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On the cover: John Carroll prepares to lay bricks for the top step on a brick stairway in Fuquay-Varina, N.C. See the story on page 27. Photo by Matthew Carroll Navey.

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BY JOHN SPIER

Installing an Exterior Door

Exterior doors are the most challenging of all of the penetrations in a home's envelope. They are opened and closed about a hundred times as often as the average window, and everything in the house goes through them, from teenagers to baby grand pianos. Proper installation is the first step toward meeting that challenge.

Check the door. When I get the door, I check both the door slab and the preassembled jamb carefully, looking for quality issues from the manufacturer. Prehung exterior doors sometimes come with the trim attached, but I never order precased doors from the factory, preferring to trim my own doors. Preattached molding interferes with adjusting the jambs in and out, and it makes air-sealing the jambs difficult as well.

Check the opening. Make sure the rough opening is the right size, ideally about an inch bigger than the outside dimensions of the door jamb in height and width. If the opening is not plumb from side to side, make sure it's big enough that the door can stand plumb within it.

If the wall plane is a little bit out of plumb (no more than 1/4 inch over the total height of the door), you can hang the door plumb and fudge the casings. If the discrepancy is more than that, you will need to fix the wall before hanging the door. Also, make sure that the sides of the opening are in plane with the wall by setting small nails near the corners of the opening and stretching a chalk line between the nails to form an "X." If the sides of the opening are parallel, the lines should just kiss in the middle where they cross.

Checking the rough sill is always top priority. Unlike an interior door, for which you can cut the jambs to different lengths if the floor isn't level, an exterior door has an integral sill that needs to sit level. The sill should be evenly supported across its entire width, so that loading from the inevitable traffic doesn't flex it constantly. You can shim the sill, but a shim is a potential path for water intrusion. Whenever possible, I level the rough sill before installing the pan.

Flash the sill. A traditional approach for flashing a rough sill is to install a metal pan with upturned sides and an interior curb that fits against the finished flooring. But custom pans are expensive and also form a thermal bridge. Adjustable plastic versions are available, but they often don't work with different sill configurations, and they can crack over time. Instead, I prefer to use flexible self-adhering flashing tape to make durable and effective pans (see "Flashing an Entry Door," Jan/06).

Have everything ready. With the sill pan in place, I lay the door face down on a protected surface in front of the opening so that it can be lifted into place without turning it. I remove all of the packing materials, paying special attention to the staples in the bottom of the sill. Some heavy doors come with lifting handles that I usually remove before setting the door in the opening. At this point, I make sure that everything I'll need to fasten the door to the framing is within easy reach. That includes a pile of shim

Photos by Gabriela Gazzo

Inspect the door and remove any protective packaging **(1)**. After flashing the sill with flashing tape **(2)**, apply a heavy bead of caulk to the sill pan **(3)**. Carefully slip the door into the opening, keeping movement of the door to a minimum **(4)**.

When the door is in position, shim behind the jamb at the bottom hinge **(5)** and on the opposite side as well **(6)**. Check the sill for level **(7)**, and shim if needed **(8)**. Hold the door in plane with the wall **(9)**, and shim both sides at the top **(10)**.

shingles in addition to the necessary tools and fasteners.

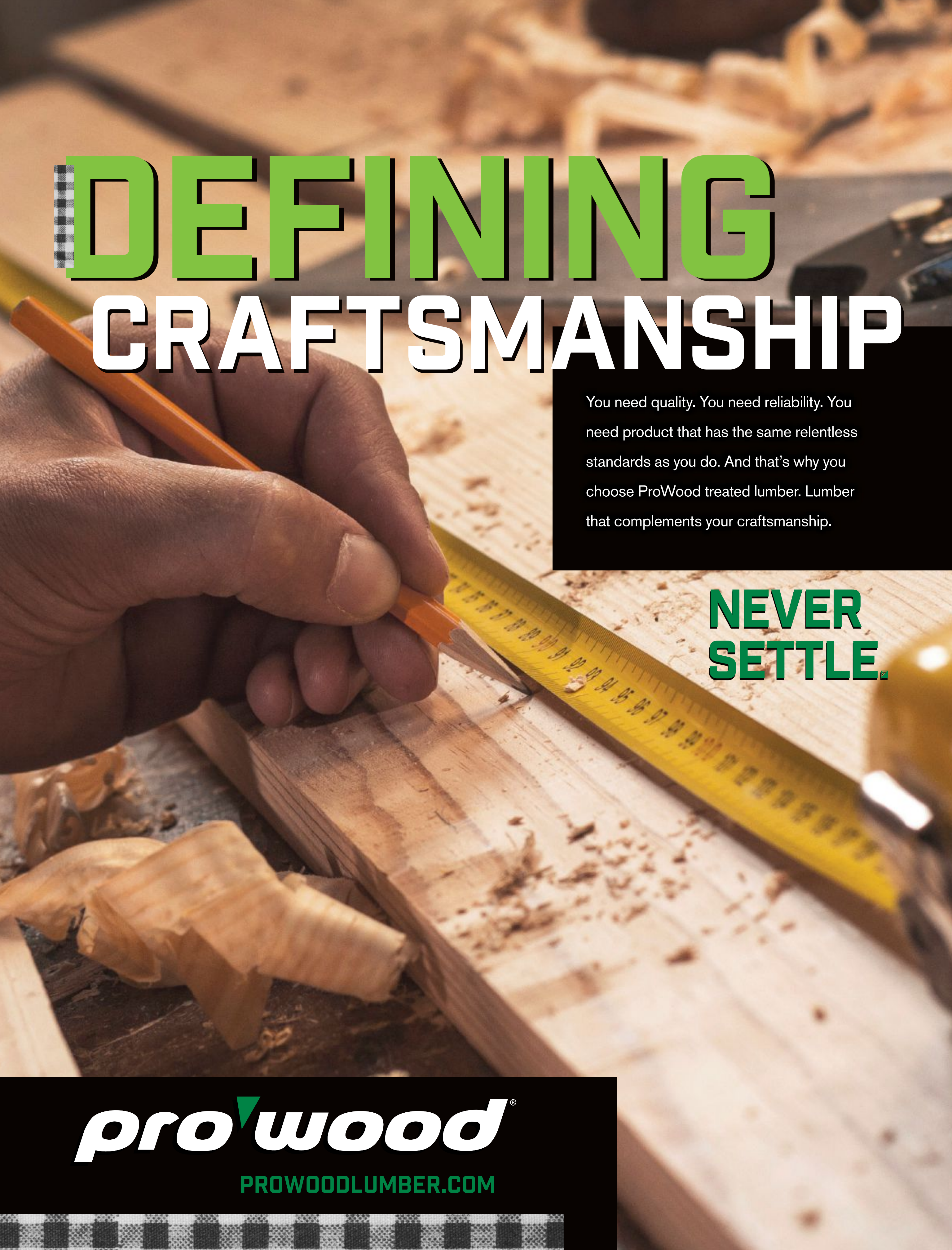
Caulk the sill pan. Some manufactured sills have hollow or recessed areas, so before caulking the sill pan, I check the bottom of the door sill to make sure that I apply the caulk where it will make good contact. I clean and dry the sill pan, and then apply a very heavy bead of silicone caulk across the entire width. I use silicone because it is flexible but cures hard enough to provide some support to the sill, and it can be peeled off years later if the door needs to be replaced. I put additional caulk at the two ends, which are areas prone to leaking. After installing the door, I reach in with a narrow shingle and tool any excess caulk into a sloped dam toward the outside of the pan.

Secure the hinge side first. Some doors come with screws and predrilled holes for securing the jambs, others can be drilled and countersunk for screws and plugs, and some I simply fasten with finish nails that will be puttied and painted. Regardless of the fastening strategy, I lift the door into place and try to set the sill down into the caulk just once, with minimal sliding around.

With one person (or a couple of blocks tacked to the wall) holding the door vertical, I center the sill in the opening, making sure that it is fully seated. Next, I check the sill for level, adding small shims as needed until it's perfect. Any shims need to be fully bedded in and surrounded by the caulk to eliminate any entry points for water. I also check the top of the jamb for level at this point, but if the head and sill don't match, the problem is with the manufacturer.

Before securing the bottoms of the jambs, I make sure that there is enough room in the rough opening to plumb the door from side to side. Sometimes it's necessary to start with the sill closer to one side. Once I'm sure of the placement, I shim and fasten the hinge jamb right behind the bottom hinge.

Using the door itself as a guide, I shim the tops of both side jambs until the margin between the door and jamb across the top is perfectly even. If the sill is level, this occurs when the jambs are plumb. I use a level only for double-checking and as a straightedge. As I shim and fasten the door jambs into place, I keep them in plane with the wall so that the exterior casing lies flat. Out-of-plumb walls may need tapered extension jambs for the trim to lie flat. I drive two screws—one in the thick part of the jamb and one in the door rabbet—at each set of shims.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Drill and drive a stainless steel screw to hold the jamb at the top hinge **(11)**. Make sure the jamb is straight **(12)**, then fasten the rest of the hinge jamb **(13)**. Fasten the top of the strike jamb **(14)**, then straighten **(15)** and fasten the rest of that jamb **(16)**.

I add shims directly behind each of the hinges and drive long screws (typically provided by the manufacturer) through the hinges and into the framing as soon as I confirm that the jamb is plumb. Without the screws into the framing, the weight of the door tends to flex the jamb and makes it difficult to control the margin on the strike side.

Attach the strike side. When shimming the strike side, I use the margin between the jamb and the door as a reference. Installing shims very close to the top and bottom lets me straighten both ends of the hinge jamb at the same time by pushing the head jamb and sill over as needed. I shim behind the lockset strike for security and then add more sets of shims as needed to hold the jamb straight. I avoid putting shims and nails where I might need to drill and mortise later for a deadbolt.

Because of the inevitable movement and settling of the framed opening, I never shim between the head jamb and header, so that the jamb stays straight and the door operates properly over time. If I need to hold the head jamb straight, I shim it temporarily, fasten the exterior casing, and then remove the shims with the casing left to hold the jamb straight. Another strategy is driving a couple of 10d galvanized finish nails up through the jamb and using the friction of the nails to hold the jamb straight until I install the trim.

When the door is secure in the opening and operates smoothly, I cut off the excess shim material with a razor knife or multi-tool. While the caulk is still wet, I make sure that the sill is supported anywhere that it might flex when stepped on. The final step is installing the lockset, and then I'm ready to air-seal and trim the door.

John Spier owns Spier Construction, a building and remodeling company on Block Island, R.I.

For a more detailed discussion of installing an exterior door, go to **jlconline.com/training-the-trades/installing-an-exterior-door**.

Q How do I prevent the mesh backing on transparent glass mosaic tile from showing through when the tile is installed?

A Tom Meehan, a second-generation tile installer and co-author of *Working with Tile* who lives and works in Harwich, Mass., responds: Glass tile can be very frustrating, even when you do things right. Most problems with glass tile arise from installation methods. My article, "Working With Glass Tile" (Mar/17), goes into more detail about the whole installation process.

Proper installation of any glass tile begins with prepping the walls. For installations in bathrooms and other high-moisture areas, I usually give the walls a coat of liquid stress-crack membrane. I follow that application with a skim coat of the thinset recommended by the manufacturer of the glass tile that I will be installing. When the skim coat has set, I give it a light sanding to make sure there are no ridges or bumps.

Because the thinset will be visible through the glass tile, it's important to use white thinset and to make sure you're using the thinset recommended by the glass-tile manufacturer. It is equally important that you have 100% coverage of the thinset—especially with mesh-backed glass tile **(1)**.

