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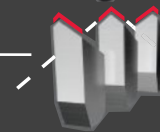
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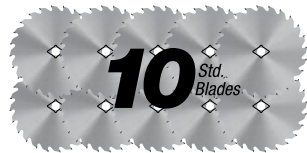


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On the cover: To avoid heat stress, Kyle Davis, of Pioneer Builders in Port Orchard, Wash., knows to drink water often and take breaks in the shade. He'll need both after hauling this floor sheathing. See the story on page 59. Photo by Tim Uhler.

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V.P., Editorial Director John McManus, jmcmanus@hanleywood.com
Editor in Chief, JLC Group Clayton DeKorne, cdekorne@hanleywood.com
Chief Design Director Aubrey Altmann, aaltmann@hanleywood.com
Managing Editor Laurie Elden, lelden@hanleywood.com
Art Director Tina Tabibi, ttabibi@hanleywood.com
Senior Editors Ted Cushman, tcushman@hanleywood.com;
Chris Ermides, cermides@hanleywood.com;
Tim Healey, thealey@hanleywood.com;
Roe Osborn, rosborn@hanleywood.com
Senior Graphic Designer Lita Ledesma, lledesma@hanleywood.com
Contributing Editors Greg Burnet, Sue Burnet, Michael Byrne, David Frane,
Bruce Greenlaw, Dave Holbrook, Joe Stoddard, Jon Vara, Charles Wardell,
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Senior Web Developer Braddock Bull,
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Production Director Theresa A. Emerson
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Editorial & Advertising Offices:
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SALES OFFICES

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Rick Strachan President, Contractor Group

202.736.3332

rstrachan@hanleywood.com

Dan Colunio Vice President, Sales, Remodeling & Distribution Groups

617.304.7297

dcolunio@hanleywood.com

NORTHEAST/MID-ATLANTIC

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BY GREG AND SUE BURNET

Installing a Prehung Door

It used to be, not so long ago, that just about every carpenter hung doors from scratch. But as we rushed to build faster and more efficiently in the post-WWII boom years, specialty shops began making prehung door assemblies that required less skill and less labor to install.

These days, carpenters routinely install prehung doors in both new construction and remodels. But prehung doors are not very forgiving, so having a systematic approach to installation is crucial to being efficient and leaving behind a solid, problem-free product.

We start by unpacking and inspecting every prehung door we take delivery of. The door must fit within the jambs properly, with even reveals and accurately mortised hinges. In addition, the door must be square.

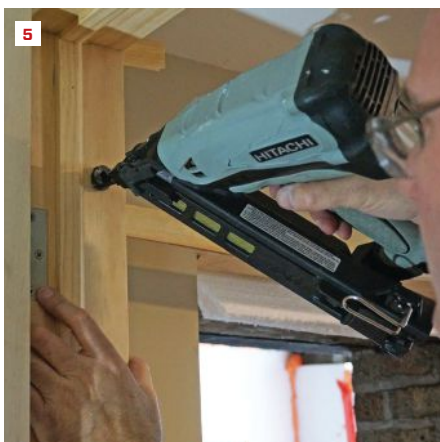
If we see any issues, we refuse the door. A prehung door that does not fit properly in its jamb has little chance for a successful install.

My approach to installing prehung doors has evolved over the years as I've picked up tips and developed more-efficient procedures. In the past, I'd simply grab a prehung door and wrestle it into position. Now I work much more methodically. If the door is prehung correctly by the manufacturer, most of the work is focused on evaluating how square and true your rough opening is and adjusting accordingly.

Greg and Sue Burnet are co-owners of Toolbelt Productions (toolbeltproductions.com), an education and training firm for the building industry.



Always check the rough opening first. Be sure jacks are plumb and not twisted **(1)**. Check the floor level by measuring up a given distance on one side, then leveling over and measuring the distance on the other side **(2)**. If there's a difference, cut that amount off the jamb on the shorter side. Next, use two diagonal strings to check that the rough-opening jambs aren't "cross-legged" **(3)**. When both jambs are in the same plane, the strings should barely touch where they cross.



Once the rough opening is checked and ready and the bottoms of the door jambs have been cut to let the door sit plumb and level, place the prehung door assembly in the opening with shims in the corners at the head jamb on both sides (4). Working the hinge jamb first, insert a shim just above the top hinge. Shoot one nail above the shim (not through it), to hold the shim and the door in place while allowing the shim to be adjusted, if necessary (5). Repeat this shimming and nailing process below the bottom hinge. Place a level on the jamb to make sure it's plumb and straight, and then shim and nail at (either above or below) the middle hinge (6).



To strengthen the installation on the hinge side, remove one of the screws on the top hinge and drive a screw long enough to anchor into the framing (7). On the strike side, insert a shim near the middle of the jamb and tack the jamb in place (8). Anchor the bottom of the jamb with a shim and nail, as well, and adjust the jamb to make the reveal consistent between the door slab and the jamb. Add shims in the spaces between the installed shims on both sides, and when satisfied with the fit of the door, drive nails directly through the shims to hold them permanently in place (9). The additional shims help to keep the jamb from twisting over time. The final step is trimming the shims flush to the jambs with a razor knife.

For more information on installing prehung doors, go to www.jlconline.com/training-the-trades/installing-a-prehung-door.



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How do I waterproof the shingled roof of a framed addition where it meets an existing wall of a log home?

A Robert W. Chambers, a consultant and log-home construction specialist, responds: The new roof of the addition will have step-flashing, installed in the typical fashion with a piece of metal flashing added as each course of shingles is put down. But the step flashing itself does not attach to the log building. After the addition roof is completed, counterflashing attaches to the existing wall of the log building, overlapping the step flashings by at least 2 inches. The height of the step flashing and counterflashing depends in part on whether future log-wall settling is expected (more on that later).

To install the counterflashing, cut a kerf, or reglet, into the logs to capture the top part of the counterflashing. The reglet needs to be deep enough to completely bridge the “valleys” between the logs, and be cut with a slope of at least 30 degrees for drainage. The best way to cut the reglet is with a circular saw, using a straight edge to guide the cut. If the reglet is not straight, sliding the counterflashing into it could be problematic. If the space is too tight for a circular saw, an oscillating multi-tool with semi-circular blade might work.

The counterflashing tucks into the reglet and stays in place by friction, with no pins or nails needed for attachment. The vertical leg of the counterflashing should sit snugly against the step flashing (but not be attached to it in any way). The counterflashing may be caulked to the reglet, but do not use caulk where the step flashing and counterflashing meet.

Log homes take up to five years for the logs to reach the equilibrium moisture content for local humidity

Roof-to-Log Wall Flashing

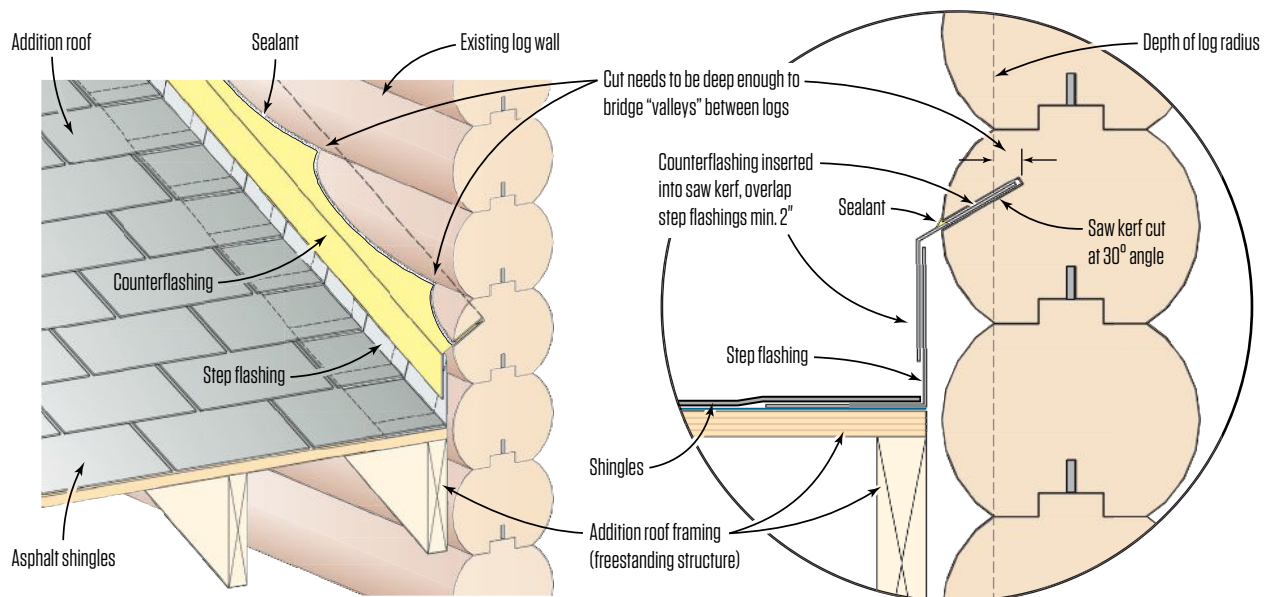


Illustration by Tim Healey

conditions. Up to that point, the logs will settle or shrink dramatically—6% is the industry standard, which means that a 9-foot wall will settle as much as 6½ inches! Your conventionally framed addition will shrink very little by comparison. So if the log home you're adding on to is more than five years old, you shouldn't have to worry.

If the log home is less than five years old, then you must leave a gap between the bottom of the counterflashing and the new roof that is at least as big as the settling that is still expected. You will need to work out the dimensions of the flashing to maintain the 2-inch overlap when you install it, but still have room for the bottom edge of the counterflashing as it settles closer to the addition roof over time.

If settling is expected, the addition should not be attached to the log building, unless you allow for unrestricted movement of

the log building. It is safer to build the addition as a freestanding structure, holding the addition structure away from the logs by several inches. And be aware of any protruding parts of the logs such as knots that may move down and interfere with the addition as the log structure settles.

If you've never worked with a log home before, or if you are unsure about the settling that may occur, I'd recommend consulting with a log-home specialist in your area. Also, there are a couple of good publications that can help you better understand the dynamics of log home construction: *Effective Practices & Methods for Log Home Construction*, available through the International Log Builder's Association, logassociation.org, and *Log Construction Manual*, available at logbuilding.org.



Q The stair layout method described in *Training the Trades* (Apr/17) was great, but what do you do when the rise turns out to be an odd fraction?

A Greg Burnet, author of *Training the Trades* and a remodeling contractor from Chicago, Ill., responds: We used a fairly simple example in the column on purpose, but in reality, the rise calculation rarely works out to a nice, even fraction. For more complex situations, I break out my Construction Master calculator. I go through the same initial steps as described in the article, but then double-check my calculations by multiplying the rise dimension that the calculator arrived at by the number of rises.

This figure hardly ever exactly matches the actual overall rise that I started with. Why? Because the Imperial measurement system that we use in this country is based on units of sixteenths and thirty-seconds and their multiples, and quite often these fractions are not equally divisible by what are essentially odd numbers. As a result, the calculator rounds up or down slightly, providing an approximate rise. The difference is then averaged between all the rises.

In some cases, this “close enough” method may be perfectly acceptable, but if I am doing fine finish work on the stairs, those differences may compound and require me to custom-cut all the finish pieces. Instead, I prefer to go a step further in the calculations.

So let's say that the overall rise is 30¹¹/₁₆ inches and I have four rises. Turning to the construction calculator, I enter the overall rise measurement and divide it by the number of rises (see calculation

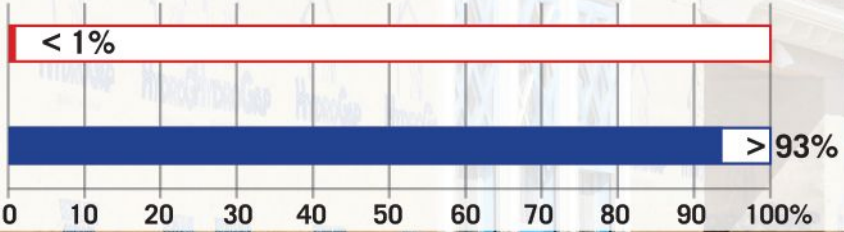
After setting rise and run stair gauges, place a square against the board and mark the heel (1). Adjust a combination square to that measurement (2) and use it to scribe a line down the board at that distance (3).

Photos by Sue Burnet



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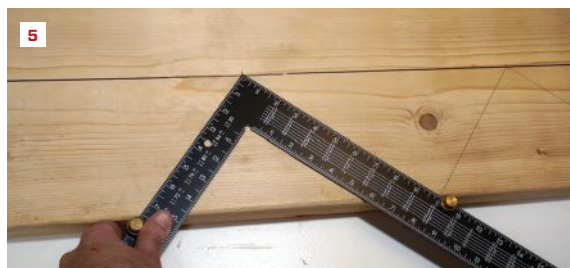
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Determine Unit Rise

Total Rise ($30^{11}/16$ ") \div number of rises (4) = Unit Rise of $7^{11}/16$ " (or 7.671875)

Determine Unit Diagonals

On the Construction Master, punch in the following sequence:

7 **Inch** 11 / 16 **Rise** 10 **Run** **Diag** = $12^{5}/8$ " Unit Diagonal

Then hit **+** **=** = $25^{3}/16$ " **=** = $37^{13}/16$ " (remaining Unit Diagonals)

sequence, below left). I enter the result (7.671875) as "Rise," and the Run (10), and then press the "Diagonal" key. This number (a hair less than $12^{5}/8$ inches) is the hypotenuse of each tread-riser combination. With the number still displayed, I press the "+" key, then the "=" key, and so on, to calculate the number for each diagonal tread-riser location: $12^{5}/8$ inches, $25^{3}/16$ inches, $37^{13}/16$ inches.

