached to a hinged cover on the back of the box. With most boxes, a lot of pressure is required to force the joint compound out of the box mouth in a consistent flow and to smooth the compound out at the same time. So coating seams on walls is a little awkward and physically difficult when you are working with a tool that has a long pole-style handle.

Enter the Wizard handle from Ames (see photos, above). It's a short handle that offers better control over the box when you're coating horizontal seams. When I used it for that purpose, I was able to maintain consistent pressure throughout the joint, and I was able to maneuver the box more easily near corners. In addition, I really liked being able to coat all the seams in closets with the box, instead of by hand as I had been doing.

Attaching the handle to a box (see inset, above) is fast and easy, so changing it out for a longer handle for coating ceiling seams is very simple. There's also likely to be less of a learning curve compared with using a box equipped with the long pole-style handle and brake.

Myron Ferguson, also known as "That Drywall Guy," is a drywall contractor in Galway, N.Y.

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BY DARREN TRACY


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Lowering the Lights

A few years ago, our construction firm was doing emergency work on the roof of the New York State Capitol to repair a bad leak. At the same time, a renovation was underway in the assembly chambers below that required one of the large chandeliers to be lowered and removed **(1)**. The antique chandelier (circa 1913) was ornate and very heavy (estimated weight of one to two tons with its translucent alabaster and brass construction). Because we have rigging experience and specialize in unique projects, and because we happened to be in the right place at the right time, the field engineer at the capitol building offered us the task of lowering the chandelier approximately 60 feet from the chamber ceiling to the floor below. We jumped at the chance.

The chandelier was one of nine hanging from the ceiling. The job wasn't as difficult as we had initially thought. When we went into the attic space, we found that the chandelier was attached to a permanent heavy-duty, gear-reduction winch assembly **(2)**. We just needed to disconnect the wiring and carefully hand-crank the fixture to the floor. It took more than 20 rotations to lower the chandelier 1 inch, so the 60-foot drop required more than 14,000 rotations—some arduous cranking!

Even with the controlled descent, it was a bit nerve-racking to lower the huge fixture, and became even more so when one of the brass links broke just as the unit touched the floor **(3)**. Of course, that created quite a stir. We used penetrating dye to check for cracks in the remaining links and found others that were cracked.

Water dripping on politicians' heads is one thing; a two-ton chandelier falling would be quite another. With concern about the other eight fixtures, we lowered and inspected them as well. We installed safety cables on each fixture to supplement the original brass chain. We now return annually to lower the chandeliers for inspection and cleaning and to replace the lamps. We're usually able to complete the project in two very long days.

Darren Tracy, P.E., owns West Branch Engineering, a consulting firm, and West Branch Inc., a construction firm, in Saratoga Springs, N.Y.

Photos by Darren Tracy

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