To achieve 100% coverage, spread the thinset on the wall with the flat side of the trowel, as close to perfectly smooth as possible. Then switch to the notched side of the trowel (use the appropriate-size teeth for the size of the tile) and comb the thinset evenly in one direction **(2)**. Last, go back to the flat side of the trowel and flatten all of the ridges of the thinset without scraping off any of the thinset, while continuing to maintain an even thickness.

When the thinset is ready, push the sheet of glass tile into it, shifting the tile back and forth until it is 100% embedded in the thinset **(3)**. The white mesh on the back of the sheet should disappear completely into the thinset. Occasionally, some threads of the mesh might be visible next to the grout joints, but only if you are looking at the tile at an angle. When in doubt, try out your installation methods on a small area first.

Mesh backing lets you install the tiny glass tiles as a single sheet **(1)**. Start by spreading a thin, even layer of thinset on the wall. Comb the thinset in one direction using a notched trowel with the recommended-size teeth. Next, flatten the ridges with the flat side of the trowel **(2)**. Then press the tile into the thinset and move it side to side slightly for 100% coverage **(3)**.

Q The interior of a building with full masonry walls was gutted after a fire and is being rebuilt. What is the best way to air-seal the brick wall?

A Foster Lyons, an engineer and building-science consultant, responds: There are many variables that could affect the answer to your question. But if the plan is to leave the interior exposed with no framed wall over the masonry, then repoint the exterior and plaster the inside of the wall with a cement-based, vapor-open, three-coat plaster.

Of course, if you intend to add framing and insulation on the interior, that interior plaster recommendation would be financially wasteful. But, the basic idea is the same: Make sure the exterior side of the wall is well-pointed, then apply something on the interior side to stop air ingress while still allowing water-vapor transfer. This air-control material should be vapor semi-permeable (permeance between 1 and 10).

There are many commercially available products that can achieve this combination of interior requirements, and they generally fall into two categories: liquid-applied membranes and trowel- or brush-applied slurries. Some of these may require a primer. If the interior of the brick wall is lumpy and uneven, you first need to parge it with a Portland cement-based stucco to create a surface that is smooth and continuous enough to allow the air-control material to achieve continuous coverage.

If the building is in a northern climate (any place where the heating system runs regularly, such as climate zone 5 or above), then the insulation must not be air permeable, or you must add a smart vapor barrier on the interior side of your air-open insulation. (A smart vapor barrier changes permeance with changes in humidity to keep the wall cavity dry.) These precautions will prevent moisture-laden, warm air from getting to the cold interior surface of the brick wall and allowing condensation to form. If the building is air conditioned, then do not use vinyl wallpaper or epoxy paint as the interior finish, as these products will inhibit vapor movement.

If your building is in a southern climate (any place where the air-conditioning system runs twice as much as the heating system, such as climate zone 4 or below), then any type of insulation would be acceptable, but it's still not a good idea to apply vinyl wallpaper or epoxy paint on the interior. The right thing to do is to allow the water vapor to pass through the interior finish and eventually make its way to the cooling coils in the AC system, where it will condense and drain out of the building. For a more in-depth discussion of this topic, check *Building Science Insight #105*, "Avoiding Mass Failures" by Dr. Joseph Lstiburek, of Building Science Corporation, June 2018.

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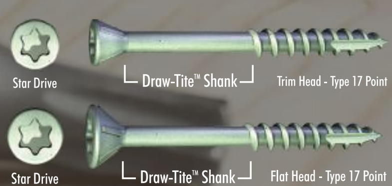

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Custom Trim for Deep Windows

BY NIELSEN CRIST

The rubble stone farmhouse walls were 18 inches thick **(1)**. New windows were installed, set flush to the outside of the walls. In the shop, the author prebuilt custom window-well trim for all the openings **(2, 3)**, sizing each assembly to fit precisely in its opening **(4)**.

Photos by Nielsen Crist

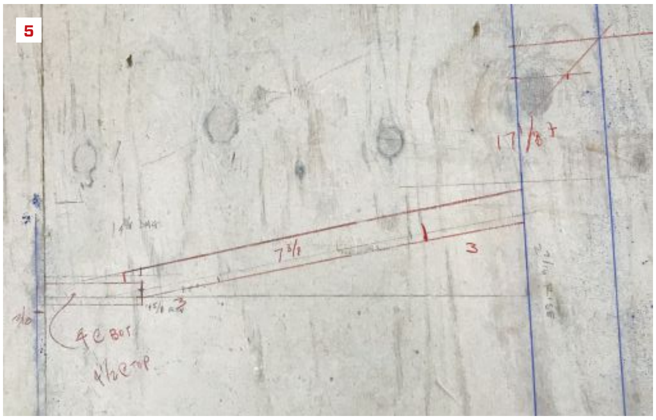
I have been trimming windows since my early teens. But when I saw these windows, I knew that they had the potential to be something special. The rubble stone walls of the 230-year-old farmhouse were roughly 18 inches thick, and the new windows were set flush with the outside. Wood framing on the inside of the walls brought the total wall thickness to about 2 feet. My job was to fabricate custom trims to dress up the irregular window wells.

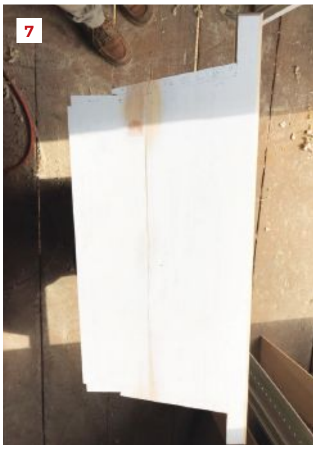
Planning. Because of variations in the thickness of the stone walls, the depths and widths of the rough openings varied significantly from window to window. So at the corner of each window opening, I measured from the frame of the bare window (ordered without jamb extensions) to the finish surface of the drywall. I also marked the centers of each window on the interior face of the bottom window jamb. With the tongue of a framing square held against the jambs, I transferred those centerlines to the drywall.

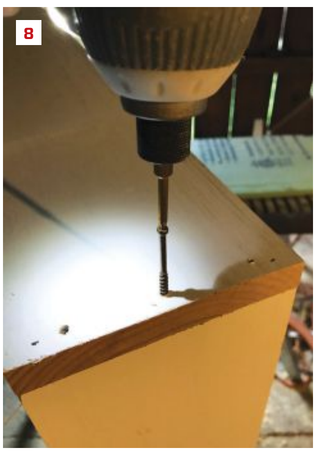
From those marks, I measured left and right to the drywall to determine the interior rough openings (the left and right numbers were rarely the same). From the smaller of the two measurements, I subtracted 5/16 inch (for shimming) and doubled the result, giving me the width (on the interior side) of the trim assembly for each window. As a result, the frame-and-panel-style side jamb extensions would flare open towards the interior 10 degrees.

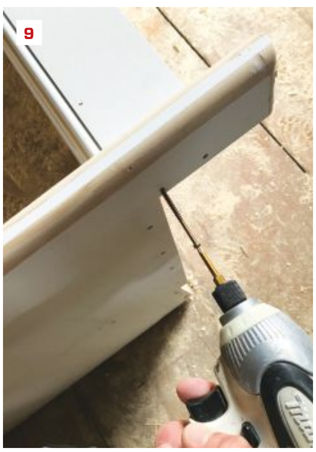
I planned to use 5/4 stock for the stool, with a 1/2-inch rabbet cut along the bottom edge to allow it to bear on the window frame. Both the applied jambs and the frame-and-panel jamb extensions would have 1/4-inch reveals, while I chose a 3/16-inch reveal on the interior edge of the panel extensions, at the casings. The heights of the window rough openings were slightly larger than normal; this was simple to cover with the casing.

Stool layout. The first step in the actual construction of the window trim unit was to glue up the window stool so that it was deep enough to reach from the jamb of the window to the nosing of the sill beyond the plane of the drywall. I removed the primer from the adjoining edges of primed 5/4-by-12-inch finger-jointed pine with a









The author drew full-scale drawings of the trim panels on each window stool **(5)** and laid thin wafers of the chosen moldings on each drawing to determine the dimensions of the overhanging horns of the stool **(6, 7)**. The trim pieces were assembled using glue, trim screws **(8, 9)**, pocket screws, and Festool Dominos.

planer. Then I glued those two pieces together, reinforcing the joint with Festool Domino Tenons as well as pocket-hole screws.

As soon as the two 5/4-by-12-inch pieces were joined, I drew a full-scale plan view of the sides on the window stool to establish the overall width of the stool. A centerline drawn across the glued-up boards (representing the centerline of the window) served as a reference.

At the interior edge of the stool, I marked the overall width of the trim unit, as measured from the centerline. The beaded 3/4-inch-by-3 1/2-inch window casings would have a backband, so to lay out the window stool, I cut 1/4-inch-thick slices of the selected moldings and laid them in place on the stool. The casing would reveal 3/16 inch of the interior edge of the panels, while the horns (ears) of the stool would extend 1 inch wider than the outer edge of the casing backband, determining the overall width of the window stool. I wanted the stool to project into the room 1 inch farther than the backband, which in turn would project inwards 1 3/8 inch from the drywall, to create an even reveal on the stool at the front and outside edge of the casing. This meant that the interior edge of the window stool should project into the room 2 3/8 inches.

So now I had the outside dimension of the side panels of the trim unit at the interior edge, and I had the inside dimension of the side panels of the trim unit at the window edge. Next, I needed to locate (on my full-scale drawing) the distance between the interior edge of the window jamb and the drywall. I had measured the distance between the corners of the window jamb and the surface of the drywall. In plan view, I then drew the location of the interior edge of the window on the stool.

Jamb extensions. The windows had been set in a rough 2x8 PT frame, which was fastened to the antique masonry. Therefore, the windows were not perfectly parallel to the plane of the drywall. To absorb these discrepancies, I used typical 1-by jamb extensions (which were also part of the prebuilt assembly) coming straight back from the window jamb. In order to clear the treated rough framing behind them, the 1-by jamb extensions needed a minimum depth of 4 7/8 inches. And depending on how far the window was out of parallel with the plane of the drywall, these parts were sometimes quite tapered and were cut using a track saw.

I cut rabbets into the edges of the panels at the jamb extensions, which allowed me to maintain a 1/4-inch reveal on the visible edge of the jamb extensions. The sides on the units flared outwards 10 degrees, so the rabbet cut on the edge of the side panels is angled. I made this with two passes on the table saw with the blade beveled at 10 degrees, so that I could screw it to the back of the 1-by jamb extensions with 1-inch-pan-head screws.

The sides each have three flat panels, with the height of the center flat panel centered on the top rail of the bottom sash of the window. This resulted in the upper panel being a shade taller than the lower. The 5/4 material making up the stiles and rails of the panels allowed for solid connections at both the 1-by extension edge (the rabbeted edge) as well as the jack-mitered beaded casing.

I cut the panels from 1/4-inch birch plywood to reduce weight, and sized them so that they would be a shade smaller than the 9/16-inch-deep slot cut in the inner edges of the rails and stiles. The

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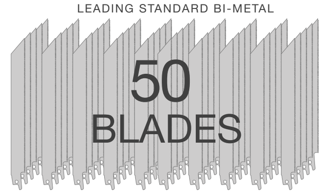
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Jamb extensions coming straight back from the windows **(10)** were joined to side panels at about a 10-degree angle **(11)**. Window casings were jack-mitered **(12, 13, 14)** and preassembled with pocket screws. Then the casings were fastened to the side panels using 18-gauge pneumatic brad nails and trim screws **(15)**.

slot was cut $7/16$ inch from the face of the panels, which allowed the nose of the $3/4$-inch nose-and-cove molding lining the panels to project proud of the rails and stiles.