The calculator stores the leftover tiny fraction and rounds up or down accordingly. I have my calculator set to $1/16$ inch, so these numbers are all rounded to the nearest sixteenth. This method works because it averages the weird little fractions to the closest sixteenth without creating accumulating errors. I write down these numbers as "Unit Diagonals."

After setting up the square with gauges at the rise and run locations, I place the square against the stringer stock and mark the heel (the intersection of the tongue and body) (1). I adjust a combination square to the heel mark (2) and use it to scribe a line along the length of the board (3). Then I hook my tape measure on what will be the lower portion of the stringer and make tick marks at the Unit Diagonal measurements along this line (4). To lay out the steps, I slide the square along the edge of the stock until the heel intersects each tick mark, and then I strike the tread and riser lines at each location (5). The layout now should accurately reflect the exact overall rise of the stair, with each rise being equal.

After determining the diagonal distance on a construction calculator (left), mark those measurements along the scribed line (4). Then lay out the stringer by aligning the heel of the framing square with each of the measurement marks (5).

The Schluter manual recommends that tile underlayment be installed so that the distance between its edges and the nearest joist is one-quarter of the joist spacing. What is the logic behind this advice?

A Bryant Bouchard, an installation specialist at Schluter Systems, responds: This recommendation seems counter-intuitive, but it's quite ingenious once you take time to understand it.

Typically, the subfloor (which in many cases is $3/4$ -inch T&G plywood or OSB) bends the most at the center of the space between the joists when a load is applied. With 16-inch-o.c. joists, the center is approximately 8 inches from the joists on either side. At the same time that a load is bending the panel down at the center, the areas of the subfloor that are under the second-most amount of stress from the applied load are directly over the joists. Those areas

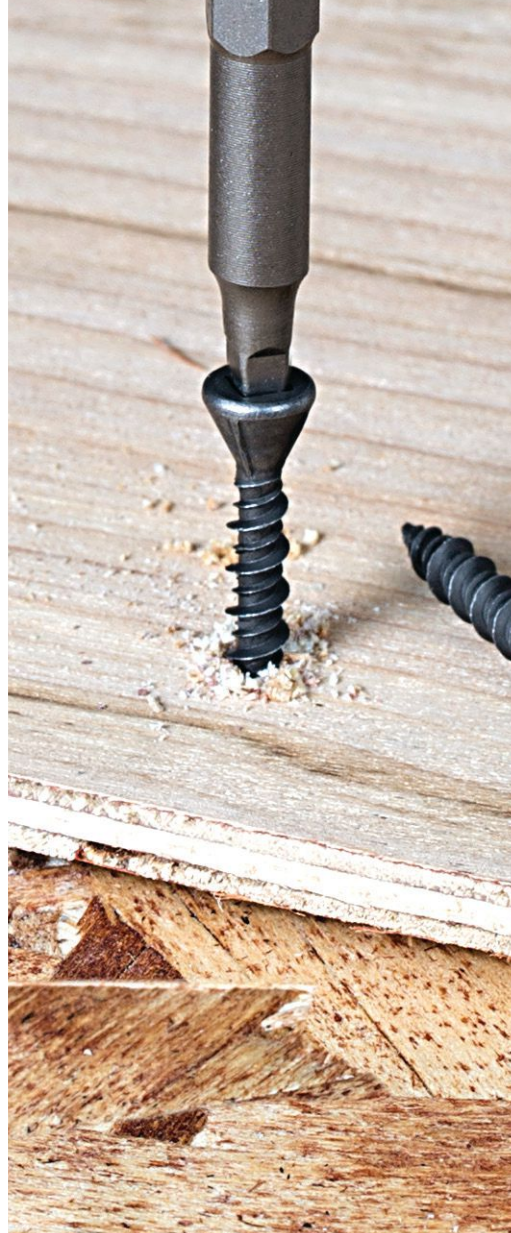
want to lift under the load. So the area in the subfloor that is changing the least—or is under the least amount of stress—is halfway between the center of the panel and the joist, or at the quarter point of the joist spacing.

When installing underlayment for tile, you try to have the least amount of movement to make the floor assembly as stable as possible beneath the tile. The weakest spots in the underlayment are the seams, so when you're putting down the underlayment before applying Schluter's Ditra Mat, we recommend you place the weakest points—the seams—of that second layer of plywood over the most stable area of the subfloor—at one-quarter of the joist spacing. So with 16-inch-o.c. joists, the quarter point would be 4 inches from the joists; with 19.2-inch spacing, it would be 5 inches; and with 24-inch-o.c. joists, the quarter point would be 6 inches from the joists. (Be aware that with wider joist spacing, a thicker subfloor might be needed to meet the deflection requirements.)

And while we're on the subject of underlayment, always remember to leave the proper gap between sheets of underlayment to allow for expansion. We recommend $1/8$ -inch gaps between sheets and a $1/4$ -inch gap around the perimeter of the floor.



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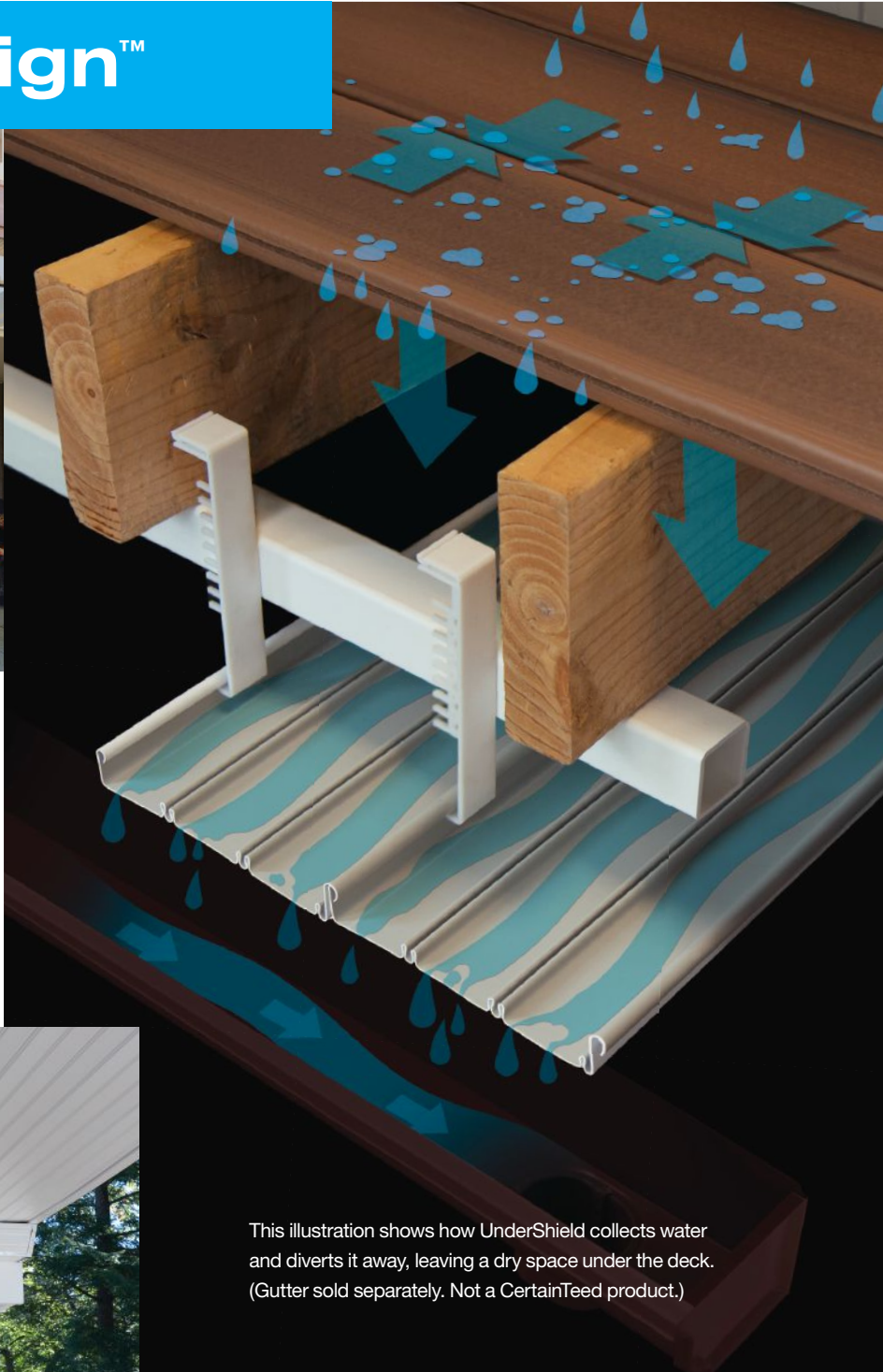
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Green Glue offers a simple sound-dampening method the author employed in a basement apartment. He hung a second layer of ceiling drywall, using two quart-size tubes of Green Glue per sheet. The product is not an adhesive but a sound-absorbing layer that evens out to a 1/8-inch-thick layer when the second sheet of drywall is pressed into place with a drywall lift.

Photos by Scott Gutheridge

Sound-Dampening A Basement Ceiling

BY SCOTT GUTHERIDGE

I was recently in the final phase of remodeling a basement apartment, painting the kitchen and living-room ceilings, when I heard someone talking on the phone in the room directly above. I was surprised, and extremely disheartened, to hear this sound because I thought I had addressed a lot of the noise issues by filling the floor-joist cavities with netted and blown cellulose insulation. That had been my go-to method for mitigating sound transfer on other projects, and I had gotten positive feedback from past clients who convinced me it worked. My current client had a limited budget, and while we were discussing what could be done about sound, he said his chief concern was reducing the noise of tenant conversations. I didn't expect the insulation to stop sound from foot traffic above, but if I could hear a phone conversation above me, clearly what I had promised wasn't working.

Thinking through my options, I remembered talking with a past client who had a basement home theater. He had explained that the contractor who built the house used a second layer of drywall on the ceiling with a special sound-absorbing glue between the drywall layers. According to that client, that method had worked well, and he could barely hear the sound from that room when it was in use.

I did some online research and came across several different products, settling on Green Glue (greengluecompany.com) after watching YouTube videos of various product tests. The method using Green Glue seemed simple enough, and while adding a second layer of drywall to the ceiling was the "least effective" of the methods using this product, doing so wouldn't significantly alter my project and in that way would be a good test. While not a big disruption, this additional step would throw my completion schedule off. I figured the best thing to do was just to admit to the client I had been mistaken about my sound-muffling strategy.

The client understood and gave me the go-ahead for the extra step. I ordered a case of 12 large (quart-size) caulk tubes from an online source that offered free shipping (buyinsulationproductstore.com), and it arrived in a couple of days. The case cost around \$200, or about \$17 per tube. With just the cost of glue, some sheets of drywall, and my labor, I felt the project was inching forward. I decided to hang the extra drywall in the living room and kitchen area first, and if it was successful at reducing noise there, I would continue into the bedroom and bathroom.

According to the manufacturer's instructions, Green Glue should be applied in a random, squiggly pattern on each sheet of drywall. It takes approximately two tubes of glue per 4x8 sheet of drywall. The glue is sticky, and following the instructions, I tried to keep it back from the perimeter of the board to minimize the amount that oozed out around the edges when the sheet was hung. The glue did not run much and stayed where I placed it. When I cranked the sheet up against the ceiling with the lift, I used twice as many screws as I usually do, following the manufacturer's instructions to fasten every 12 inches on-center for ceilings. The glue is not really functioning as an adhesive, but as a vibration-absorbing substance.

As each sheet was hung, a bit of glue squeezed through the outer edges. According to the manufacturer, the compressed glue results in a layer a little thicker than $\frac{1}{8}$ inch, or 0.5mm, between the sheets. The manufacturer recommends using a product called Green Glue Sealant to fill gaps. I hadn't ordered any, so I used the same Green Glue to fill in the gaps around the perimeter and any gaps in the field. Here, the glue kept wanting to ooze out, and I used my putty knife to trowel it up tight until it set up and stayed. (I imagine the sealant designed for this purpose would have oozed less.)

I also had to make sure any extra glue that had oozed between the joints was scraped off so that the drywall mud could bond. The next day, when I went to place the first coat of mud, some of the glue had started to sag around the edges, so I pushed it back into place and quickly taped and mudded the joints. Because of adding a second layer of drywall, I couldn't use products like Rock Splicers to help create recessed butt joints. Instead, I coated the butt joints with a wider swath of mud to create as flat a finish as possible.

When we painted the ceiling, we found a couple of spots of Green Glue that had been accidentally left on the surface. I had to rub and sand all these areas as thoroughly as possible; otherwise, paint would not adhere on them.

After all was done, I was relieved it seemed to work effectively. When someone was talking or walking upstairs, I could still hear sound and voices, but I couldn't make out what they were saying. In retrospect, I realized some of the sound was coming through the ventilation ductwork. Having the basement on a separate heating and cooling zone with no shared ductwork would have also helped to prevent sound travel between floors.

If a project looks beautiful, but doesn't perform well acoustically, you risk having a less-than-satisfied client. To stop sound, there are many other things that can be done—hanging the initial ceiling drywall on hat-channel with isolation clips, using thicker layers of ceiling drywall, and separating the floor structure from the ceiling structure are all effective ways to stop sound vibration that I will continue to explore on other projects when the budgets allow. But it's reassuring to know that something as simple as separating two layers of drywall with squishy layer using a product like Green Glue can be effective at reducing noise transfer.

Scott Guthridge is the principal of Guthridge Construction Services, based in Lancaster, Pa.



In a basement ceiling, if you can get all the wires, pipes, and ductwork above the bottom edge of the joists, two layers of drywall is an easy retrofit for sound control. Gaps can be filled with a thick bead of Green Glue, but it gets messy and you want to scrape it off the face so it won't affect drywall finishing.