Each unique trapezoidal top panel was laid out using the shape of the window stool for that particular unit for reference.

Installation. I fastened the 1-by jamb extensions and the panels to each other and to the stool with GRK trim screws. After jack-mitering the joints on the beaded casing, I fastened the head casings to the side casings with pocket screws. Then I fastened the casings to the extensions using glue and 18-gauge brad nails, along with trim screws driven in from underneath the stool.

When we carried each labeled window trim unit to its particular location and installed it, the units pretty much located themselves on the lip of the window jamb. Then I fastened the unit to the rough framing with GRK $3\,1/8$-inch RT trim screws driven through the 1-by jamb extensions, which allowed me to move the 1-by left or right to make the reveals of the window jamb consistent. Finally, I applied the backband molding to finish up the installation.

Nielsen Crist is a finish carpenter based in Bedminster, N.J.


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Building Big Barn Doors

BY DAVE HOLBROOK

Last fall, a client asked me to build barn doors for a new outbuilding. There were two openings in need of doors: one about 8 feet square and the other 12 feet square (the larger opening would allow him to move small boats he planned to build in and out of his new ground-level shop). He wanted hinged double doors for each opening, and because the shop would be conditioned space, he asked that they be insulated. To let extra daylight into his shop, transom windows would be incorporated into the design of the larger doors **(1)**.

Sizing the doors. We chose 2-inch-thick rigid polyiso insulation (R-14) for the cores of the new doors. On the exterior surface, he wanted to use 5/8-inch T1-11 plywood siding, bordering the T1-11 with red cedar to match the barn's western-red-cedar trim. The interior surface would be 3/8-inch AC plywood, making the door's total thickness 3 inches.

For the transoms, I ordered fixed-light, 2-by-5-foot insulating units with 2 7/8-inch jamb depths from Andersen's "Silver Line." Including the red-cedar trim above and below the transom window and at the base of the doors, the total height of the larger doors would be 11 feet 10 inches.

Torsion boxes. I planned to build the doors torsion-box style (essentially, scaled-up hollow-core doors with two skins over a lightweight inner grid). I knew they would only be as flat and true as the surface I assembled them on, so I selected dead-straight 2-by SPF lumber and screwed together an open-frame temporary workbench. I made the bench the same size as the biggest door, scrupulously set to a laser level line and braced to be wobble-free **(2)**.

For the doors' inner grids, I used 2x6 SPF ripped to a 2-inch width. I laid out the grids straight and square (undersized by the thickness of the red-cedar border) and incorporated the window rough opening. To reinforce the heavy-duty strap hinge locations—four per big door and three for the smaller doors—I added blocking. I used urethane glue and screws to assemble the grids, clamping the pieces flush, then gluing, predrilling, and screwing every joint.

Next, I wrapped the perimeters with 2-inch-wide western-red-cedar strips **(3)**. I glued the cedar with

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Photos by Dave Holbrook

urethane adhesive, clamped it up, and let it cure. Because I planned to rip the door edges to a straightedge at final sizing, I avoided using fasteners. I assembled the grid for the second door directly on top of the first, using it as a pattern. I set this second grid aside, marking its opposite face as exterior so that I'd have a mirrored construction once both doors were complete and paired.

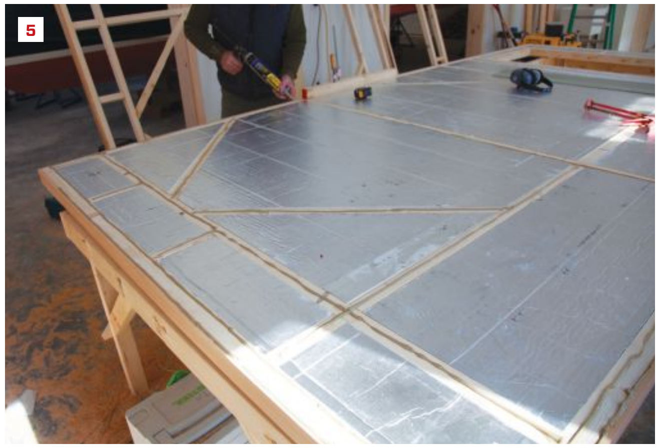
Assembling the pieces. Next, I installed the full-size 4x8 T1-11 panels, which required narrow add-on panels to bring the exterior siding to the same width as the 5-foot-wide transom windows. Here, I backed the joint with a full-length grid member. To provide a seal and eliminate the need for continuous backing at the vertical joint between the cedar border trim and the T1-11, I detailed the joints with the same 1/2-inch shiplap used to mate the T1-11 panels **(4)**.

I attached the panels to their grids using urethane glue and stainless trim-head screws, fully gluing the T1-11 shiplap to seal it. After allowing the glue to dry overnight, I flipped the doors and installed the 2-inch rigid foam **(5)**, followed by the 3/8-inch AC plywood interior face **(6)**. Then I flipped the doors again to install the windows, first dressing the openings with sequenced 3M flashing tape that overlaps aluminum flashing I used to cap the T1-11. Before trimming the windows, I covered the nailing flanges with another sequenced layer of tape **(7)**. Making the smaller pair of doors followed much the same track, although simpler, without windows or border trim.

Installing the doors. It took three men to move the big, 200-plus-pound doors to the opening. I'd already drilled and screwed the hinge pintles along the quadruple 2x6-framed jambs, using a story pole to locate them relative to the blocking in the doors. We shimmed the doors in the opening, establishing a uniform reveal at the side and head jambs. Next, we applied the strap hinges, hanging each on its pintle, then drilling through the door and installing the 3/8-inch carriage bolts **(8)**.

We knocked the shims out and door number one swung free, with a nice sense of heft to it. Door two followed suit, with all clearances shockingly good. The final proof came with all shims removed and the doors swung to join at center. I honestly expected some degree of misalignment, regardless of careful layout. Whether by luck or design or some of both, the doors swung smoothly, with a nice, hefty feel, and met nearly perfectly at center. I then left it to my competent client to apply astragals and interior security bolts.

Dave Holbrook is a JLC *contributing editor.*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Layout for a Brick Staircase

Precise measuring and mason's twine keep courses straight

BY JOHN CARROLL

Photos by Matthew Carroll Navey

Sometimes, in a building project, the most creative part of the job is figuring out how to stage the scaffolding. After that, the actual work can be pretty routine. With masonry, doing the layout and setting guide lines are often the most creative and challenging—and critical—parts of the job. The actual task of laying the brick can be mundane by comparison. That was the case with a set of freestanding brick stairs that I built recently.

Though the masonry skills (mixing mortar, troweling, and brick laying) required for the stairs were routine, the layout was involved. Executing that layout required setting up the lines in some creative ways, and getting those lines correct and then following them precisely was essential to the success of the stairway.

TRADE COMPARISONS

Although masonry makes up most of the work that I do, I'm lucky to have spent a lot of time as a renovation carpenter. The biggest difference between carpentry layout and masonry layout is that the latter is three-dimensional. Carpenters, roofers, and siders usually work in two dimensions, marking their layouts with chalk lines on flat surfaces.

Masons occasionally snap chalk lines, but most of the time, our lines stretch across open space. We often build a small part of a structure on each end and then set a string across to fill in the space between. Sometimes we set up brackets to hold the lines, as I did in several places on this stair project.

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Slab layout. From the porch floor, the crew measured down 66 1/4 inches (6 5/8 inches multiplied by 10 risers) and marked a base line for the 6-inch-thick slab. They set the 1/4-inch-per-foot slope of the base by placing a 6-foot level on the form board with one end of the level sitting on a 2-by block to create the proper slope **(1)**. For comfort and layout simplicity, they set the tread depth at 12 inches. For nine 12-inch treads plus a 12-inch column on each side, the forms extended 120 inches from the porch wall to the concrete walkway, which was cut square to the slab **(2)**. The sidewalk height was close to being right for the slab. The crew used a straight 2-by to screed the concrete even with the sloping forms **(3)**.

Masonry layout typically starts at the top. For example, when laying out brick veneer on a house, the mason establishes a top line about 4 3/4 inches below the sills of the first-story windows (the thickness of a brick sill sloped to shed water). The mason then measures down from that line to lay out the veneer. For this stair project, the layout started at the porch floor elevation. That height determined the height of the slab base as well as the elevation of each step.

Masonry layout is driven by three-dimensional unit sizes (brick and block), especially the height of the units. For these stairs, the rise of 6 5/8 inches was determined by the height of one course of stretchers (2 5/8 inches) plus one course of rowlocks (4 inches). By adjusting the mortar thickness, I can adjust the rise by 1/8 inch higher or lower, but without ripping bricks lengthwise (which is hugely labor intensive), I was limited by those dimensions. (I also could have used three courses of stretchers for an 8-inch rise, plus or minus 1/8 inch). Contrast this with laying out wood stair stringers, where riser-tread combinations are almost unlimited.

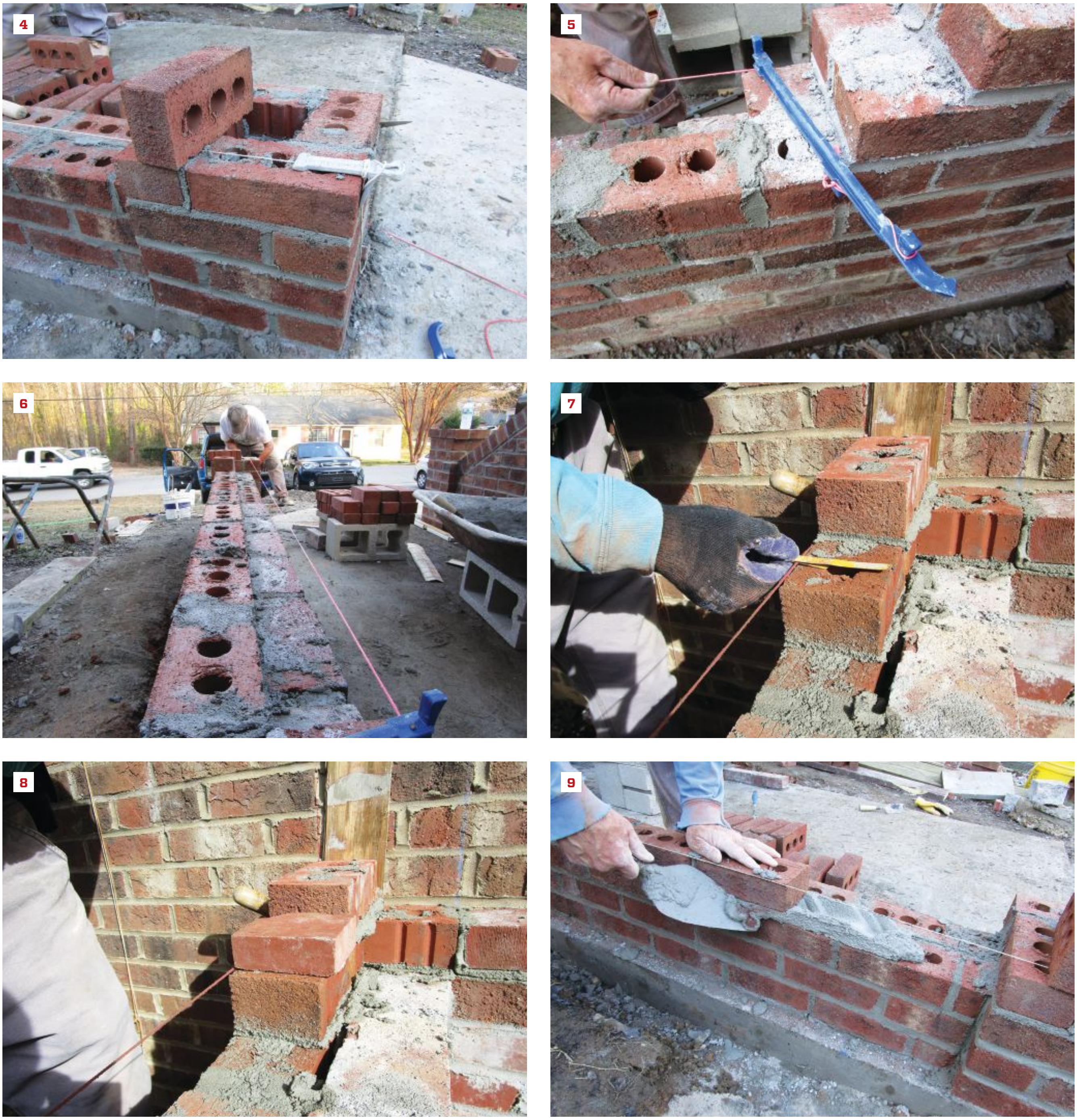
OTHER LAYOUT ODDITIES

Prudent carpenters would never lay out studs on a wall plate one at a time with a framing square. If they did so and were off by just a tiny amount on each one, they could gain or lose length over the course of the layout, which would make the plywood or drywall break incorrectly. Masons, on the other hand, use cumulative gain or loss to their advantage. We deliberately adjust the thickness of mortar joints so that the brickwork grows or shrinks to fit a given space or length. I used this cumulative gain with the rowlock course for each step on this staircase. The tool we use to lay out for cumulative gain or loss is a brick-spacing ruler.

The last big difference between masonry and carpentry layout is that exterior masonry must be pitched to shed water. While wood stairs and decks are typically pitched slightly, it's a more critical detail with masonry. Water drains through the spaces of wood treads and decks, but masonry surfaces are solid and water must flow off of them readily. For this reason, the pitch of a masonry surface (1/4 inch per foot) is steeper than carpentry projects usually require.

This article walks you through each phase of building these stairs, focusing primarily on the layout involved. There is a lot more to masonry work than meets the average eye.

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



Tools for holding mason's twine. An L-shaped line block hooks over the edge of the column to hold one end of the twine while a brick holds it in line with the wall **(4)**. An 8-inch line stretcher hooks over the bricks to hold the other end **(5)**. Tension on the twine holds the stretcher in place while the next course is laid **(6)**. A flat clip, called a twig, is another tool for securing twine **(7)**. It slips around the twine, and while the weight of a brick holds it precisely in place **(8)**, the author lays bricks to the line **(9)**.

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Setting the sloped wall. After laying up six courses on the column, the author made a mark 15 inches above the concrete base **(10)**. Next, he transferred the 15-inch mark to a brick set on the wall with a 3/8-inch plywood spacer to simulate a mortar joint **(11)**. A site-built jig holds the brick at the correct 29-degree-angle (based on a rise of 6 5/8 inches and a run of 12 inches) for cutting on the wet saw **(12)**. The author set the angled brick in mortar along the stretched course line **(13)**.

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Stringing the slope. With the first angled brick placed, the author set up two lines to follow as he laid up the sloping side walls of the staircase **(14)**. At the bottom, he held the lines with a 2-by block ripped to 29 degrees (the layout pitch) **(15)**. At the top, he attached the lines to the sides of a board ripped to 7 5/8 inches (the width of the wall), anchoring them to a makeshift cleat **(16)**.


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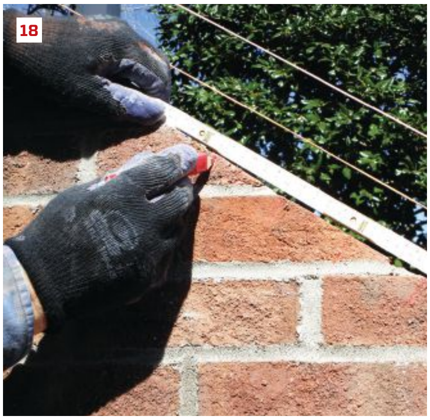
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Capping the side walls. After laying the field bricks for the side wall, the author began the final course of rowlocks (bricks laid on edge). He ripped the bottom brick at 29 degrees for the pitch of the slope **(17)**. Using a brick-spacing ruler, he laid out even spacing of the rowlocks **(18)**, and then set up two lines for laying the rowlocks **(19)**. At the top of the slope, the course transitioned to level with another 29-degree-angle brick. A torpedo level kept the overhang of the column cap straight and consistent **(21)**.


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Weep holes for drainage. To provide drainage, the author left the head joints in the lowest course of the stairs unmortared, with sand keeping the bricks behind that course clear of mortar droppings **(22)**. A rowlock course finished that step, leaving the open weep holes, and he spread a layer of sand to protect the step from mortar droppings as he worked his way to the top **(23)**.

Setting lines for the steps. The author began each step with a 2 5/8-inch-high course of stretchers (bricks laid with their longest edge facing out) **(24)**, then used 2 1/4-inch-high concrete cap blocks for fill so that the first layer of each step was 13 1/2 inches deep. The second layer of each step consisted of rowlocks. Keeping a quarter of a bubble outside the line on the level ensured that the rowlocks would be pitched to drain surface water properly **(25)**. A line guided the installation of the rowlock course. To anchor the line, the author clamped a 2-by block to each side wall, looped the line over nails on the blocks, and secured the line to makeshift cleats on the faces of the blocks **(26)**. He clipped twigs over the line at each end and held the twigs in place with bricks **(27)**. The twigs held the line even with the upper corners of the starter bricks to guide placement of the rest of the rowlock course across the step **(28)**.


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Finishing the steps. As the author laid each rowlock brick to the line, he set his torpedo level on top to ensure that it was pitched the same as the end bricks **(29)**. Every few bricks, he checked the spacing with a brick-spacing ruler. By adjusting the thickness of the joints, he fit the final brick perfectly **(30)**. He buttered one side of the last brick with mortar and set it in place, leaving the other joint open. After spreading mortar on a hawk, he used a 3/8-inch tuck pointer to pack the final joint with mortar **(31)**. He finished the joints with a sled runner, which packs the mortar tight and leaves a straight joint with a concave profile **(32)**. After finishing the rowlock course at the front of each step, he laid two courses of rowlock stretchers behind the front row **(33)**. These bricks ran perpendicular to the front row, with the joints between bricks in each of the two rows offset by half of a brick length. Behind the steps, he filled in with blocks cut to 6 1/4 inches high. With the mortar joint, the blocks came up even with the brick step at the front.

Defining Efficiency Goals

A process for selling performance in new homes

BY INDIGO RUTH-DAVIS

Photos by Indigo Ruth-Davis

Most people who approach our company to build a new house are looking for an energy-efficient home. Some have heard about the Passive House standard but don't know exactly what it means, others have heard about heating with mini-split heat pumps and want to get off using fossil fuels, while others just want to be more comfortable and spend less on heating. Regardless of how serious or committed future homeowners are to energy efficiency in early conversations, decisions will have to be made before bids are gathered and pricing is finalized.

Future homeowners want to make smart, informed decisions about their new home. In the same way that you, as the builder, want to be the one able to offer the best advice on materials and construction details, you want to be the one with the inside scoop on energy efficiency. Helping determine how far to go with energy efficiency is now part of what builders need to be able to do.

I've developed a process for this over the past few years that combines construction cost estimates for four levels of efficiency with Passive House-style energy modeling. This gives homeowners a good idea of what they should expect to pay to heat their home at each level of efficiency, and what that reduction in yearly expenses will cost to build. As the contractor and energy consultant, I am able to provide this completely customized information to the client, information that they will never be able to find on the internet.

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In this example, the homeowners chose a superinsulated wall system with an exterior insulation curtain composed of 10-inch wood I-joists filled with dense-blown cellulose insulation. A smart vapor and air control membrane was located in the center of the wall between the interior stud frame and the exterior I-joist build-out.

I see five main factors that will determine how energy efficient a project will be. The energy modeling in combination with construction cost estimates will help the builder and homeowner address these questions.

- Budget: Can the homeowner afford a Passive House? Can they afford an Energy Star Home?
- Return on investment: Is the homeowner thinking long term? Small efficiency improvements pay for themselves quickly, but over the course of many decades, larger upgrades will save more money.
- Schedule: Is the added complexity of a super-efficient envelope, or lead time on special-order materials like European windows, going to throw off the building schedule? Higher-performing homes take longer to build.
- Comfort: A more energy-efficient home will be less drafty, with warmer exterior wall and window surfaces. These are huge benefits for some people.
- Commitment to the environment: Does this future homeowner want to make a statement with their house and be at the forefront of a movement that is building for a changing climate? Or is saving money up front—or in the future—most important?

PRESENTING THE OPTIONS

I'll use a recent project of mine as an example of how we helped a homeowner figure out their efficiency goals, and how my design and building process helped bring those goals to fruition.

These homeowners had heard about the Passive House standard, and they were interested in seeing if it was possible at their building site and for their budget but were not looking for any certifications or awards. They are environmentally conscious people, but they didn't want to go overboard if it didn't make sense financially. They plan that this house will be the family home far into the future. They had a design that they liked that was roughly 2,200 square feet.

Modeling the choices. My first step was to do energy-model comparisons of different levels of efficiency for their design. An energy model is a computer program that uses information about the building's size and shape, insulation levels, windows, HVAC,

The homeowners chose a rainscreen siding system requiring a drainage-plane membrane and cross-strapping, which resulted in a significant increase in cost compared with the next-lower-performing option.

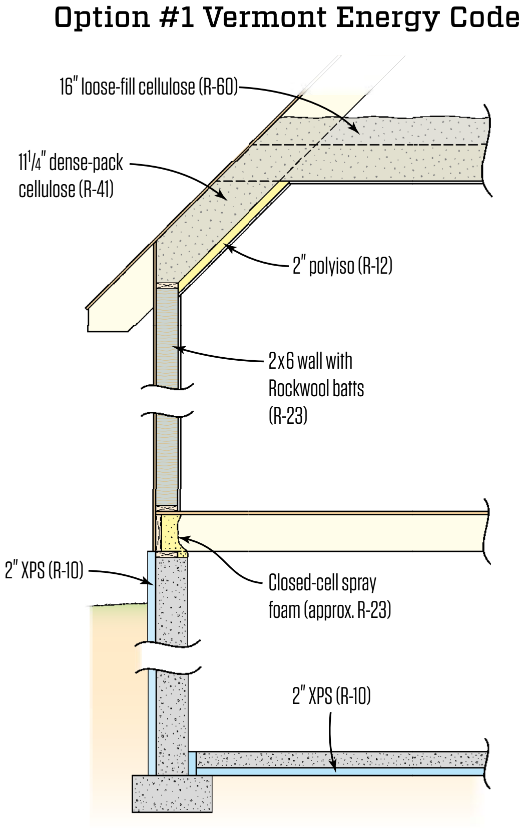
airtightness, and climate data to predict that building's energy use. Since the Passive House standard was still a possibility for this project, I used Passive House software for my energy-modeling comparisons. In particular, I used the Passive House Planning Package (PHPP), although the Passive House Institute US now requires WUFI Passive as the modeling tool for certifying projects starting this year. There are many other energy-modeling tools that would do this comparison modeling; the PHPP isn't necessarily the easiest, but it does have a proven track record for being detailed and accurate, which is an advantage particularly when comparing very low energy demands.