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Tiling a Backsplash

BY TOM MEEHAN

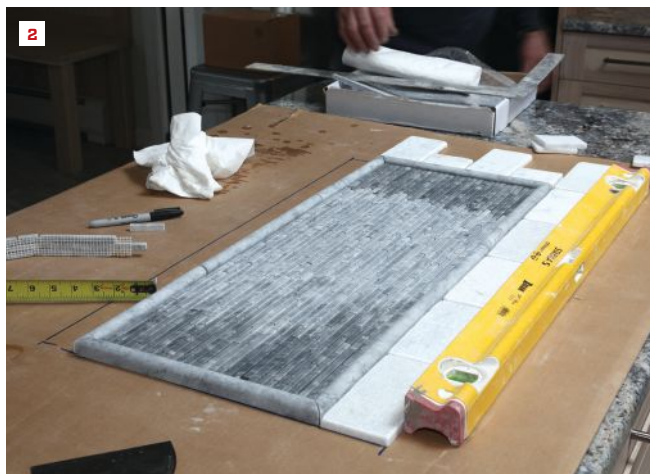
Nothing can put a new kitchen over the top like a tiled backsplash. After bathrooms and tiled floors, it's one of the most common tile jobs that I do.

During a recent remodel that included opening up their kitchen and dining room, clients replaced their old cabinets with Craftsman-style bleached oak and their old countertops with beautifully figured black and white granite. For the space between the countertop and upper cabinets, they chose tumbled marble subway tile, with a framed mural of horizontal mosaics over the stove. They also wanted

the same mosaic tile installed under the window behind the sink.

Knowing that with proper prep-work a tiled backsplash installation usually goes smoothly and quickly, I started there. In this kitchen, part of the prep was patching old outlet holes, left in the wall when the outlets were relocated to strips below the upper cabinets. With that small task completed, I was ready to roll.

Tom Meehan, co-author of Working with Tile, is a second-generation tile installer who lives and works in Harwich, Mass.



Prepping the backsplash. The author begins by screwing a temporary ledger to the wall behind the stove to support the tile (1). For the mural that will be installed above the stove, he does a dry layout first, cutting the mosaic sheets to fit inside a mitered border (2). Drywall patches bedded in thinset fill the holes left over from relocated outlets (3). Behind the sink, a bead of silicone seals the seam between the tile and the countertop (4).

Photos by Roe Osborn



Tiling the mosaic wall. After determining the exact location of the mosaic mural over the stove, the author installs the subway tile, working from one side of the mural toward the corner, using wedges to keep the tiles spaced evenly (5). He then takes the mural tiles directly from the layout board and installs them behind the stove. A rubber trowel beds the mural tile into the thinset and flattens the mosaic (6). The subway tile then runs from the other side of the mosaic mural to the other corner to complete the first backsplash wall (7).



Tiling the second backsplash wall. Tile layout for this wall begins with a full tile at the window casing, where the tile will be the most visible (8). Odd sizes won't be nearly as noticeable in the corner under the cabinets. The installation continues from that first tile toward the corner (9). Then, after the author installs the mosaics under the window casing and behind the sink, he works from the other side of the window over to the opposite corner (10).



Bring on the grout. The author applies a coat of sealer to function as a grout release on the stone tile (11). The grout goes onto the field tile in the usual fashion, applied with diagonal strokes in opposite directions until all the joints are filled (12). A narrow grout trowel can be used in hard-to-reach places, such as under the mural and behind the sink. After the grout begins to set up, the author uses a dry paper towel to make the first wipe. He purposefully does not add water, because too much water can weaken the grout (13).



Special grout for the mosaics. After taping around the edges of the mosaic mural, the author applies a darker color unsanded grout (14). While the grout on the mosaics sets up, a damp sponge cleans the surface of the field tile (15). When all the tile has been grouted, the author then removes the final grout haze with paper towels (16). Even when stone tile has been presealed, a final wash with grout cleaner may be necessary to clean the last of the grout off the stone. The author finishes the job with a coat of sealer on both the tile and the grout, and the kitchen is ready for the chef.



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Close-Up on Taping Drywall Seams

BY MYRON FERGUSON

All drywall seams need to have tape embedded in joint compound. The tape strengthens the joint, and the joint compound, or mud, is the adhesive that holds the tape in place. But there's a lot more to hand-taping beveled drywall seams than slapping a bunch of mud on the wall and running tape. In this article, I'll focus on the methods I use for taping beveled (or tapered) seams with the most common types of tape—paper, fiberglass-mat, and fiberglass-mesh.

Paper tape is the tape used most often by professionals. Fiberglass-mesh tape is self-adhesive and is more popular with people who tape only occasionally, because it has a light adhesive on it and you can run it out over the seams and then cover it with compound. This saves you from the juggling act of applying mud and tape simultaneously. Fiberglass-mat tape is at least as strong as paper tape and gets embedded in a similar manner but, like fiberglass mesh, is made from an inorganic material.

CRITICAL FIRST COAT

In my opinion, the first coat (when you embed the tape) is the most important part of the drywall finishing process. Some folks think that it's the sanding or the finish coats that are most important. But if you get the tape embedded properly in joint compound to begin with, you create a strong foundation. This is critical to a good finish. The joints must be as strong as the drywall itself, otherwise normal movement of the wall and ceiling framing can cause cracks to appear at the seams. If you get the first coat right, the other two coats are relatively simple.

Mud matters. I prefer to use an all-purpose, heavyweight, drying-type joint compound for embedding paper and fiberglass-mat tapes. The heavyweight, all-purpose material (the original type of all-purpose compound) is stronger than lightweight or mid-weight compounds.

By a "drying-type" compound, I am referring to a compound has to air dry before subsequent coats can be applied. Drying compounds shrink slightly when they dry, but this shrinkage is not a problem if you use a paper or fiberglass-mat tape, as I will explain further on. In contrast, a setting compound (sometimes called "hot mud") does not dry, but rather it cures by a chemical reaction. Setting compounds are stronger than drying compounds, but if you're using a paper or fiberglass-mat tape, added strength is not the reason to use hot mud, it's speed. Setting compounds will cure faster than drying compounds will dry, so you can apply the finish two coats sooner.

Drying compounds are purchased in premixed form, and most of the time, the premixed drying compounds are the proper consistency for embedding tape right out of the bucket or box, but mixing the compound is still recommended. Mixing loosens up



First coat. For hand-taping, there are three options for carrying mud (1)—a hawk (left), a large trowel (center) or a pan (right). The author uses a 6-inch knife for the first coat (2), applying a healthy 1/8-inch-thick bed of compound on the seam. He coats the entire length (up to about 20 feet) before rolling out the tape and gently pressing it into the mud every 18 inches or so to keep it in place (3).

Photos by Linda Ferguson

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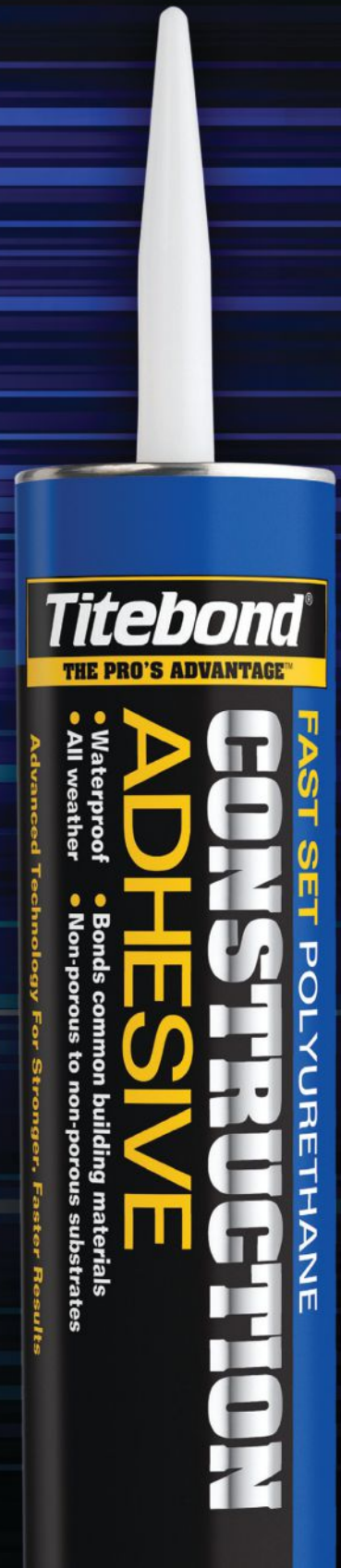


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the compound; for minimal effort, the mud becomes easier to apply. Older mud may be stiff and you can add a little water to it. But use caution: Over-thinning can also reduce the strength and adhesion qualities of the compound. Whether added water is needed is a judgment call. Too thick of a compound means working harder physically and working slower. But if it's too thin, the mud won't stay on the tools. This slows you down, too, and the jobsite soon becomes messy.

Taping tools. There are basically two tools needed to embed the tape—one to hold the compound and the other to apply the compound on the wall and embed the tape.

There are three options for holding the compound. A mud pan can hold quite a bit of compound, and its edges work well for removing compound from a taping knife. Because it is shaped like a bread pan, even thin compound won't end up on the floor; a pan is a must when you're working with thinner compounds.

A hawk can also hold a lot of compound, even more than the average pan, but it takes experience to hold a hawk so the compound doesn't run off. The compound can't be too thin or it will. The edges are used for removing compound from the taping knife.

A large, 11- or 12-inch drywall trowel can also be used to hold the compound, but of the three options, it holds the least amount of mud, and thin compound will run off the edges. Because the trowel holds less compound, a person using a trowel generally makes sure the compound bucket is always close at hand. The one benefit that a trowel has is that it can be used to smooth out compound that is applied with the taping knife, if the need arises.

Taping knives come in different widths, typically from 3 or 4 inches to 10 or 12 inches wide. For the first coat, I use a 5- or 6-inch taping knife to apply compound over the seams.

Getting mud on the seam. The basic technique I'll describe is for beveled seams—the long edges of a sheet of drywall. The drywall sheets should lightly butt each other. Any gaps that are wider than $\frac{3}{16}$ inch between two sheets of drywall should be prefilled with a curing-type compound and allowed to dry before you begin to tape out the seams.

When I'm ready to tape, I grab a taping knife and remove some compound from my container by pushing the knife under the compound, and then twisting the knife over, cutting the compound off against the side of the pan or the surface of the hawk or trowel.

On the first pass, I spread the compound over the seam. With the knife blade centered on the seam, I guide the knife along the seam at about a 20-degree angle from the drywall surface. Grabbing more compound, I make the next pass. My goal is to leave an even layer about $\frac{1}{8}$ inch thick over the seam. This is thicker than compound manufacturers say you need, but at this initial stage, you want plenty of mud on the wall so you don't end up with dry areas under the tape. The excess mud at this stage will get forced out from under the tape later, as I will explain.

I apply the compound over the entire length of the seam, up to about 20 feet long. I work multiple seams in my immediate area, applying mud on the entire length of each seam before I begin to embed the tape.



Embedding the tape. With the tape positioned over the seam, the author draws his taping knife along the length, holding the knife at a steep 60-degree angle while pinning the tape in place with the trowel he uses to carry compound (4). He tests the embedded tape (5); if it leaves a dimple, not enough mud has been forced from the back of the tape. You can also peel back the end of the tape to inspect (6): There should be an even layer no more $\frac{1}{16}$ inch thick.

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Embedding paper tape. Once the compound has been applied, center the tape over the seam. For efficiency, I keep a tape reel on my belt and roll it out from there. This saves me from bending down to grab the roll off the floor and from hunting around for it.

I press the end of the paper tape into the compound with my hand at one end of the seam, and as the tape is pulled off the reel and centered over the seam, I press it lightly into the compound every 18 inches or so to hold it in place. The tape has to be kept tightly pulled as it is centered over the joint. Once the end of the seam is reached, the tape can be cut. I do this by pushing the edge of the blade tight into the compound with my taping knife, then pulling the tape across the blade, tearing it crisply.

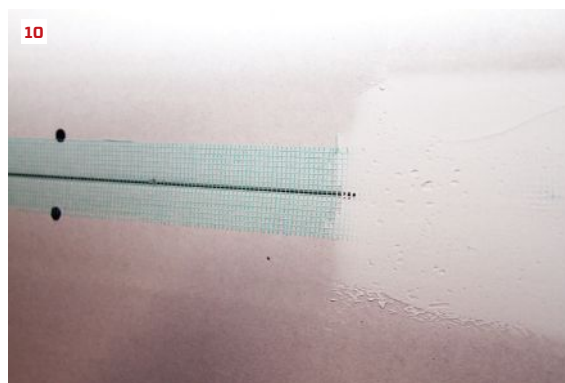
Pre-creased paper tape is not just for corners. It works well for flat seams, too, but you want to place the tape so the crease creates a valley, so to speak, rather than a peak. (If the end of the roll of paper tape sticks out of the bottom of a reel, the tape will be pulled off the reel with the correct side—the back—facing down into the compound.) If the tape gets embedded backwards, the center of the tape could ridge out slightly after embedding, which may be difficult to conceal later when you're applying the finish coats.

Once the paper tape is positioned over the seam correctly, it has to be embedded into the compound. Start at the center, regardless of the length of the seam, and draw the knife along the tape towards one end, holding the blade and handle at about a 60-degree angle to the wall. This steep angle makes it easier to apply the necessary pressure to properly embed the tape. But even so, it requires a lot of pressure to pull a knife along the tape and force excess compound out from behind the tape. To avoid pulling the tape along, I hold it in place with the corner of whatever tool I'm using to hold compound (in photos 4 and 5 on the previous page, I'm using a trowel, but the corner of a hawk or pan also works).