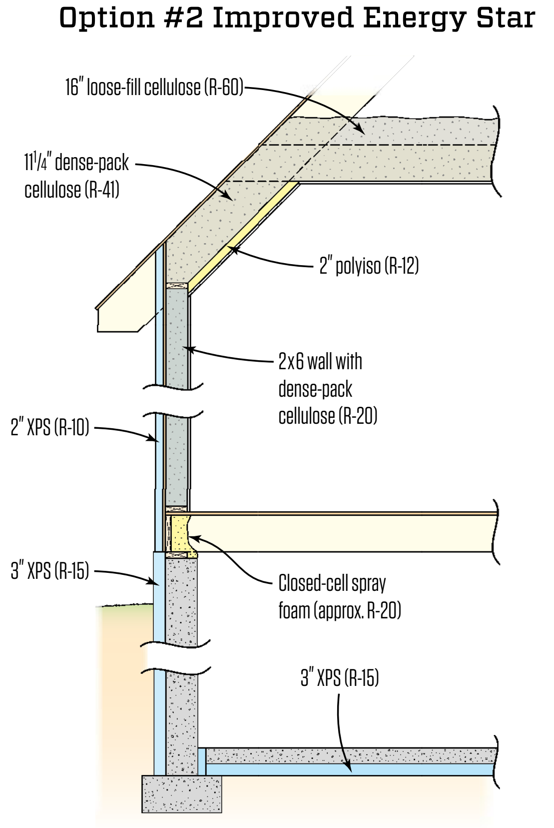
The process of energy modeling itself is simply a matter of inputting all the relevant data into the computer. This includes the square footage of living space, the orientation and square footage of exterior envelope, the size and orientation of each window, the climate where the building will be located, and the R-values of each envelope assembly and U-values and solar heat gain coefficient (SHGC) of the windows. The most time-consuming part of energy modeling is inputting the areas and window list. Once that is done, it is easy and fun to try out different levels of insulation and window specs.

I use four benchmark levels of efficiency for my comparison modeling: the Vermont Residential Building Energy Code, Energy Star (with some upgrades to meet Efficiency Vermont's Base Level Certified Home), Efficiency Vermont's High Performing Certified Home, and Passive House Institute US Certified Passive House. These four levels make sense for my area but could differ by region. The efficiency specs and how I planned on satisfying them for this project are presented in the tables on the following pages.

By the way, the Vermont energy code offers five "packages" or combinations of different insulation levels for compliance. I chose Package #4 to model, because it seemed the most cost-effective option for this house design.

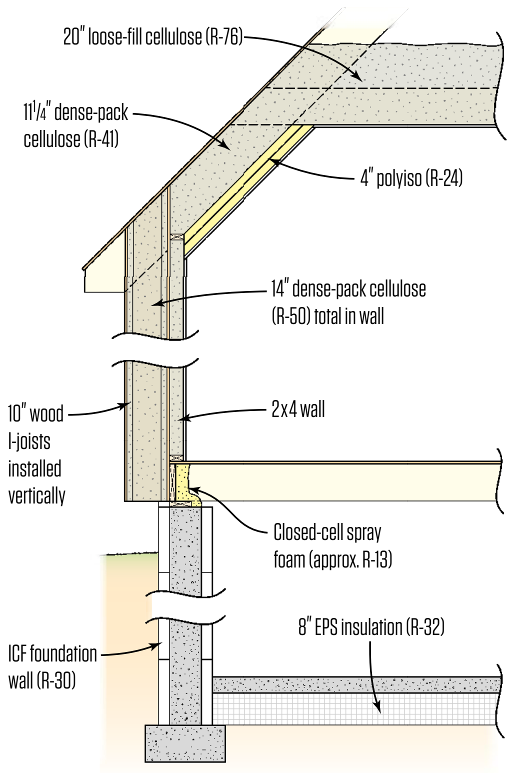
Estimating energy use. With each level of efficiency modeled, the energy use of each level of performance can be prepared. The metric I use for comparison is the heating and cooling demand per square foot of living space in a typical year, or kBtu/square foot/year.



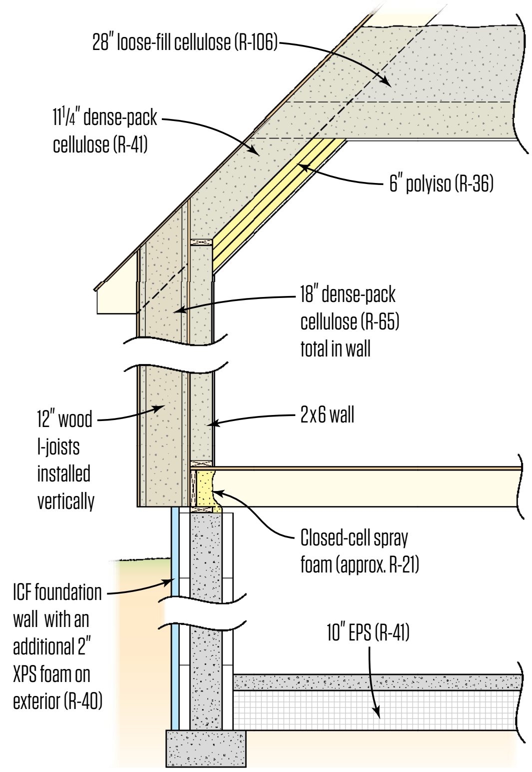


	Option #1 Vermont Energy Code	Option #2 Energy Star
INSULATION		
Sub-slab	R-10 (2" rigid XPS foam board)	R-15 (3" rigid XPS foam board)
Walls	R-23 (2x6 stud walls insulated with Rockwool batts)	R-30 (2x6 walls insulated with dense-pack cellulose with 2" rigid foam on the exterior)
Ceiling Slope	R-53 (11.25" dense-pack cellulose with 2" polyisocyanurate rigid foam)	R-53 (11.25" dense-pack cellulose, 2" rigid foam)
Ceiling Flat	R-60 (16" loose-fill cellulose)	R-60 (16" loose-fill cellulose)
WINDOWS		
	Double pane	Double pane
		U-.27 or less
HVAC		
Heating	Woodstove and mini-split	Woodstove and mini-split
Ventilation	Exhaust fans in the bathroom	HRV (75% heat recovery)
AIRTIGHTNESS		
	3 ACH50	2 ACH50

Option #3 High-Performing Home



Option #4 Passive House



	Option #3 Efficiency Vermont Certified High-Performing Home	Option #4 PHIUS Certified Passive House
INSULATION		
Sub-slab	R-32 (8" rigid EPS foam board)	R-41 (10" rigid EPS foam board)
Walls	R-50 (13.25" dense-pack cellulose. 2x4 walls with 10" TJI insulation curtain to the exterior)	R-65 (18" dense-pack cellulose. 2x6 walls with 12" TJI insulation curtain to the exterior)
Ceiling Slope	R-64 (11.25" dense-pack cellulose, 4" rigid foam board)	R-76 (11.25" dense-pack cellulose, 6" rigid foam board)
Ceiling Flat	R-76 (20" loose-fill cellulose)	R-106 (28" loose-fill cellulose)
WINDOWS		
	Triple pane	Triple-pane Passive House–style windows such as Kleerwall or Schuco
	U-.21 or less	U-.1
HVAC		
Heating	Woodstove and mini-split	Mini-split
Ventilation	HRV (75% to 85% heat recovery)	HRV (80% to 90% heat recovery)
AIRTIGHTNESS		
	1 ACH50	.6 ACH50

FUEL-USE SPREADSHEET		
Option #1 Vermont Energy Code	Wood	Heat Pump
Energy (million Btu/cord; kBtu/kW)	21	0.293
Cost Per Unit	$300.00	$0.17
Yearly Use (cords; kW)	6.28	11,512.68
House Size (square feet)	2,250	2,250
Heating Unit Efficiency	0.65	2.18
% Usage	50%	50%
Yearly Use (kBtu/square foot)	38.07	38.07
Yearly Cost	$941.29	$978.58

In other words, this is a measure of the amount of heat that is leaving the building through the outside walls for every square foot of living space for a whole year. In my climate, a code-built house uses about 35 to 45 kBtu for every square foot of living space in a year depending on the design, while a Passivhaus certified by the German Passivhaus Institute uses no more than 4.75 kBtu per square foot per year, regardless of the climate zone. The kBtu/square foot/year is a useful metric because it doesn't tell someone how big a building they should build or how it should be used, but it does tell them what each square foot of living space will need for heating and cooling. It is also rooted in the projected performance of the building in the climate where it is located, which is a better guide in maximizing performance than purely prescriptive measures like increasing R-values and U-factor levels.

While kBtu/square foot/year is useful during energy modeling, it doesn't necessarily mean that much to the average homeowner. The real goal is to be able to tell the homeowner about how much their house will cost to heat or cool. To do that, I take the kBtu/square foot/year data and input it into a spreadsheet that gives me the cost per year to heat based on the type of fuel used (see Fuel Use Spreadsheet, above). The approach for the heating system on this project was to use a woodstove and mini-split heat pump combination. The example above is for Option #1 Vermont Energy Code, which, given a 50%/50% split between wood heat and mini-split heat, was estimated to cost about $1,919 per year for heat. For each level of efficiency, I convert kBtu/square foot/year to yearly heating costs.

COMPARING CONSTRUCTION COSTS

The next step is to do construction cost estimates for each level of efficiency. Estimating construction costs is the most time-consuming part of this process and as any builder would tell you, the thought of quadrupling the amount of time you would normally spend on estimating isn't exactly the most appealing. Without getting into a debate about whether estimating is part of sales (and therefore nonbillable) or a service an experienced contractor is providing to the customer (and therefore billable), an accurate estimate for each option is critical to the success of this whole exercise. Whether you are charging the client directly for your time estimating different options or are hoping you will get the job and compensate yourself with potential future profits, taking enough time to think through all the potential costs for each option is important.

Each level of efficiency will involve different wall assemblies, different size heating systems, a different ventilation approach, and different windows, each with different labor and material costs. On this project, Options #1 and #2 were similar, while Options #3 and #4 had big differences. To achieve the Passive House heating demand, Option #4 required more windows on the south and more insulation, which meant a different wall construction.

With regard to airtightness, Option #1 required the least effort and cost. For Option #2, reaching 2 ACH50 would be easily accomplished by taping the seams of the rigid-foam insulation layer. General air-sealing would be done in the attic prior to installing loose-fill cellulose. Options #3 and #4 required labor-intensive Passive House air-sealing techniques. Sticking to not more than four options will limit the amount of time you spend on estimating. Some homeowners will want to explore every option available, but for this process, four is more than enough. The final building assembly and price can be fine-tuned later.

The final step is combining the construction cost estimates and heating cost estimates to calculate payback periods. I use a spreadsheet for this (see facing page). I don't attempt to account for energy cost inflation because energy prices move up and down seasonally and year to year.

For this example, the largest jump in cost was from Option #2 (the Energy Star Home) to Option #3 (the High-Performing Home). For the homeowners to be willing to make this jump, they would have to plan on living in the house for a while—almost 20 years—before seeing a return on their initial efficiency investment. After that point, however, the savings start to add up quickly. The reasons for this jump in cost for this particular house were threefold: the cost of upgrading to triple-pane windows (about $7,000), the cost of the added insulation (about $8,000), and the cost of the additional frame needed to hold the insulation (another $8,000). The ratio of dollars spent on upgrades to dollars saved changes drastically at the High-Performing level because of these big-ticket upgrades.

For most projects, the construction cost jump from Option #2 to #3 is difficult to avoid. There will be significant increases in frame costs whether you do a double stud wall or a TJI curtain wall, triple-pane windows will cost at least 20% more, and, obviously, the insulation itself will cost more. If a homeowner is looking for something between these two levels, an over-insulation approach will give the most flexibility. With exterior foam, 1 inch of insulation can be added at a time with little increase in labor cost, and the frame costs don't change significantly. On this project, we were trying to avoid foam as much as possible mostly for environmental reasons, which meant the homeowners were going to have to commit to a cost jump or stick with Energy Star.

CONSTRUCTION COST ESTIMATE				
Efficiency Level	Construction Estimate	Annual Heating Cost	Annual Savings Over Code Built	Payback Period (Years)
Option #1 Vermont Energy Code	**$324,178.00**	**$1,919.87**	–	–
Option #2 Improved Energy Star	$327,738.00			
Efficiency VT Incentive	-$2,000.00			
TOTAL	**$325,738.00**	**$1,311.18**	**$608.69**	**2.6**
Option #3 High-Performing Home	$347,538.00			
Efficiency VT incentive	-$3,000.00			
TOTAL	**$344,538.00**	**$813.44**	**$1,106.43**	**18.4**
Option #4 PHIUS Certified Passive House	$356,968.00			
Efficiency VT Incentive	-$3,000.00			
TOTAL	**$353,968.00**	**$380.94**	**$1,538.93**	**19.4**

THE HOMEOWNERS MAKE THE CALL

These homeowners were willing to make the jump. The biggest factor is always the budget, and for this project, we were able to provide Option #3 within their budget. Because they plan on living in this house far into the future, a payback period of 20 years was worth it for them. The additional comfort this option provided was a bonus.

Going a step further to Passive House at first seemed to make sense based on this analysis, but the devil was in the details. In order to keep the Passive House budget close to the High-Performing Home budget, a few compromises had to be made in the construction cost estimating. The woodstove wasn't needed and therefore was eliminated; we had to switch from domestic-wood-interior/clad-exterior windows to European uPVC windows with limited color options; and the design needed to be altered for more solar gain. With the woodstove and comparable-looking Passive House windows added to the Option #4 budget, Passive House was out of reach. The payback period without these compromises would be 32 years. Passive House performance ultimately involved too many compromises for these homeowners, and they decided to stick with Option #3, the High-Performing Home.

The ability to provide heating cost estimates along with construction cost estimates is a valuable tool that enables builders to have meaningful conversations with future homeowners about energy-efficiency decisions. The size of the house, where it's located, and what its components are (the envelope R-values, the type of windows, the ventilation, and heating systems) have a direct effect on how much the building will cost to live in, and without energy modeling, there is no worthwhile way to have this conversation. Being able to tell these homeowners that they could expect to save roughly $1,000 a year on heating and live in a more comfortable home with the High-Performing option made all the difference.

The four-tiered energy-modeling approach I've started using shows that just about any level of energy efficiency upgrade will eventually pay for itself in this climate. There is no magic point along this continuum of efficiency that every future homeowner should try to attain. If they are building with the future in mind, high levels of efficiency will pay for themselves eventually and the savings will add up over the long term. If the budget is tight, small, simple improvements to airtightness and insulation levels can save a surprising amount on heating and pay for themselves quickly.

Attaining the highest levels of efficiency will most likely involve design modifications, and except in the rarest cases where budget isn't an issue, some compromises will probably need to be made in material choices. For most people in our area who are interested in energy efficiency, Efficiency Vermont's High-Performing Home level is a good benchmark, but with a site well oriented for passive solar gain and with a few compromises, a certified Passive House isn't that far off.

Indigo Ruth-Davis is a Certified Passive House Consultant at Montpelier Construction, in Montpelier, Vt.

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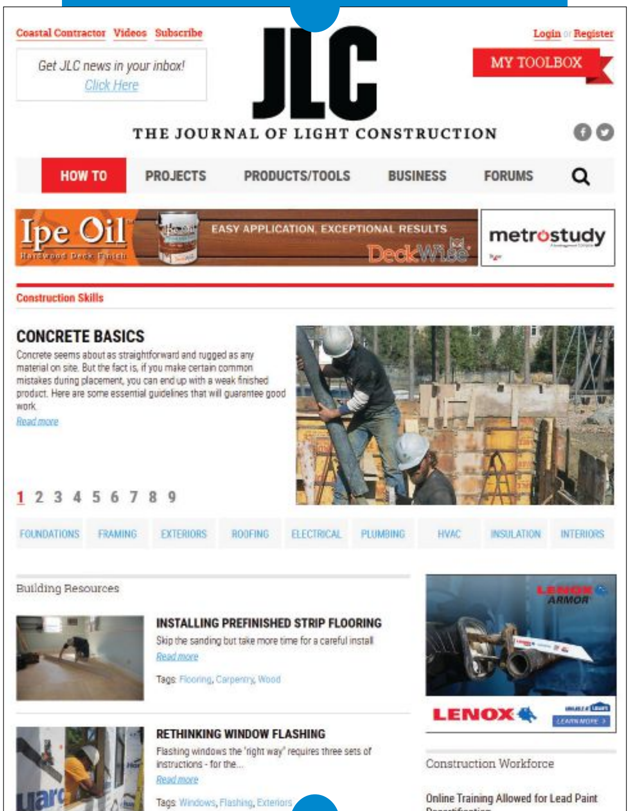

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FOUNDATIONS

A Partial Foundation Retrofit

Save what's solid and replace what's not

BY JAKE LEWANDOWSKI

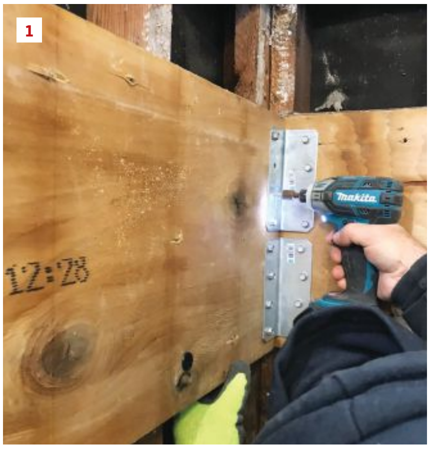
This project started for the clients with a burst pipe in the middle of winter. When they opened up the exterior basement walls—which had been framed and drywalled—to find the leak, they also found a crumbling foundation. Continued investigation revealed that the foundation was failing in two locations. A structural engineer devised repair strategies, and our company, Great Lakes Builders, was hired to do the repair work.

The most deteriorated section of the foundation demanded a remove-and-replace approach. When the original foundation had begun to fail, layers of parging had been applied. Those layers had since separated and the entire foundation on one corner of the house was in imminent danger of collapse.

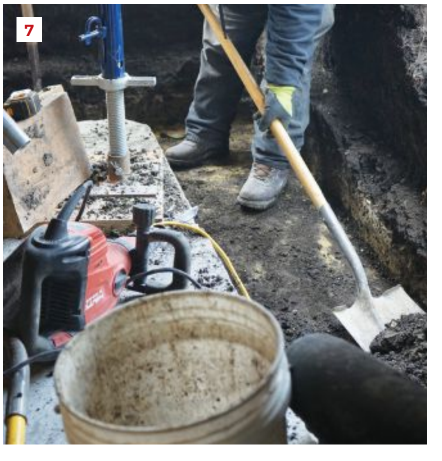
Our plan was to replace the crumbling foundation, but first we had to stabilize the building above. To do this, we attached horizontal LVLs to the exterior wall framing, basically creating temporary headers on adjacent sides of the corner. After installing the LVLs, we made holes in the sheathing for needle beams. Outside, we supported the beams with cribbing, while interior beam support consisted of four screw jacks linked together. Once the structure was reinforced and supported, we could tackle the foundation.

Photos by Jake Lewandowski

Jake Lewandowski is a construction manager with his family's business, Great Lakes Builders (greatlakesbuildersinc.com), specializing in structural repairs, in Elk Grove Village, Ill.



To help support the house walls at the corner, the crew bolted LVLs to the studs **(1)**. A crew member scored the concrete with a saw for the new footing **(2)**. After making holes in the sheathing, the crew inserted needle beams and supported them inside with double screw jacks **(3)** and on the exterior with solid cribbing **(4)**. The beams supported the exterior walls via the LVLs.



The foundation walls in this corner were in bad shape and fell apart easily with an impact hammer **(5)**. Once the walls were removed back to solid concrete, excavation for the footings could begin **(6)**. The crew dug trenches 12 inches deep and 24 inches wide for the footings, removing all the excess soil and debris in five-gallon buckets **(7)**.

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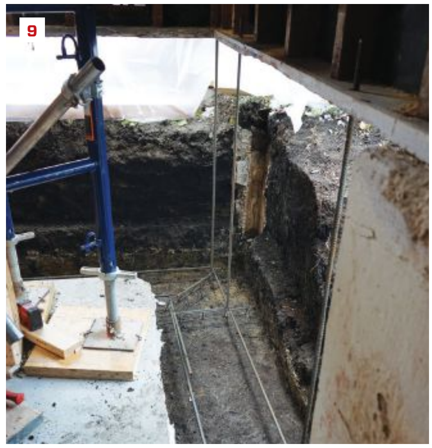

The new footing was reinforced with $^1/_2$-inch rebar, which was tied to chairs pinned to the base of the footing trenches **(8)**. The rebar in the footing was wired together with vertical rebar that extended up through holes in the existing sill plates (which would later be replaced), tying the footing to the concrete-block replacement foundation **(9)**.

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With limited space and limited exterior access, the crew had to mix all the concrete by hand **(10)**. Each batch was dumped into the trench until the footing was level with the basement floor **(11)**. To remove air bubbles and create the densest concrete for the footing, the crew vibrated the wet concrete **(12)**. Vibration not only consolidated the concrete but also made the mix more liquid, which made it easier for the crew to smooth the wet concrete surface of the footing with a float **(13)**.


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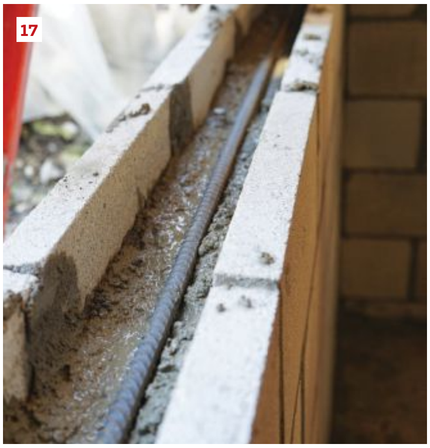
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Masons built the foundation walls with Dry Block CMUs (which are made from water-repellent concrete) **(14)**, packing the cores with grout where vertical rebar extended up from the footing **(15)**. The walls were capped with a course of bond beam blocks, which were tied to the lower block courses with short lengths of rebar **(16)**. After filling the bond beam blocks partway with concrete, the crew installed horizontal rebar **(17)**, then continued placing concrete until the blocks were completely filled **(18)**.


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With the block wall finished, the crew replaced the old sills with new treated sill stock **(19)**. Using inflatable shims and heavy-duty pry bars to hold the new plates tight against the bottoms of the existing studs for fastening, the crew then drove galvanized toe screws through each stud and into the sills to secure the sills to the studs **(20)**.