One way to test whether the tape is embedded properly is to tap on the embedded tape with a finger or the edge of a trowel. The surface should not dimple enough to wrinkle the paper or cause a visible indentation. If I'm concerned about removing too much compound, I'll lift the end of the tape to inspect the amount of compound left behind. I want an even layer no more than about $\frac{1}{16}$ inch thick. Leaving too much compound behind can make seams difficult to conceal later because the tape may form a slight ridge.

Fiberglass-mat tape. When finishing tapered seams, I prefer mat tape because it is so easy to embed and I am confident in its strength. It gets embedded into seams in the exact same manner as paper tape, using the same heavyweight all-purpose joint compound. However, fiberglass-mat tape is easier to embed because the mat is porous, making it easier to force excess compound out from behind the tape. You can freely apply plenty of compound over the seam and not worry about working too hard to smooth it out, eliminating the likelihood of dry areas behind the tape. The only precaution is that mat tape cuts a lot easier than paper tape, and you need to be careful not to apply too much pressure with a taping knife, otherwise you can damage the tape.

Fiberglass mesh tape. There is a wide variety of fiberglass mesh tapes on the market. Some have very close fiberglass strands, while



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Non-paper tape. Fiberglass-mat tape gets embedded into joint compound the same way as paper tape (7). The mat is woven in such a way that it can stretch slightly as the compound dries. Fiberglass-mesh tape is a different animal. While there are different varieties, including different weaves (8), all fiberglass-mesh tape gets applied over a dry seam (9). This can save time because it eliminates the step of pressing the tape. All mesh tapes should be coated with a setting compound (10), not a drying compound. Mesh tape is more resistant to stretching and can leave fine cracks at the tape edge when a drying compound dries and shrinks.

others have strands that are quite wide apart; there are even different weaves available. As far as I know, all varieties are self-adhesive.

Unlike paper or fiberglass-mat tape, fiberglass mesh resists stretching. This means that when the seam is put under stress, which happens when a drying compound dries and shrinks, you can get fine cracks along the seams. For this reason, drying-type joint compounds are not recommended for most fiberglass tape; you should use a setting compound. The added strength and bond of a setting compound give the fiberglass mesh tape the necessary strength. The setting compound is mixed to the same consistency as the drying-type compound. There is no need for a fast setting time; the main goal is to strengthen the seams. But, of course, if the tapper wants to apply the first finish coat earlier, there is no detriment to using a faster setting compound.

With mesh tape, you just roll out the self-adhesive tape, pressing it into place over the seam by hand or with a taping knife. At the end of each seam, the tape can be cut, either with the taping knife or with a utility knife. The mesh tape gets embedded when it gets covered with joint compound. I typically apply this compound with the same 5- or 6-inch-wide taping knife, firmly pressing the compound through the tape. A trowel or knife can then be used to remove the excess and smooth out the remaining compound. Because the tape just has to be coated, the same tools you use to apply the tape are kept in hand, speeding up the process.

Mesh tape offers several advantages over paper and fiberglass-mat tape. The main advantage is speed. Using mesh tape as I just described is typically faster (at least for hand-taping) than embedding paper or fiberglass-mat tape. You can tape over all the seams in an entire room before applying any compound. Taping and mudding become two separate steps, and you eliminate the step of pressing the tape into the compound to force out the excess mud, which saves a lot of time and effort.

Using fiberglass mesh tape also greatly reduces the likelihood of any blisters under the tape. A tape blister is a small dry area under paper tape that may not be noticeable until a finish coat is applied over the tape. The area will then show as a blister-like spot.

Myron Ferguson is a drywall and home performance contractor in Galway, N.Y.

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BY MELANIE HODGDON

The Right Reports

In my previous column (“The Reluctant Bean Counter,” Feb/17), I described ways you can work with your bookkeeping staff to develop reports that will help you make better management decisions. This month, I’ll focus on the substance of those reports. You don’t want to get buried in accounting reports; you want only the ones that answer questions that let you make management decisions based on company data. These can be grouped as follows:

Financial reports. If you can’t give your tax preparer something that is accurate and complete, you’re missing the boat. At the very least, your accounting software should provide you with reports that help you and your tax preparer file company taxes. Even more important are reports that show the gross margins and net profit you achieved.

Profit-center reports. You should be able to identify what kinds of jobs produce the highest profit. Without knowing whether you’re making more on kitchens than on baths, for example, how can you decide where to focus your marketing?

Job-cost reports. You should be able to perform job autopsies for every completed job. Regardless of what categories you have set up to compare your budgeted costs with actual costs, you must be able to sort out which cost estimates were accurate and which were over or under. But it’s not enough to just know you didn’t make the profit you’d hoped for on Job X. If you can’t tell exactly where things went south, how can you plan to avoid similar mistakes on the next job?

Time-related reports. It’s obvious if you do T&M invoicing that you need to accurately report the number of hours spent on each job, so you can invoice for what you’re owed. But tracking time can show so much more.

Let’s say you use a lead carpenter system. Your lead carpenter will be engaged in two different kinds of job-site activities: production tasks (like demolition, framing, and trim) included in the estimate, and administrative tasks (like meeting with inspectors, conducting preconstruction meetings with subs, and writing change orders). If both categories of time are tracked separately, you can generate a simple proportion to use when estimating future jobs. For example, if the lead worked 90 hours on the job and 10 of those hours

were spent performing “administrative” tasks, then for every hour of production time, he spent $\frac{1}{8}$ hour of administrative time (a ratio of 10:80 or 12.5%). The next time you price a job, add 12.5% hours to the estimated production hours.

Unless a company is very large, it’s common for a few people in the office to perform multiple tasks. In fact, in the early phase of a business, it’s common for the owner to wear many hats. And to grow the company, you need to know how much time is spent performing each type of task. This requires office personnel (including the owner!) to record time based on their different roles—bookkeeping, marketing, sales, estimating, production management, and the like. This way, even if you have multiple people performing bookkeeping tasks, at the end of the year you’ll have a total number of hours spent, and this might help you decide whether hiring a full- or a part-time bookkeeper is justified. You don’t have to make yourself crazy; just be sure that at the end of each day, you reasonably track what kinds of tasks were performed and how long they took.

Profit-sharing reports. Every company I know has a slightly different formula for sharing profits. Regardless of how you do it, you want reports that identify the key figures in your profit-sharing policy. For example, if quarterly profit sharing is based on gross margin achieved on each closed job, you need to be able to run a report showing the gross margins for all jobs that closed in a given quarter. This can be done easily if you plan ahead.

THINK IN QUESTIONS

For reports to work for you, stop thinking in terms of what canned reports are available, and think instead about what kinds of questions you need to have answered in order to monitor, modify, and improve. If you’re not an expert in the software, seek assistance from somebody who not only will be able to create the framework for the report and train you in how to populate it, but who also can suggest useful reports to answer those questions that you haven’t thought of yet.

Melanie Hodgdon, president of Business Systems Management, provides management consulting and coaching for contractors.

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BY TED CUSHMAN

Insulating Foundations In Earthquake Country

California's energy code (known as Title 24) has long been one of the strictest in the nation. That fact helps to explain why the state's per capita electric power consumption has stayed flat for 40 years as the rest of the nation has consumed more power per person almost every year since 1975.

Given the mild climate in the state's most populous regions, California's code authorities have tended to focus on power consumption items—setting tough standards for lighting and HVAC efficiency, but sticking with relatively modest requirements for envelope airtightness and insulation.

But that has been changing. In 2008, then-governor Arnold Schwarzenegger set California on a path to net-zero energy consumption for new homes by 2020. In response to that challenge, the 2013 edition of Title 24 boosted required wall and roof R-values statewide, and the 2016 edition, which took effect January 1, continued to ratchet requirements up.

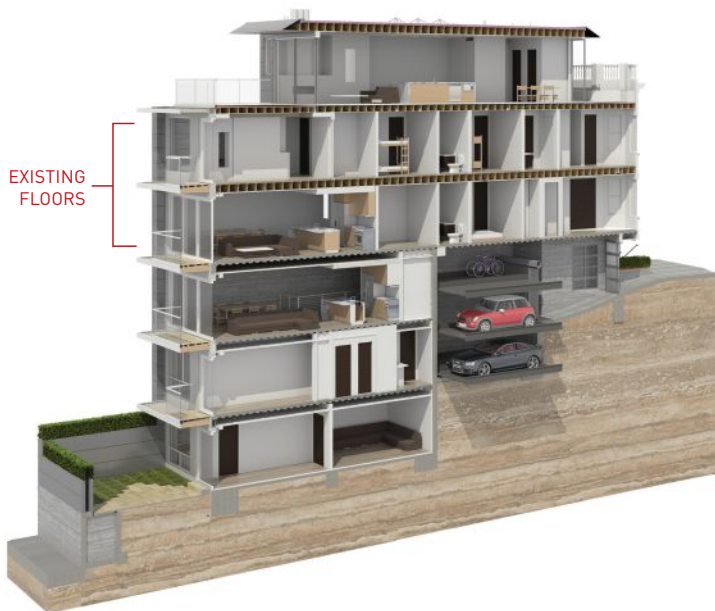
As the state's code gets stricter, the gap between code-compliant homes and above-code protocols such as the Passive House standard narrows. California's Title 24, in other words, is catching up to Passive House—but it's not there yet.

For a 2016 publication called "California's Energy Future," Passive House designer Graham Irwin modeled code-compliant homes (using the 2013 version of Title 24) versus Passive House-compliant designs in each of California's 16 climate zones, in an effort to focus on the key differences between the two approaches. Irwin added Passive House measures to the code-compliant designs one by one, to isolate the incremental effect.

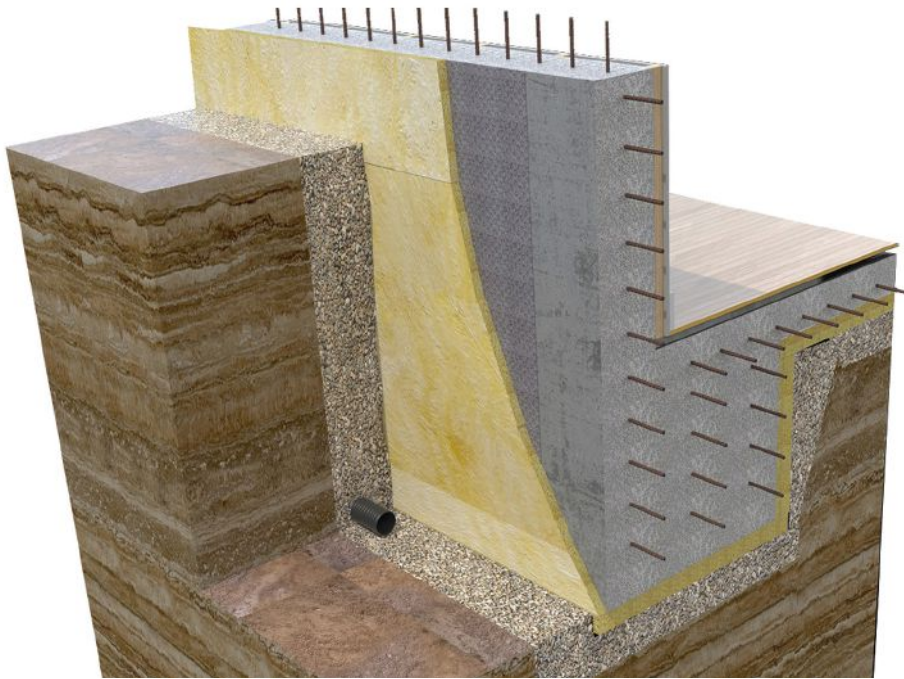
"Air leakage reduction, from the code assumption of 5 ACH50 to the Passive House maximum of 0.6 ACH50, was the most effective first measure in every climate," Irwin reported. Interestingly, however, foundation insulation also made a big difference. "Another extremely effective upgrade, universally, was insulating the slab," wrote Irwin. "In some cases, the improvement from slab insulation exceeded that of airtightness."

But insulating a foundation in California brings up a question: What about the seismic analysis? "California's Energy Future" profiles dozens of Passive House projects in the state, and in at least two cases, the

A showcase multifamily retrofit still under construction by San Francisco developer Tyson Dirksen will add three stories of concrete and steel structure under an existing historic wood-framed house. Engineers okayed EPS insulation around the new lower portion's reinforced footings.



Dan Hruby/Visualize It Built



This rendering by California architect Dan Hruby shows the insulated footing detail for developer Tyson Dirksen's project in San Francisco's Russian Hill neighborhood. The heavily reinforced footing supports three stories of concrete and steel construction set underneath an existing wood-frame house, which was lifted one story to create a four-unit multifamily building. Two inches of EPS insulation isolates the building's lower apartments from the surrounding earth.

seismic issues influenced the design process when it came to insulating the foundations. For an ambitious retrofit project in San Francisco, engineer Erevan O'Neill (onedesignsf.com) gave developer Tyson Dirksen the okay for insulation around a massive footing buried in a hillside. But for an addition in Los Angeles, architect Sylvia Wallis (who is also the homeowner) opted to break the conditioned space away from the ground, framing the insulated floor system atop an unconditioned crawlspace set on a pier-and-grade-beam foundation, rather than challenge her engineer with evaluating an unfamiliar insulated foundation assembly.

LIFT AND INSULATE

With its limited available land and its population of cash-rich tech entrepreneurs, San Francisco has some of the nation's highest-priced living space. For an investment project in that market, developer Tyson Dirksen (evolve-us.com) went to considerable lengths to squeeze more living space into a tight footprint, and he added luxury touches (including a three-car garage elevator). But he also took the opportunity to explore the energy-efficiency frontier, pushing for a Passive House-compliant envelope.

"There's a lot of cool stuff going on there," says project architect Dan Hruby (visualizeitbuilt.com). "We're on a hillside there. And we're carrying five stories, so half of that is underground, essentially, with just the one end open. We've got a view of the Golden Gate Bridge straight out of the west side, with balconies on that end." But along with the view comes direct afternoon sun.

Code required the new lower stories to be Type I noncombustible concrete and steel construction, and the engineering analysis resulted in a structural requirement for massive reinforced concrete footings and concrete walls. Passive House consultant Katy Hollbacher (who is also a civil engineer) recommended insulating the concrete elements with 2 inches of exterior EPS foam.

Foam around a foundation can be a hard sell in a seismic zone. In a previous Passive House project, Hollbacher says, a different engineer refused to even consider putting insulation under the thickened edge of a structural slab—even for a one-story house on a flat site. "Some people just like to have a quick reason to say no," says Hollbacher, "because they're not used to doing it."

In that case, Hollbacher dropped the issue—even though the uninsulated slab edge accounted for 4% or 5% of the one-story home's calculated heating load. "You have to pick your battles," she says. But for the Tyson Dirksen project, she says, "Erevan just said, 'Okay, I understand what you're trying to go for, and we will make it work.'"

Hollbacher herself is on the fence about insulating foundations in the California climate. "The engineering part shouldn't be a challenge," she says. "I think more of a challenge is the constructability—just the phasing of getting insulation in there, and the dirt not falling in ... it's something people haven't done before, and it's tedious. It's doable, but it's a pain. And the energy savings is small, so the cost-effectiveness argument is serious. Realistically, you're probably only saving a few dollars a year."

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Still, says Hollbacher, “What I love about this mind-set of Passive House is, hey—just do the envelope right from the start. It’s going to be there for a long time, and the added cost to do some of this detailing is negligible on the scale of the project. Don’t even spend the money to do all these software runs and calculate the cost effectiveness—spend that money on mitigating it instead. Just do it.”

GETTING OUT OF THE GROUND

Architect Sylvia Wallis chose a different path for her project, a deep energy retrofit with a large addition to an existing home on a Los Angeles hillside. Wallis, who works for the architecture firm Harley Ellis Devereaux (harleyellisdevereaux.com), learned about Passive House in 2009 while she was planning her remodel, and ended up taking the organization’s nine-day consultant course. She applied Passive House principles to her own project (which has ended up taking years to finish).

“It’s important to understand that this project had already completed plan check before it was modified for Passive House,” said Wallis in an email to JLC. “If we had been starting from a blank slate, some simpler options might have been possible. But conditions at the site include California seismic conditions, moderately steep slope, expansive clay soil over bedrock, and bedding planes somewhat parallel to the slope, producing



Above, foundation workers set rebar cages for deep structural piers into the hillside for Sylvia Wallis’ high-performance addition.

Photos: Sylvia Wallis

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Above, a worker shovels out the trench for grade beams that will support the stem wall for the unconditioned crawlspace under Sylvia Wallis' addition.

a tendency towards creep. As a result, moderately deep piles were required at the low side of the addition, with spread footings sitting on the bedrock on the high side of the house. Everything is supported on the bedrock, not sitting on loose soil above the bedrock.”

“The soils report called for a combination of passive earth pressure and friction from the piles and footings to resist the lateral forces (primarily seismic),” Wallis continued. “So the connection of the foundation against the bedrock was significant. All foundation excavations had to be hand-cleaned of all loose material to maintain this connection.”

“The standard Passive House solution is an unvented basement or slab on grade, either of them completely surrounded by insulation,” said Wallis. “You can see how difficult it would have been to try to insulate around them, even if the structural engineer had allowed it.”

“So instead,” Wallis concluded, “the insulation was moved up to the underside of the raised floor. The difficult detail then is the connection of the floor to stem wall (impossible to have continuous insulation and difficult to do the air barrier). But in the benign L.A. climate, the thermal bridge is not huge and can be calculated into the model without a terrible penalty.”

Ted Cushman is a senior editor at JLC.



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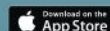
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HOME PERFORMANCE



Scissors Trusses and Home Performance

The right details can make scissors trusses an energy winner

BY MATT BOWERS

As a HERS rater and Passive House consultant working for a professional home performance and insulation contractor, I see all kinds of houses, from old-school energy hogs built in the 1960s and 1970s to award-winning high-performance homes built recently with the latest materials and methods.

Some of the builders in our market are struggling to meet our most recent energy code's benchmarks, using house designs that date back to the 1970s and 1980s. Sometimes, the framing systems from those older house styles are a stumbling block. Scissors trusses can be an example of that problem—but they don't have to be. With a few thoughtful modifications, a scissors-truss roof system can contribute to outstanding energy efficiency.

In this story, I'll show some tricks for squeezing better performance out of conventional old-school scissors-truss roofs. Then I'll take a look at the improved version of a scissors truss that our company has used to build exemplary high-performance homes.

SCISSORS TRUSS PROS AND CONS

As a sort of hybrid between a rafter-framed cathedral ceiling and a standard flat attic, scissors trusses have obvious advantages for the builder. You get the benefit of the vaulted ceiling and the extra headroom, without the headaches of the rafter detail. Truss framing is quicker and simpler than rafter framing, and it offers better energy efficiency too: You don't have to run vent channel up the whole length of each bay, you can pile deep blown insulation above the ceiling, and you don't have a thermal bridge from the ceiling to the roof as you would in a full rafter-framed cathedral.

But scissors trusses have drawbacks in terms of home performance. The main challenge is providing an effective insulation and attic-venting detail at the edge of the roof, where the low profile of the truss above the wall plate restricts the available space. In addition, the tight access at the narrow end of the truss makes it hard to air-seal any penetrations through the ceiling near the outside wall.



For a slight boost in R-value and to create a vent space that won't be crushed by the pressure of dense-blown cellulose, the author's company installs a custom insulation baffle in cathedral-roof rafter bays and scissors-truss bays. Here, the custom baffle is shown installed in a custom stick-framed roof (1, 2). Thin strips of foam hold the R-5 baffle down from the sheathing (3).

To address venting and insulation, our company has devised a custom ventilation baffle for the roof edge, which we make on site out of one-inch rigid XPS insulation, instead of using a standard foam or cardboard vent channel. We cut one-inch strips from the foam board and tack them to the truss directly under the roof sheathing. Then we fit a piece of foam across the rafter bay to create a one-inch air space under the sheathing, and we fit a piece of foam up under that channel at the outside edge of the wall plate, sealing the foam board to the framing with gun foam. Sometimes, we seal and insulate the whole area above the wall plate with spray foam.

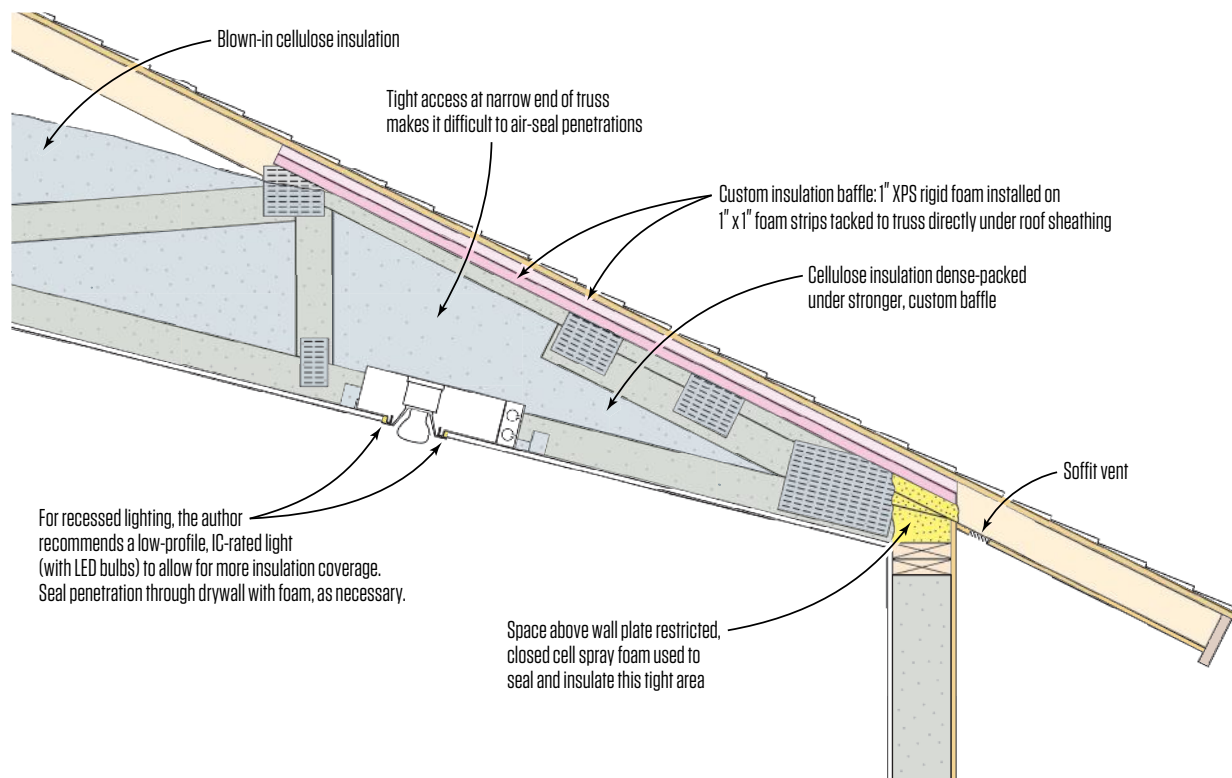
The R-5 foam adds a little insulation value right at the wall-to-roof juncture, where the insulation is thin. But more importantly, the foam board is stiff enough that it won't collapse from the pressure of the blown insulation when we dense-pack the slope. We've been called to existing homes many times for ice-dam issues and found

either crushed vent channel or the opposite case: insulation that was installed loosely to avoid crushing the channel and ended up being blown away from the ceiling by wind pressure. Our tougher, custom baffle lets us dense-pack that space without choking off the vent, and it protects the cellulose insulation from wind pressure.

But scissors trusses pose another problem for insulation and air-sealing contractors: They don't give you much room to work in the attic, especially near the eaves. Builders often like to place recessed lights in sloped ceilings near the edges of rooms, but for the insulation contractor, those light fixtures are a hassle.

It's our job to air-seal those can light fixtures where they poke up into the attic. Usually, we bring some crawl boards up to the attic with us and screw them down across the sloping bottom chords of the scissors trusses, so that we can lie on something as we try to reach way out into the very end of the slope. In that situation, it's

Details for a Conventional Scissors Truss



Conventional scissors trusses are hard to detail for high performance at the edge of the roof near the outside wall, because there's only a small space for insulation, and any ceiling penetrations are close to the roof sheathing in a difficult area for workers to access. The author's crews use a custom baffle made of one-inch rigid foam to help contain dense-packed insulation.

basically foam and go. We're working blind—it's never going to be the perfect air seal that would be possible if you had room to access the area.

And when the tops of the recessed light fixtures extend up near the roof sheathing, they contribute to roof melting in winter, and they complicate the venting problem. Sometimes, we just decide to seal off the one or two bays that have can lights in them, and don't vent that little section of soffit at all.

But that's a compromise. In fact, to be honest, if you start with a conventional scissors truss, the whole area at the very edge of the roof is always a compromise. No matter what you do, there's only so much R-value that you can pack into 3 or 4 inches above the wall plate, even if you didn't have a vent space to contend with. That's why when we considered scissors trusses for two high-performance projects, we went back to the drawing board.

HIGH-PERFORMANCE SCISSORS TRUSSES

The photos on the following pages come from an advanced custom home project we helped to build a few years ago, but the ideas originally evolved as we worked on the proposal for a similar high-performance Habitat for Humanity project at around the same time. The house was to be a one-story, three-bedroom, two-bath house built on a slab foundation, and the slab was also going to be the finish floor. The challenge we faced was how to keep mechanical systems, including the extensive tubing for a Zehnder energy recovery ventilator (ERV), within the conditioned envelope when we couldn't put anything in the concrete floor.

As we sketched ideas on the back of a napkin at lunch, we realized that scissors trusses could help us solve the problem. If we ran the scissors trusses along the whole length of the house, we could construct the air barrier with OSB on the underside of the trusses.



After attaching OSB to the underside of the scissor trusses and sealing the seams with tape, the author's crew foamed the gaps in the gable end wall to contain blown insulation (4). Intello smart vapor retarder fabric was wrapped up the gable wall (5). A horizontal strip of OSB at wall-plate height tied the inner wall frame to the outer frame (6). Inner walls were faced with Intello (7).

We could have vaulted ceilings in the great room and dining area, and fur down the ceilings to build a chase for wiring. Then we could build down a flat dropped ceiling in the kitchen and bedroom areas. The little triangular space between the false ceiling and the air-tight truss-roof underside would create ample room within the conditioned envelope where we could run wiring, ERV tubing, and line sets for the home's minisplit heating and cooling equipment.