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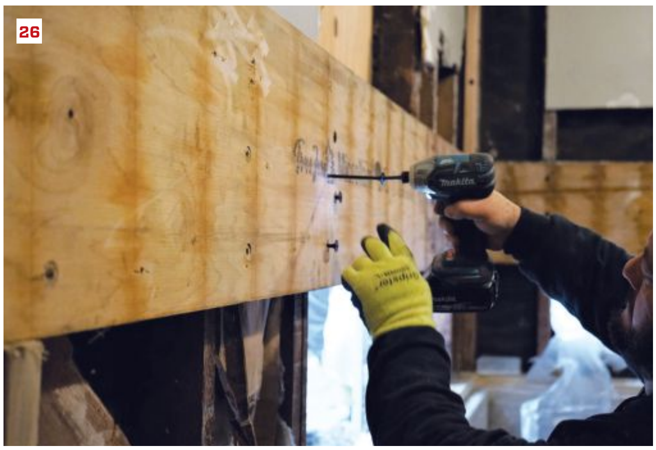
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The crew filled the gap between the block foundation and the sills with high-strength non-shrink grout, forcing it under the sill from the inside **(21)** and outside **(22)** with a margin trowel. They used an edging trowel to smooth the grout along the top of the foundation and to smooth the seam between the existing foundation and the new block foundation **(23)**. After allowing the grout to cure, the crew removed the needle beams, leaving the corner of the house fully supported by the new foundation **(24)**. The crew anchored the sill to the new foundation with Simpson Titen bolts **(25)**, then removed the temporary LVL supports **(26)**.

To finish the exterior of the new foundation, the crew applied waterproofing to the block, after first masking off the part of the block wall that would extend above grade **(27)**. Removing the tape left a clean line on the block **(28)**. Then they secured drainage mat to the block with concrete fasteners **(29)** and backfilled with pea gravel to provide additional drainage next to the mat **(30)**. Once the topsoil was in place, the only remaining task was repairing the beam holes in the siding **(31)**.

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BY SYMONE GARVETT

1. Heavy-Duty Pocket Door

Johnson Hardware just revealed a new version of its Series 2000 All-Steel Split-Stud pocket-door frame. Designed for 2x4 walls, the frame features 18-gauge cold-rolled galvanized steel split studs that can support solid-core doors weighing up to 400 pounds, along with wall-mounted fixtures such as shelves and towel bars. Kits come in 16 different models for doors 1 1/8 inches to 1 3/4 inches thick, in a wide variety of heights and widths. Pricing ranges from $212 to $423. johnsonhardware.com

2. Durable Roof Shingles

The Nordic Collection, IKO's newest line of laminated architectural shingles, has a Class 4 impact rating against hail and resistance to winds of up to 130 mph. Shingles incorporate a 1 1/4-inch-wide nailing surface, with nail positions that IKO says resist pull-through and shingle blow-off. Fastlock sealant strips are designed to create a strong bond between shingles, protecting against wind uplift and water penetration. The shingles are available in nine color palettes. Contact a local distributor for pricing. iko.com

3. Large-Format Glass Tile

Lunada Bay Tile has introduced a new collection of large-format glass tiles, Tomei Modules, for creating custom patterns and statements. It features a neutral color palette that can complement cool- and warm-color surroundings, and its clean lines and large rectangular shapes are inspired by the geometric shapes in modern architecture. The tiles are available in eleven colors, which can be used alone or combined for decorative effect. Each color comes in two finishes, natural (glossy) or silk (matte), and four sizes. The suggested retail price is $30 per square foot. lunadabaytile.com

4. ADA-Compliant Toilet

Icera has added a squared tank and transitional lines to create the new Karo II toilet, crafted from white vitreous china and treated with an anti-microbial MicroGlaze finish. The skirted trapway allows for easy cleaning and has a finished look. The chair-height bowl is ADA-compliant, and the toilet uses only 1.28 gallons of water per flush. The tank lever comes in polished chrome, with additional finishes available. Pricing starts at $924. icerausa.com

5. Sustainable Engineered Flooring
Cali Bamboo has launched its new Odyssey Collection, a line of engineered hardwood flooring that includes European white oak styles, as well as American maple and hickory. Construction features a 2mm hardwood top layer adhered to a laminated birch core, which the company says gives the $\frac{1}{2}$-inch-thick planks dimensional stability. They come in random lengths up to about 82 inches, and in $5\frac{1}{2}$-inch and $7\frac{1}{2}$-inch widths. Pricing starts at $5.49 per square foot. calibamboo.com

6. Colorful PVC Trim
Azek Exteriors is now distributing its PaintPro trim line nationally. The cellular PVC trim features similar benefits to classic white Azek trim, but is designed to be painted any color. Azek says the line's durable, low-maintenance trim boards don't require primer, can be painted easily with one coat, even with darker colors, and can be handled sooner after painting because paint dries significantly faster. Additionally, PaintPro comes in a two-sided, reversible finish: smooth traditional and wood-grain frontier. Contact a local distributor for pricing. azekexteriors.com

7. Drywall Corner System
CertainTeed's No-Coat drywall corners can help finish off angles, archways, and corners with optimal strength and performance. The company says the product's "Structural Laminate Corner System" integrates three components: a tapered copolymer core that withstands severe impacts, joint tape that bonds corner to drywall with mud, and a formulated surface paper that eliminates cracks and peeling, resists abrasion, and accepts any finish. No-Coat comes in outside and inside 90°, bullnose, L-trim, and arch profiles. We found an 8-foot length of outside corner for $3.28 online. certainteed.com

8. Square-Cut Dryer Box
InOvate Dryer Products has redesigned two Dryerbox models, 425 and 350, with square edges instead of rounded edges. The original edges on the Dryerbox 425 and 350 models were designed for installations where a zip tool knocked out the drywall. However, research and input from drywall professionals led the manufacturer to conclude that square cuts were easier, faster, and more precise for installers. All other specifications of the Dryerbox remain the same, including its paintability and its flange that protrudes past the drywall. Pricing starts around $32 per unit. dryerbox.com


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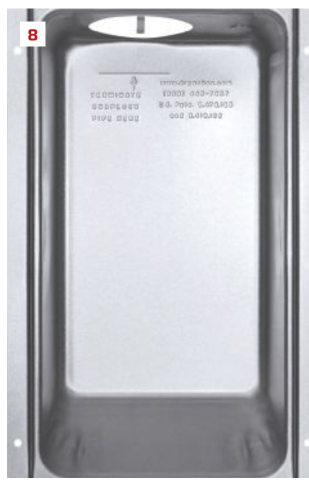
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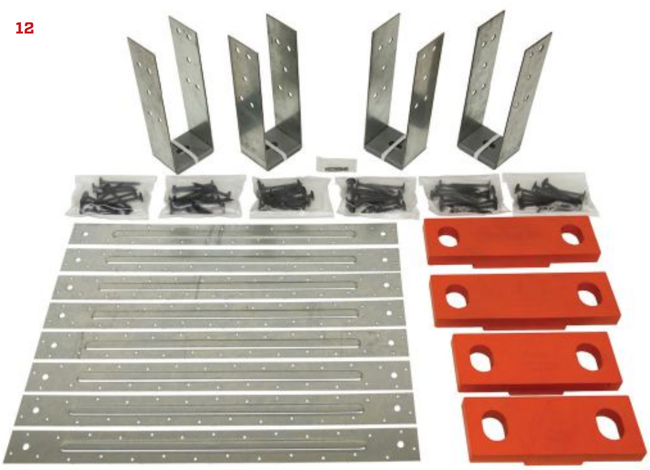

9. Intelligent Kitchen Faucet

The side dial on American Standard's new Beale MeasureFill Touch kitchen faucet can be set to deliver precisely half a cup to five cups of water, measuring more quickly than a person using a conventional measuring cup, according to the manufacturer. Users can operate the faucet by a touch of the hand or wrist to its dial window, a convenience if hands are full or dirty. The faucet is available in a stainless steel or polished chrome finish, and features a pull-down faucet head. Pricing starts at $806. americanstandard-us.com

10. Smart Water Assistant

Phyn Plus, a new, smart water assistant and shutoff, uses pressure-wave sensing to detect water leaks in a home. The system sends real-time mobile notifications to alert users about potential leaks and lets them turn off the water remotely using a Phyn app. In the event of a catastrophic leak, the system has a built-in shutoff valve to turn the water off automatically. The system runs daily diagnostic checks and notifies users of irregular pressure levels and potential ultra-low leaks. Water-usage reports break down how much water each of the home's fixtures is using. Pricing starts at $850, without installation. phyn.com

11. Glass Shower Barn Doors

The Eclipse series by Coastal Shower Doors adapts a sliding barn-door design for modern shower doors. The series includes a frameless door, a single frameless sliding panel, and three Gridscape door designs. The Gridscape configurations feature the same smooth-gliding hardware as the frameless version, with thick, black aluminum frames. Each style is available as a shower or tub door in varying heights, with a choice of six tempered-glass styles. Pricing was unavailable. coastalshowerdoors.com

12. Site-Built Portal Frame

Simpson Strong-Tie's new Strong-Wall site-built portal frame system (PFS) gives contractors a way to meet code-defined wood wall-bracing requirements for narrow wall widths. A cost-effective alternative to IRC braced-wall solutions, the PFS is available in single-wall and double-wall portal frame kits, which include holdown assemblies, standoff and adjustable post bases, truss-ply screws, connector screws, and a six-lobe T40 driver bit. Contractors add lumber and assemble. Contact a local distributor for pricing. strongtie.com


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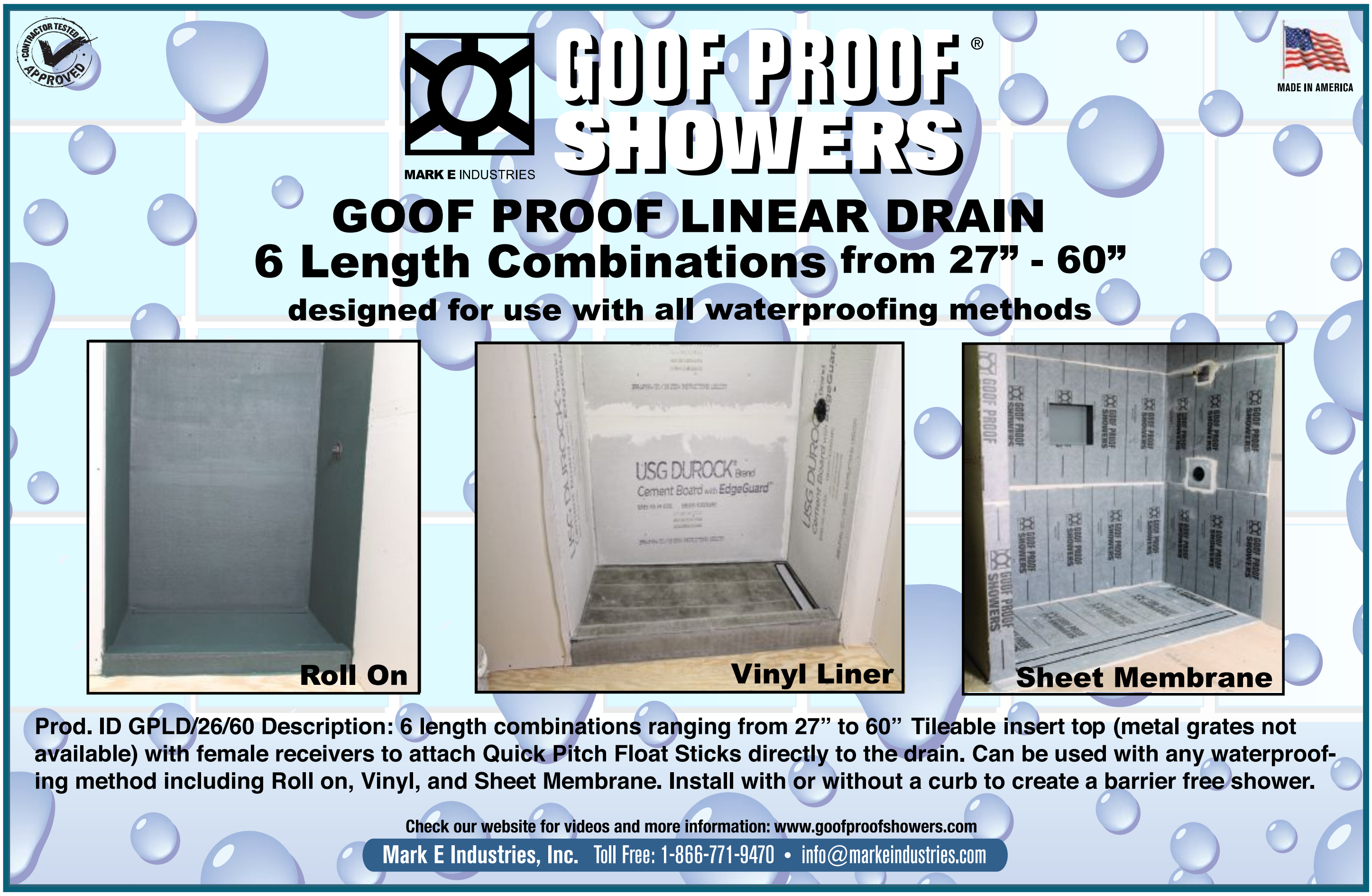
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Sheet Membrane
Prod. ID GPLD/26/60 Description: 6 length combinations ranging from 27" to 60" Tileable insert top (metal grates not available) with female receivers to attach Quick Pitch Float Sticks directly to the drain. Can be used with any waterproofing method including Roll on, Vinyl, and Sheet Membrane. Install with or without a curb to create a barrier free shower.
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Rub Some Dirt in It and Get Back to Work

BY MARK CLEMENT

The general category for this month's tool coverage is "safety." But there are only so many pieces of eye protection and fall-arrest gear any single person can stand to read about, so I'm going to take a wider view and include a few things that'll keep your work safe, your temper safe, and your "you" safe too. First, though, is a reminder to take a first-aid and CPR class; it will be well worth your time. Our co-workers and colleagues don't hurt themselves only with tools or by falling, and you can't solve every jobsite injury with electrical tape and a paper towel (or by rubbing dirt in it). Since it's possible that a co-worker could have a seizure or go into shock or get heat stroke, it's handy to have a reasonably good idea of how to remedy those problems. In a first-aid class, you'll learn that the Heimlich Maneuver is a little more involved than a bear hug, and CPR isn't chest-pounding theater like you see in bad movies.

Standing Cool

I don't know if being cool is actually "safe" in the narrowest definition of the word, but I can certainly say that being uncomfortably warm in a sweltering shop or an unconditioned room isn't maximally productive. And no one would argue that having sweat pouring off your face while setting cabinets or running a table saw is not, at the very least, a distraction.

Now, you can be cool at work when the heat is hammering, with Portacool's Cyclone 140 evaporative air conditioner on wheels. Instead of refrigerants, the portable unit uses water evaporation, ambient air, and a specialized evaporative medium to create a current of cool air. It can be plugged into a 110-volt outlet or a generator, and it can be used with open windows and doors.

The company says that the unit delivers 3,900 cfm and can effectively cool up to 900 square feet—which means it can be stowed in a corner out of the way. Well, as out of the way as anything standing 5 feet tall can be. It costs about $1,000. portacool.com

Safety in a Cage

The Knaack Safety Kage looks to be more commercial than residential in its pedigree, but I think it's a cool idea, at least for jobsites bigger than the ones I work on. The brand calls it the industry's first one-stop-shop for jobsite safety. The interior of the unit has space for fall-protection gear, including harnesses, lanyards, lifelines, ropes, and the like. There are also three shelves for hard hats, vests, and gloves. The top shelf has cubbies for smaller safety items like ear plugs, glasses, and dust masks. The exterior of the unit has protected storage for a first-aid kit, a fire extinguisher, and personal eye-wash station. PPE is not included with the box.

The Power Pass feature allows for power distribution on every shelf. The unit is made of 16-gauge solid-steel panels and has Knaack's Watchman IV Lock System with a three-point latch and recessed lock housing to keep the idiots with bolt cutters challenged. A foot latch enables you to open it with your foot. The doors just pop open. At 370 pounds unloaded, it's a heavyweight. Prices range online from $2,210 to $3,000, so check around. knaack.com

Customers, Dust, and Reputation Safety

I don't need to explain the dangers of dust and disappointed customers. What you perhaps haven't seen is ZipWall's new take on sealing the perimeter of a sheet-plastic dust-containment system. The company's Span Kit looks cool and—thank you, ZipWall—seems to eliminate tape.

The core of the kit is the six included expandable FoamRail Spans that seal the sheet plastic to the walls, ceiling, and floors. The FoamRails telescope from 4 feet 3 inches to 8 feet long and can seal up a barrier 16 feet all the way around, or 32 feet along the ceiling and walls.

There are also mounts for jogging past protrusions like crown molding and radiators, which otherwise result in frustrating holes that you can't tape and that suck drywall dust through your barrier, no matter how carefully you try to seal them up.

The FoamRail Spans and accessories work with ZipWall poles (not included) and come with a carrying bag. A kit costs $270 at the company's website. zipwall.com

Site Light

Cast a little light on the subject with Milwaukee's Radius LED 130-watt Temporary Site Light. At 15,000 lumens, the company says, the "TrueView" high-definition technology reduces the number of fixtures required on a jobsite while still maintaining OSHA standards (if that's on your radar). If it means less squinting, fewer shadows, and vibrant light (the light temperature is 3,900K), then that's good for everybody.

The light is hardwired with a 3-foot, 120-volt power cord, but Milwaukee has designed it with an integrated wiring terminal that accepts voltages from 120 to 277 volts, allowing multiple units to be wired together in a series with MC or Romex cable through universal strain reliefs. Milwaukee says this significantly reduces the labor time associated with temporary lighting installation. Able to hang from virtually any overhead area with its convenient hanging cable, the new light has a quick-feed cable retention, so users can easily adjust the height of the cable during installation.

Milwaukee says the light's polycarbonate lens can survive a 9-foot drop, making it tougher than lenses on a typical work light. As proof, the company offers a limited lifetime LED warranty and five-year product warranty. The Radius costs $250. milwaukeetool.com

Safe Face

Some of the best money I ever spent for work was the nine bucks I paid for my 3M plastic face shield. I thought I'd use it just once, but as it turns out, I've used it so many times for so many things, I forget the original reason I bought it. It's one of those things that I thought would occupy a shelf for most of my working life, but instead has become one of those things about which I find myself saying: Hey, I could use the face shield for that.

I know I used it on an ill-fated job stripping paint from an old door for a quirky remodel I was doing. I wanted to protect my face from the projectile layers of paint that I had planned (wrongly) to rotate out of existence with my angle grinder. The door turned out OK—and nothing touched my face, thanks to the face shield.

It's great for insulation, too. During a basement remodel, I had to stuff fiberglass batts into the ceiling joists of an old house. The bays were filled with ancient dust, so I used the face shield to keep it out of my eyes. Well, it worked, but even better, it kept the dust out of my hair and off my face. Ditto for drywall sanding above my head.

The OSHA-compliant polycarbonate window is tough. After seeing a photo on Facebook of a guy with a failed grinder wheel severing his safety glasses, I know I'll never run an angle grinder without wearing my face shield. 3M.com

Tape It Up

The MyMedic Boat Medic is the first-aid kit of first-aid kits. While it's designed for boating, this thing looks born for the jobsite, with a wide range of medical supplies including a tourniquet, fingertip bandages, and a CPR mask. Everything comes packed in a rugged, waterproof Pelican-style case that comes in bright colors that make it easy to see when it gets knocked over or pushed aside, or (better yet) hung on a wall where those things won't happen to it. Also jobsite friendly, it comes with tweezers and paracord. We'd probably all try to impress each other with various knot-tying skills with the paracord, but the tweezers are sure to come in handy. The company calls it the best waterproof first-aid kit on the planet, describing it as sink-proof, dust-proof, and crush-proof. It's worth a look, even at $300. mymedic.com


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As Best I Can

BY MARK LUZIO

Perfection is elusive. Good craftspeople make mistakes, but most of the time, we are the only ones who see them. That has been mostly true over my career, except for the curious case of one client who, against all odds, could see every detail of my work.

I learned my trade working in various custom millwork shops in New York City. After about six months in one shop, I was given my first project to build to completion. It was a test by the shop owner: Could I be trusted to take a set of drawings and complete every detail of an entire paneled library room with mantel and crown molding? I dove into it and completed the shop work, and then we loaded the van and headed to an apartment on 5th Avenue for the installation. In the elevator, my boss told me that the client was a writer of both novels and nonfiction. He was born in India and blind from a childhood disease.

Before I began work, we went over the drawings with the client, Ved, and spent about an hour checking all the details of the room. Ved wanted to know my plans for dealing with the usual problems of existing windows, doors, and HVAC registers. I was impressed with his questions and his knowledge of interior trim and the details of the room.

The install took about six days, and each morning Ved would be waiting with a coffee. We would spend about 30 minutes in conversation about what I had completed the previous day. I quickly realized that each evening, Ved used his fingers to touch every inch of the work. I began to really enjoy our morning coffee time, listening with amazement to his input and appreciating his understanding of how each detail would fit and how it would all work once the library was complete. We made a few changes during the install, and he listened to my input on a few details. He agreed with me that we should do miter returns in two places on the crown molding and that my solution would "look" good.

Little by little, this experience made me shift how I think about what we really see. Frank Lloyd Wright was known to emphasize to all his apprentices that they should be able to visualize all the details of any design in their mind's eye before picking up a drafting pencil.

Now, looking back after 40 years and countless builds, I realize that Ved was the client who saw the most about my work, including my mistakes. I think of him even now when fixing a mistake on site or in my shop, especially one of those mistakes that I know the client will never "see."

But this remembrance of Ved is layered, and links to another notion about quality. What drives me as a craftsman is not what others—even the rare client who actually sees my work—will look at. Nor is it about an inner sense of, or striving for, perfection. It's "als ik kan."

I first learned about this Dutch expression—which loosely translates to "as best I can"—from studying the work of the American furniture-maker Gustav Stickley, who used it in his maker's mark. The term is widely seen as a statement of his aims in creating simple, unadorned furniture—work that presented a stark contrast to the ornate and indulgent European-style of furniture popular in the 19th century.

"Als ik kan" is acknowledgment that my work isn't perfect. But it's also a testimony that stands in contrast to the low bidders in our trades who aspire only to get work done as quickly and inexpensively as possible.

Stickley learned about "als ik kan" from William Morris, the founder of the English Craftsman movement, who wrote about it after seeing "The Man in the Red Turban," a painting thought to be a self-portrait by the 15th-century Dutch painter, Jan van Eyck. Van Eyck had carved the term into the portrait's frame, and for Morris, this served as apt commentary on the honest portrayal, complete with wrinkles and blemishes, of its subject. Morris celebrated the term as a sharp turn away from the sterile perfectionism that characterized portrait painting in his day. Both Morris and Stickley seized on the term as an antidote to idealism and a declaration of purpose in their trades.

For me, "als ik kan" is both an acknowledgment that my work isn't perfect and a testimony that stands in contrast to the low bidders in our trades who aspire only to get work done as quickly and inexpensively as possible. Perfection is a fool's errand and expediency a rogue's calling. Quality in a work is found not simply by looking, but in seeing; it is achieved not just by building, but in building as best we can.

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

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