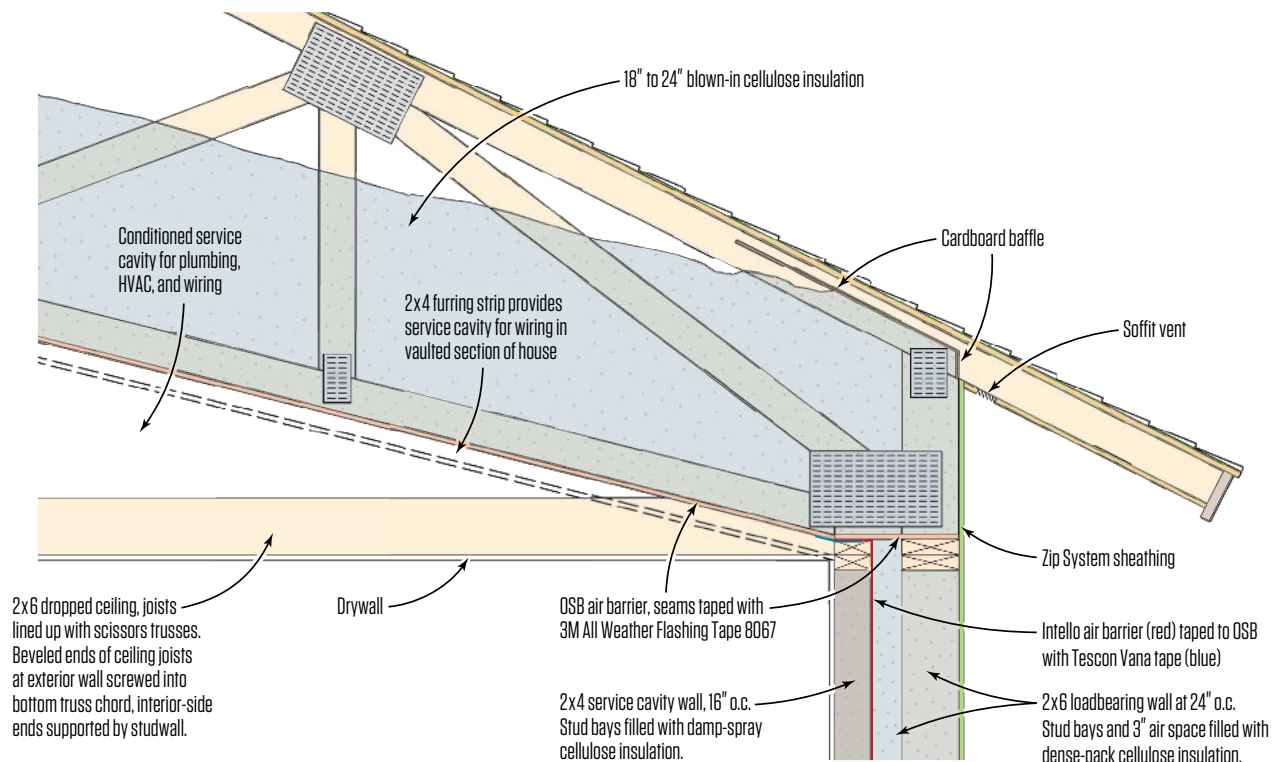
To keep the heating load low enough so that one or two minisplit heat pumps could satisfy it, we needed high levels of insulation in both the walls and the ceilings. We chose double stud construction for the walls. Then we designed our trusses with a high heel above the wall plate and with a horizontal shelf projecting inward from the outer loadbearing studwall that could catch the top plate of the inner studwall. This gave us big cavities for plenty of insulation at the wall-to-roof juncture.

WALL FRAMING STRATEGY

Whenever you build a double studwall, you have to make some decisions about which wall is load-bearing and about how you're going to define the air control layer (air barrier) for the building. In this example, the outer wall is the loadbearing wall, but the Intello smart vapor barrier fabric on the outboard face of the inner wall is our primary air barrier. The inner studwall serves as a service cavity for wiring, within the airtight conditioned space.

So to construct this, we ran an OSB shelf on top of the outer wall plates, then set our trusses and skinned their undersides with OSB, taping the seams with 3M 8067 flashing tape. Then we framed the inner walls, applied the Intello to their outboard faces, and set them in place. We folded the Intello under the bottom plates of the inner walls, and set the walls in a bead of adhesive caulk, to integrate the wall air barrier into the slab (which serves as our floor air barrier).

Scissors Truss With Raised Energy Heel



For a practical, high-performance solution, the author's company devised a raised-heel scissors truss that's detailed to work well with a double studwall configuration. They sheathed the underside of the truss with an OSB air barrier, sealed with 3M 8067 tape. By furring down from this air barrier and building dropped ceilings, they created protected chases for wiring and ductwork.

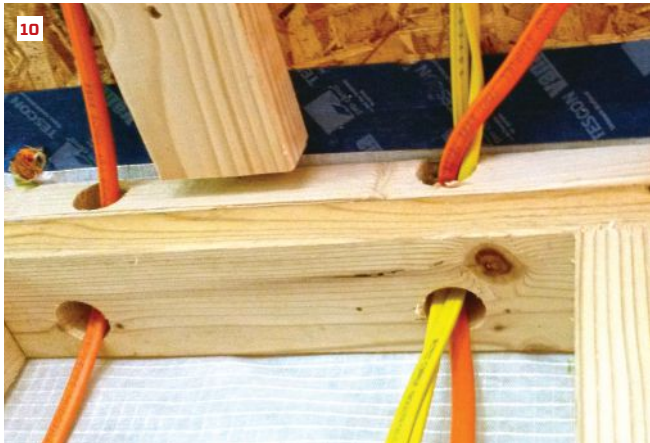
We taped the Intello at the top of the inner wall to the OSB on the underside of the roof trusses, to integrate the walls into the ceiling air barrier. Then we furred down the cathedral ceilings and built the dropped ceilings that would serve as our mechanicals chase for the bulky ERV tubing. That way, any wiring, ducts, tubing, or plumbing pipes that ran within the inboard wall or ceiling cavities would be entirely within the airtight conditioned envelope.

The gable end detail got a little complicated. At the ends of the house, we continued the OSB shelf from the bearing walls around to the gable end walls at the same height, and framed the inner wall up under the shelf in the same way. But we brought the Intello membrane in under the OSB shelf and continued that air barrier up the inside of the double wall at the upper portion of the gable. So in that one, small, upper gable area, we couldn't use the inner wall for a service cavity, because it's outside the air control layer.

A SIMPLIFIED PROBLEM

The construction sequence for these jobs, obviously, was different than for a typical production home. The outer walls and truss roof had to be framed first. Then the underside of the trusses was skinned with OSB. Next, the inner walls were framed from inside. Then the ceilings were furred down. Then, interior partitions were framed, and finally the dropped ceilings were framed in.

All this may seem complicated at first glance. But the advantage appeared when it was time to detail the ceiling air barrier and the roof insulation. If this house had been framed with typical conventional truss framing, the complicated interior shapes and different ceiling elevations would have been an energy performance liability. With our method, however, the labor that was expended on the scissors-truss framing, the OSB air barrier under the trusses, the inner wall detail, the furring, and the dropped



Furred-down chases and dropped ceilings created space for mechanical and electrical systems within the conditioned envelope (8). Ceiling lighting fixtures and air supply registers could be kept within conditioned space (9). Wiring penetrations in the service cavities did not communicate with the outdoors (10), and the dropped ceiling (11) accommodated ERV ducts.

ceiling allowed us to avoid labor at the air-sealing and insulation stage of the job—and it was a big reason for the home's outstanding energy performance.

The best illustration of this point is in photo 9, above. At the lower right of that picture, the register for a Zehnder ERV supply duct is roughed in to a 2x6 wall. In a conventional house framed with standard trusses, the back of that wall would be exposed to the cold vented attic, and the wall itself would be a truss with 2x4s on the flat. We would have to figure out how to insulate and air-seal that wall—and in a typical house built by a typical production builder, that whole wall would show up as a cold spot in thermal scans. By the same token, the penetration for the supply register would be a leak point that needed attention (whereas in this house, it's all inside the conditioned space and it can safely be ignored).

Or take a look at the junction boxes in the ceiling. Those loca-

tions received low-profile LED disk lights from Commercial Electric, which look like can lights, but can be mounted to a standard depth junction box—and provide 600 lumens while drawing only 11 watts. In typical production homes, those would be can lights that penetrate the air barrier.

And those are just two examples. By taking this approach, we eliminated dozens of similar home-performance headaches. Result: Our blower-door test came in at less than 0.6 ACH50. And although we installed two Mitsubishi minisplit heat pumps in the house for comfort—one 9,000-Btu unit to serve the bedroom, and one 12,000-Btu unit for the rest of the house—the 12,000-Btu unit by itself would be sufficient to heat the entire building.

Certified Passive House Consultant and HERS rater Matt Bowers works for Airtight Services, in Marion, N.Y.

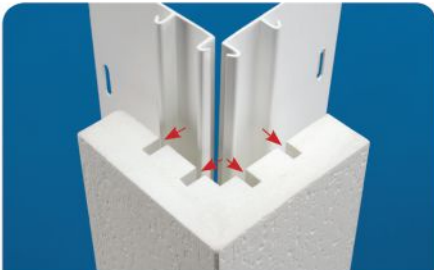
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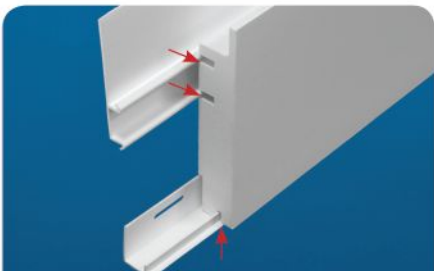
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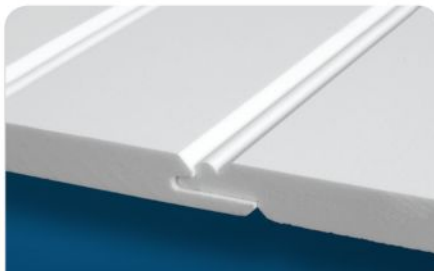
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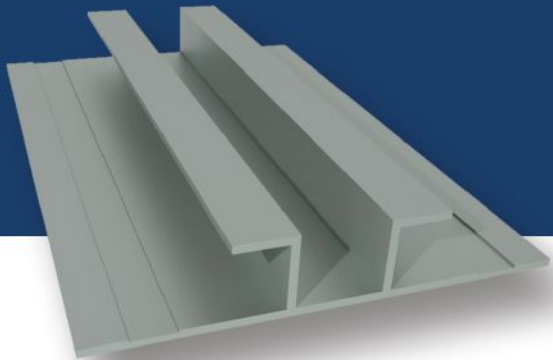
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EXTERIORS



A Primer on Water Management Strategies for dealing with water both around and on a home

BY STEVEN BACZEK

Water is probably the biggest enemy of the structures we build. It's relentless, and given the chance, it will ruin our hard work. So for residential construction, water management isn't an option or a preference—it's a requirement. And to develop proper techniques for keeping water at bay and under control, we need to understand it and respect it.

THE 'GRAVITY' OF GRAVITY

Water behaves predictably: It almost always follows the laws of gravity and flows downhill. If water-management strategies use gravity to an advantage, they have a much greater chance of success. If we try to circumvent the laws of gravity, the house will fail. Admittedly, under certain conditions, water can flow upward and

sideways. But most of the time, water will take the path of least resistance, so if we give it an easy path to flow downward, it will.

Providing that downward path solves only half of the problem, however. We still need to manage the water in and around the assembly and move it safely *away* from the structure. In other words, we need to give water a path to flow downward successfully, and then guide it away from the building—and keep it away. These simple rules are essential for successful water management.

GETTING WATER AWAY FROM THE HOUSE

For the most part, the water that needs to be managed in a home's construction comes in the form of either rain or snow, so water-management strategies can be broken down into two categories: managing water that falls around the house and managing

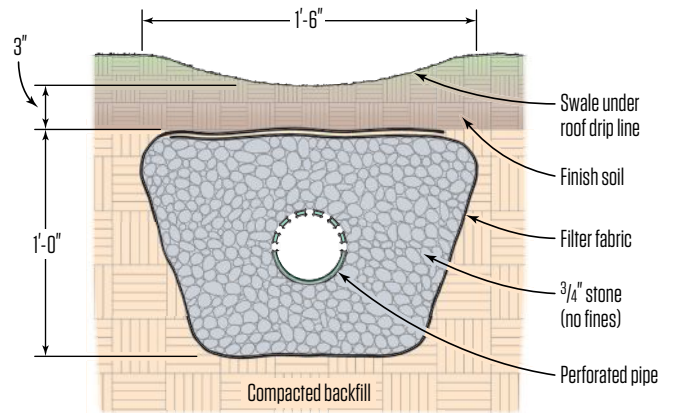


water that falls on the house. It's also important to recognize that in some instances, water that first falls on the house then becomes water that falls around the house.

A recent project gave me the chance to employ a number of different water-management strategies. The first step in dealing with water around the house is proper siting. The builder, the owner, and I sited this house on high ground in a corner of the lot, so draining water away from the structure could be easily achieved. The soil on the site was a mix of sand and gravel that was good for drainage.

Part of my strategy for routing water away from the structure was installing what I call a "ground gutter" on the uphill side of the house (see Ground Gutter, above). The pipe in this assembly connected with a network of pipes from the downspouts and from the basement perimeter drain and eventually drained to daylight at a safe distance away from the house (1).

Ground Gutter



A ground gutter (above) channels water from the perimeter of a house before it can collect and compromise the foundation. A depression or swale sits below the drip line of the roof. Water seeps through filter fabric and crushed stone before entering a pipe that carries it away safely.

Pipes from the ground gutters, the downspouts, and the basement drain all join together and drain to daylight below the grade of the house, at a safe distance from it (1). The garage sits on its own foundation, and the elevated mudroom entry between it and the house provides a clear path underneath for running piping from the back of the house to the front, where water can drain away safely (2).

I designed the house with four distinct parts: the garage, the mudroom and entry, the main house, and the screened porch and deck. Placement of the garage and the mudroom created an inside corner on the high side of the house with the potential for collecting groundwater against the foundation. To deal with that situation, I put the garage on a separate foundation and designed the mudroom as a bridge between the house and the garage (2). Elevating the mudroom gave the ground gutter a clear path from the rear of the house to the front, allowing groundwater to drain away from that inside corner. The bridge design also provided a convenient place to run downspout drains to the common pipe that connected to the daylight drain.

Along the rear of the house, the grade sloped away from the house, forcing groundwater to run parallel to the back wall. To manage the roof runoff, the ground gutter continued, situated directly

Illustration: Tim Healey



Black building paper, with 4-inch overlaps between courses, covers the side wall. To complete the drainage plane beneath the open plank siding, vertical strapping then attaches over the paper (3), and the siding nails to the strapping (4). The siding—1x6 boards painted on all four sides—is installed with a $\frac{3}{16}$ -inch gap between the boards and all adjacent material (5). The gaps provide ventilation for the back of the siding. Note that the wide overhangs on the roof protect much of the siding and the windows from water.

below the roof drip line. This simple but effective strategy captures water where it hits the ground and uses gravity to move the water safely away from the house.

Although the crew put in a drain system to service all the downspout locations, the client wasn't sure whether he wanted gutters and downspouts. But even without gutters, I am confident that the ground gutters can handle all the groundwater and runoff.

KEEPING THE WALLS DRY

The next step in water management is dealing with the water that falls on the building. Of the four barriers (water, air, vapor, and thermal) that I consider essential in a building assembly, the water barrier is number one on the list. Without a rock-solid water barrier, the other three barriers don't matter, because the structure is destined for failure.

Exterior walls are the most difficult places on a house assembly for establishing a water barrier, and a good place to start is not letting them get wet in the first place. To that end, all of the major roof planes had 30-inch overhangs—wide enough to keep much of the runoff away from the walls when there isn't much wind.

DRAINAGE FOR AN OPEN-PLANK WALL

Of course, some water will still make it to the wall. This water must be dealt with by the wall itself, as well as by all the parts and pieces in the wall—such as windows, doors, and electrical fixtures and outlets—and by intersecting planes that meet the wall. For aesthetic reasons, this house had two different exterior wall treatments: The majority of the wall area was covered with a horizontal open-plank (pressure equalized) rainscreen, while areas of shingle siding with a vented rainscreen provided a visual accent.



Strips of building paper that will be integrated with the building-paper drainage plane provide additional protection for the window sills (6). Certain wall areas are shingled in cedar for a visual accent. Rainscreen mesh applied over the building paper provides drainage space behind the shingles (7). The mesh extends to the bottom of the rainscreen to provide a measure of ventilation for the siding, as well (8), and transitions between the two types of siding have to be carefully detailed (9).

The primary weather barrier for all the exterior walls was 1/2-inch Zip System sheathing properly taped at all joints (see photo on page 51). For the open-plank areas, the building crew applied black building paper—overlapped 4 inches on all the horizontal joints to shed water properly—over the sheathing. While the building paper does act as secondary weather barrier, its main purpose is to be the primary drainage plane behind the horizontal siding.

At each window sill, the crew installed additional 10-inch strips of building paper that we integrated into the sill pan. Those strips then lapped over the building paper on the wall to provide a proper weather lap at each window.

To mount the horizontal siding, the crew installed vertical 1x3 strapping, painted black, over the building paper (3). Aesthetically, the building paper and the black furring strips darkened the gaps between the planks that attached directly to the strapping (4). The

siding was 1x6 quartersawn wood planks painted on all six sides and installed with a 3/16-inch gap between the boards on the sides as well as the ends (5).

Those boards provide the barrier for most of the water that hits the wall. The 3/4-inch air space created by the strapping allows the building paper to function as a drainage plane for any water that gets through the gaps between the boards. But more importantly, that space provides ventilation behind the siding, giving the siding a stable and near-uniform environment on all sides. That uniform environment minimizes the challenges to the paint and should extend the life of the finish and the siding significantly.

DRAINAGE FOR SHINGLED AREAS

For the wall areas that were shingled, the crew installed the shingles over a vented rainscreen mesh. Here, too, they used strips of



Where roof planes intersect with a side wall, the vertical part of the roof flashing integrates with the drainage plane of the wall. At the bottom of the flashing, a kickout diverts water away from the siding (10). At the deck ledger at the bottom of the wall, flashing channels away any water from the drainage plane (11). Window cap flashing folds in to properly divert water on a micro scale (12). Grooves on the bottom edge of the window sill let water drip off instead of following the contour of the sill (13).

building paper at the window sills (6) and integrated the strips with the building paper on the wall. Then they installed the rainscreen mesh on top of the black building paper (7).

The installation allows the rainscreen mesh to drain all the way to the bottom of the wall (8). Much like the 1x3 wood strapping on the open-plank walls, the mesh not only allows for drainage of liquid water, but it also provides ventilation behind the shingles for a near-uniform environment.

As an aesthetic treatment, a few of the shingled areas bumped out from the plane of the wall, creating shingled bays (9). These bump-outs, much like the roof overhangs, also provide a measure of rain protection for the windows below. The bump-outs returned to the main plane of the wall and integrated with the horizontal siding via inside corner boards that were painted on all sides and attached to the wall over the layer of building paper.

INTERSECTING ROOFS AND DECKS

Areas where roof planes intersect rainscreen walls are of particular concern in a water-management strategy. On this project, the mudroom roof and the porch roof, both standing-seam metal, intersected with the wood-plank walls. The crew installed proper flashing with a 2-inch vertical leg taped to the Zip System sheathing along the entire roof-to-wall intersection. The building-paper drainage plane then lapped over the flashing. Where the roof plane terminated at the eaves, a kickout flashing would channel away any water that might run down the flashing (10).

The other intersecting plane that had to be dealt with was at the base of the wall where the rainscreen met the deck frame. Here proper flashing on top of the deck ledger integrated with the drainage plane from the wall above to channel away any water that might drain down and accumulate (11).



Exterior outlets mount into boxes that are flashed into the drainage plane (14) and the rainscreen mesh. Shingles then complete the outer weather barrier (15). Temporary strapping the thickness of the siding holds the electric meter out from the strapping and the drainage plane (16) until the siding is installed. The meter then attaches directly to the siding, keeping the drainage plane intact behind the meter (17).

MANAGING THE DETAILS

With the major wall-drainage issues addressed, the final challenge was integrating the parts and pieces that attached to the house into the water-management system. In addition to the building-paper strips mentioned earlier that provided protection for the window sills, proper head-cap flashing protected the tops of the windows and doors (12). The sides of the cap flashing were folded in so that the cap itself could properly channel water away from the window at the smallest level of detail. To match the aesthetics of the other windows, even the windows that enjoyed overhead protection received the same cap flashing.

The window sills themselves received a special treatment: A groove was cut along their bottom edges to act as a drip edge. Instead of the water following the contour of the sill and dripping down the wall, the water shed off the sill could drip away safely (13).

Electrical outlets and exterior light fixtures also received a cap-flashing treatment to integrate them into the drainage plane behind the shingled sections (14, 15). Similarly, the building crew flashed in the backing boards installed for fall protection at the screen porch, and for the brackets that held the shade arbor over the basement walk-out doors.

Items such as the electric meter that mounted to the open plank siding received a little different treatment. The crew installed the meter temporarily on strapping that was the same depth as the siding (16). When the siding replaced the temporary straps and the meter was permanently installed, drainage and ventilation could take place behind it (17).

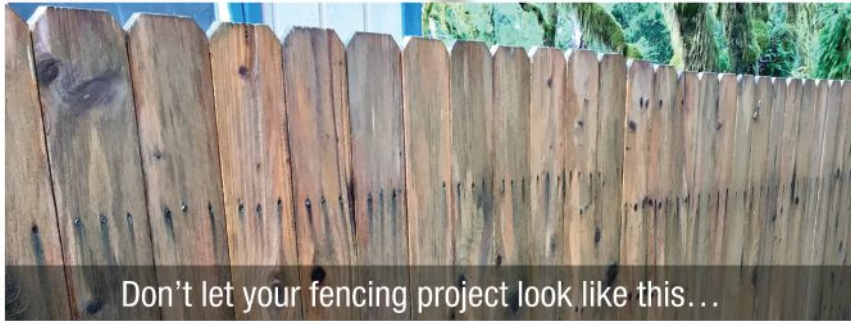
Steven Baczek, of Reading, Mass., is an architect specializing in energy-efficient design and certified passive homes. stevenbaczekarchitect.com



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Working Safely in Hot Weather Water, shade, and readiness are the keys

BY MOE DAVIS

[Editor's note: In March 2017, JLC Senior Editor Ted Cushman attended a training session presented by Moe Davis at the Green River Golf Club in Corona, Calif., sponsored by the Southern California Builders Safety Alliance. This article is adapted from that training session.]

I'm a Safety Director for Alliant Insurance Services, a national insurance broker. I'm based in Southern California, and I work with production builders in this region to help them train their supervisors, employees, and trade contractors in effective safety practices, including compliance with Cal/OSHA regulations.

For a couple of years now, I've been participating in the Southern California Builder Safety Alliance (SCBSA), a group made up of safety officers from some of the production builders in the area (see sidebar, page 62). In January and February of this year, parts of California were already starting to see hot weather, and Cal/OSHA

jobsite inspectors started to focus on heat-illness prevention. So SCBSA decided to refamiliarize its people with hot-weather safety.

Unlike most of the country, California enforces a specific rule to protect employees, including construction workers, working outside in hot weather. The basic rule kicks in when temperatures hit 80°F on the jobsite, and additional rules apply when it gets to 95°F. Failing to comply with Cal/OSHA heat illness-prevention rules can bring fines—or, in extreme cases, shut down your jobsite.

Federal OSHA regulations don't include a specific standard that addresses the risk of heat injury. But the "general duty" clause, which requires employers to provide a safe workplace, has been used in various states to penalize employers for exposing workers to unsafe conditions related to hot weather. And no matter what state you build in, the practices we're teaching here are good ways to keep yourself and your workers safe during a heat wave. In the next few pages, I'll take a look at the basic elements of hot-weather safety.



In hot weather, it's the employer's duty to provide workers with a shady place for rest breaks, and with ready access to clean, cool drinking water. There has to be enough water for every worker to consume a quart of water an hour throughout the working shift. In the example above, the employer has set up an insulated water jug with a paper-cup dispenser. On inspection visits, Cal/OSHA will check to see if the jugs are kept filled, so the author recommends designating someone to replenish the supply.

DEFINING HOT WEATHER

When the mercury tops 80°F, California worker safety rules require employers to take appropriate measures besides the usual requirement to provide drinking water. These include providing a shady rest area for breaks and meals, and having your supervisors and employees trained in recognizing the signs of heat illness. You also need to have a written plan for responding to either a minor heat illness or a life-threatening emergency.

When the temperature hits 95°F, an additional requirement for “high heat procedures” kicks in. In that case, supervisors have to conduct daily pre-shift meetings to review high-heat safety risks and procedures, and they need to monitor employees during the shift for symptoms of heat illness. Supervisors have to be in regular communication—either by direct line of sight or at least by phone or radio. Another option is to set up a formal “buddy system” in which employees keep an eye on each other for signs of heat exhaustion or heat stroke.

WATER AND SHADE

When a person is working hard in hot weather, the body cools itself by sweating and evaporation from the skin. The body loses water, and blood volume decreases. So we need to replace that water. In hot weather, supervisors should constantly remind workers to drink plenty of water—before they start, while they're working, and during breaks. Under high-heat conditions, those rest breaks should be more frequent.

How much water? The rules require employers to supply enough water for every employee to drink a quart an hour for the whole working shift, free of charge. For an 8-hour day, for example, that means two gallons per worker.

You have lots of choices for how you supply the water: You can set up a large container with paper cups, install a drinking fountain, or give each worker his or her own water container. If you do supply individual containers, they have to be labeled with the worker's name. And there has to be an easy way to replenish the supplies



Every contractor or subcontractor with employees on a site is required to supply water for its own employees. That's not the developer's responsibility. But developers or general contractors are free to supplement the employer-supplied water if they choose to do so. Here, the author takes a drink from a water fountain set up by Shea Homes, the developer and prime contractor on this site. Shea routinely makes water fountains available to all the workers on sites they control.

when they run low. I was on site when a client of mine was cited by Cal/OSHA for an empty water dispenser: The inspector picked up the jug and shook it, and there was nothing in there but ice. One good solution I've seen is to hang a sign on the water spigot, and designate one employee to check the water jug and top it off each hour, checking off the sign each time.

Workers need periodic breaks to cool off, and the employer has to provide a shaded area for that purpose. There has to be enough shade to shelter all the workers who might require a rest break at the same time. The employer should also provide seating; workers should not have to sit on the hot ground.

And the shade has to be effective: If there's enough sunlight coming through the shading fabric to cast a shadow in the shelter, it's not enough shade. In the language of the standard, the shade has to be "as close as practicable" to the work area. For employees working on a roof, the shelter might have to be down on the ground. But you don't want it to be a half-mile down the road.

PLANNING FOR EMERGENCIES

Heat illness is no laughing matter. It can be deadly. The effects can proceed rapidly from the minor discomfort of heat fatigue, easily treatable with good hydration and a rest break, to the life-threatening condition of heat stroke, requiring immediate first aid and a quick call to emergency services.

In the case of an emergency, you don't want your people having to figure out what to do on the spot. You want them trained in advance. Designate one person ahead of time to call emergency services. And make sure that the person knows how to give directions to the jobsite. In our market here in Southern California, a lot of the work is happening on new developments, and it can take years before some of these new streets and cul-de-sacs show up on Google Maps. Even if the street is marked with a street sign, the ambulance driver may not be able to find it. When you're working in that environment, you should identify the nearest cross street that is in Google Maps, in advance. When you call emergency

TEAMING UP FOR SAFETY

This March, on a visit to Southern California, I met up with Shea Homes safety officer Rod Plunkett over breakfast at the Green River Golf Club, in Corona, Calif.

I'm not a golfer, but we weren't there to play golf. Plunkett had invited me to hear Moe Davis teach a class on safe practices for hot-weather construction. Plunkett and Davis are founding members of the Southern California Builders Safety Alliance (SBCSA), a group of safety officials and other executives from some of California's top builders (who, as it happens, are also some of the USA's top builders). In that capacity, Plunkett has spent a lot of time on the jobsite, and he has a few stories of his own to tell about hot weather.

Plunkett recalled the time a Cal/OSHA inspector quizzed a worker on a Shea jobsite. "It was one of the plasterers," said Plunkett. "He was hosing the building down to get ready to put the color coat on. And Mike Alvarez from OSHA asked him, if he needed to replenish his drinking water, did he know where he could get more water. And the guy, standing there with the hose in his hand with water coming out of it, could not figure it out." (For the record: Stucco, like any cement product including concrete and masonry mortar, requires potable water.)

If understanding is a big problem, so too is motivation. The inspiration for the SBCSA, Plunkett explained, came in a conversation between him and Davis. "Moe Davis is the insurance broker for Pardee Homes," said Plunkett, "and he does safety inspections and training for them too. His company was our insurance broker for some years too, and he and I are good friends. Well, a few years ago there was a shortage of stackers—guys framing roofs and rolling trusses. So the stackers were coming to the jobsite and saying that if we wanted them to do fall protection, they would walk across the street where some other company was building. And everybody needed the labor, so people were turning a blind eye to safety, and doing whatever they had to, to get the labor on their site."

"So Moe and I were talking," said Plunkett. "And we said, if we're working on the same side of the street and we both tell the piece workers, 'We're sorry, this is OSHA's minimum standard and you are required to meet it,' wouldn't it be cool if they did go across the street and the other builder said the exact same thing? If the trades knew that all the builders were consistent, and they always had to perform to the same minimum OSHA standards, there wouldn't be any games being played."

Mitch McKibben, a consultant from Cal/OSHA, introduced Plunkett and Davis to Pulte Homes manager Brian

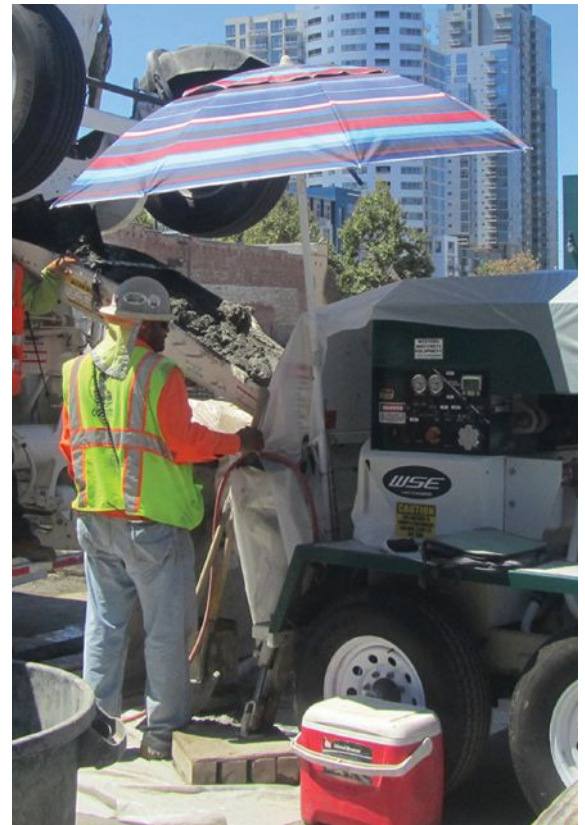
Rusaw (now working for CalAtlantic Homes). "I invited Brian Rusaw to a Shea Homes safety council meeting, and after the meeting Moe and I told Brian about our idea, and he said he was in. So then we had Alliant, Pardee, Shea, and Pulte." That was the beginning; since then, the Safety Alliance has grown. The roster currently includes representatives from Beazer Homes, CalAtlantic Homes, K. Hovnanian Homes, Pardee Homes, Shea Homes, Toll Brothers, Warmington Residential, Brookfield Residential, Meritage Homes, Richmond American Homes, The New Home Co., and Griffith Co. (developers of a safety management software tool called Safety Mojo).

"We took a couple of years to find our footing," said Plunkett. But now, the group has a focused program. Each quarter, it sends two-person teams out to member jobsites to assess safety compliance in a particular phase of the job. One person makes observations; the other, armed with a tablet computer, enters data into Safety Mojo software. Back at the office, the group crunches the collected numbers from all the member sites, searching for trends and patterns.

Cal/OSHA's early emphasis on heat injury prompted the Safety Alliance to conduct a special training on that topic in March. But the group's own jobsite audits this spring focused on fall safety. "Through all of our observations," said Plunkett, "everything was pointing to scaffolding as the top issue." So in late May, the group invited builders, scaffold erectors, and all the trades that use scaffolding on the site back to the golf club for an industry-wide training session with a focus on scaffolding rules. Look for more on that topic in *JLC* this summer.

Ted Cushman is a Senior Editor at JLC.

**"If the trade contractors knew that all the builders were consistent, and they always had to perform to the same minimum OSHA standards, there wouldn't be any games being played."
— Rod Plunkett**



As with every OSHA standard, training and communication are big factors in Cal/OSHA's enforcement of the heat illness-prevention rule. Above left, an employer has posted warnings about heat illness alongside warnings about other jobsite hazards. Shade for workers should be located as close to the work area as is feasible (above right).

services, send a ground guide to that location to meet the ambulance and bring the responders to the injured person.

RECOGNIZING TROUBLE

The best way to respond to a heat illness is to see it coming and prevent it. The California standard requires employers to train their supervisors and workers to identify dangerously hot weather, to recognize the signs of heat illness, and to take appropriate steps to prevent and treat the conditions. Employees should be trained to notice when another worker is going from bad to worse.

Acclimatization is important in the early summer, when hot weather first occurs. And here in California, a person might be working in 70°F weather on the coast, drive inland for an hour, and find themselves in the desert working at 105°F on the same day. It can take the body a couple of weeks to adjust to a change like that.

Heat fatigue is a relatively mild condition that occurs when a worker isn't acclimatized to the heat or isn't drinking enough water.

The signs include discomfort, impaired performance on skilled tasks, inability to concentrate, and a feeling of weakness and tiredness. No medical treatment is required, but rest and hydration breaks are recommended while the worker adjusts.

Heat exhaustion is more severe; the signs include dizziness, faintness, nausea, headache, and heavy sweating. Workers with heat exhaustion should be moved to a cool shaded area, cooled off with fans and a water spray, and provided with cool water to drink.

Heat stroke is a medical emergency requiring immediate first aid and a call to emergency services. The key signs include hot, dry skin and elevated body core temperature, because the body's cooling mechanism (sweating) has failed. Confusion and disorientation are also signs of heat stroke. Move the victim to a cool, shady location, cool them with cold water and ice on the armpits or groin, remove excess clothing, and dial 911 immediately.

Moe Davis is a safety director at Alliant Insurance Services.

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BY LAUREN SHANESY

1



1. Cabinets for a Modern Outdoor Kitchen

The Arcadia Series of kitchen cabinetry from Kalamazoo Outdoor Gourmet is a sleek option for homeowners looking for a modern outdoor-kitchen design. The cabinets' stainless steel detailing can be paired with oiled ipe panels (shown) or with powder-coated stainless-steel panels in more than 200 colors. Storage cabinets range in size from 12 to 36 inches, and cooktop and sink base cabinets from 24 to 36 inches, with configurations including three drawers, drawer-over-door, and pullout racks. Available August 2017. kalamazoogourmet.com

2



2. Expansive Outdoor Living

With its wide panels, the new Marvin Bi-Fold Door brings expansive views to homes. Available in one- to 16-panel configurations in sizes up to 55 feet wide by 10 feet high, the unidirectional folding doors can be used by designers to create less-obstructed views. The door hardware is less visible than on previous models. Pricing varies by configuration. marvin.com

3



3. Keeping Dry Under the Deck

Deckorators' lines of Vault (shown), Heritage, Vista, Classic, and Frontier slotted-edge composite deck boards are now all compatible with the company's Dexerdry system. According to Deckorators, Dexerdry is a polymer extrusion that's installed into the slotted edges of the company's decking boards to create a watertight seal between boards, thereby providing dry areas under raised decks and helping to reduce moisture problems below ground-level decks. It's available in black 12-, 16-, and 20-foot lengths, all of which are priced at \$2.15 per lineal foot. deckorators.com

4



4. Insulated Outdoor Plumbing

Brass has long been a choice for outdoor plumbing systems, but the material is not ideal as an insulator. To bring more effective insulation to outdoor plumbing, Aquor Water Systems created the House Hydrant V2, a stainless steel hose bib with freeze protection down to -30°F. The company says that heat loss with its design is significantly less than with a brass bib. The system costs \$90. aquorwatersystems.com

Products

5. A Universal Lighting Control System

The Decora Digital Controls line taps into Bluetooth to let homeowners use an app to control their lighting system within a 30-foot range without a hub, gateway, or internet connection. The dimmers and switches can be timed and controlled through the Leviton Decora Digital Dimmer & Timer App, with fade and optimal energy-saving options. The Electronic Low Voltage Dimmer (model number DDE06-BLZ, shown) is compatible with ELV, dimmable LED, dimmable CFL, incandescent, or halogen loads. The system also includes a fan speed control and timer. The DDE06-BLZ costs about \$73 online. leviton.com

6. Smart, Efficient Water Heater

Debuting this year, Greentherm 9000 Series tankless water heaters have rounded corners on the metal cabinet, making these water heaters as attractive as they are energy efficient, the company says. The heaters are installed with innovative top connections. The premium Greentherm 9900i SE model has a glass front, and its integrated Wi-Fi control (both features are available as options on other models) enables homeowners to control the water heater remotely through a free app. Pricing ranges from \$1,700 to \$2,100. bosch-climate.us

7. Contemporary Door Hardware

Pella has expanded its Architect Series line of windows, patio doors, and hardware pieces with a new, contemporary design aesthetic. Modern hardware pieces in the Architect Series Contemporary collection enhance the updated window line and match the series' sharp, geometric shapes. The line's door handles feature SmartKey Re-Key technology and come in a number of finishes, including matte black. Pricing varies. pella.com

8. An Innovative Low-Flow Toilet

Despite using only 0.8 gallon of water per flush, Niagara's Stealth Phantom Toilet does not sacrifice performance, the firm says. The key is the toilet's patented air transfer tube (employed on Niagara's entire line of WaterSense-labeled Stealth single-flush toilets), which reportedly allows for a vacuum-assisted pull during the flush and accelerates the force of the water and waste flowing through the trapway. Other features include an "EZ Height" design for ease of use and accessibility, and skirted sides. The toilet comes in white and retails for \$290. niagaracorp.com

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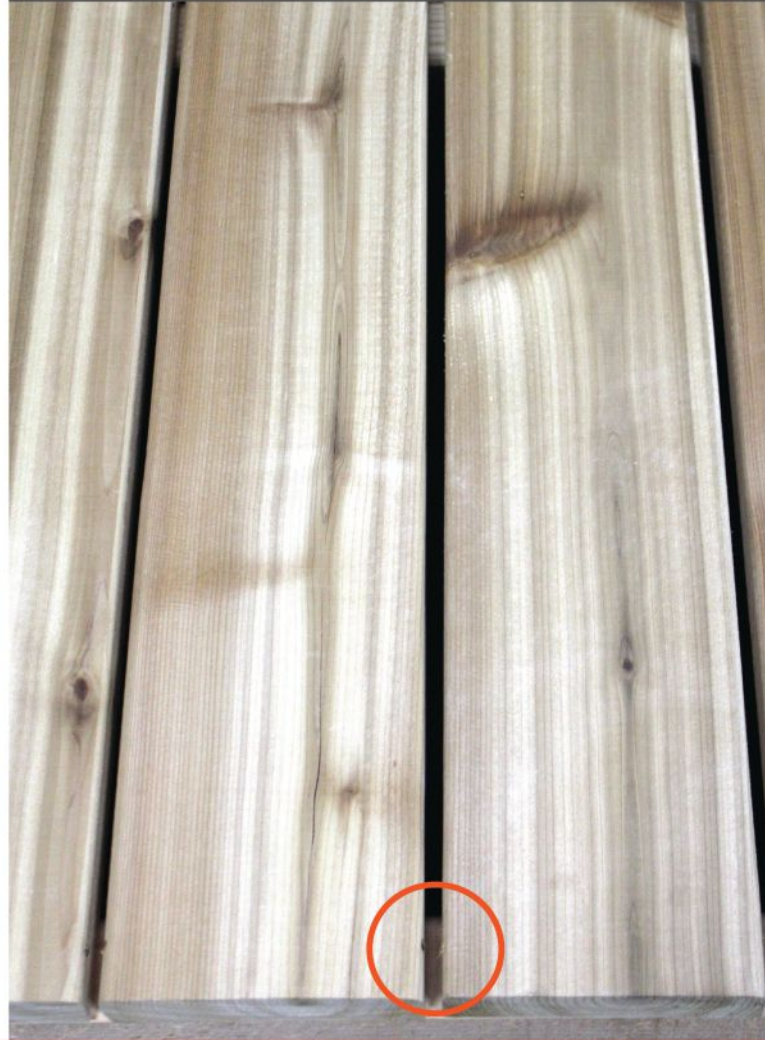
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9

9. A Time-Saving Adhesive

DAP's new DynaGrip Heavy Duty Max adhesives reportedly cut installation time with a moisture-curing formula that the maker says is easier to gun and sets up five times faster than competitive polyurethane adhesives. The maker claims that the "instant grab" of the adhesive reduces the need for nailing, bracing, and clamping most building materials. The adhesive formula is low-odor and low-VOC, cleans up with water, and costs \$6 for a 28-ounce tube. dap.com

10. Time-Lapse Camera Captures Build Progress

For builders looking to capture the work put into their next project, the Brinno BCC200 Pro HDR Time Lapse Video Construction Camera can record months of a build and display it in just minutes in a time-lapse format. The fixed-point, industrial-grade camera can be used to showcase work to clients, report progress back to a head office, and protect against claims, all without the builder having to worry about spending time on edits. The company says the BCC200 has no installation fee and no relocation fee and requires no tools or wires to install. The camera comes with a weather-resistant case, reportedly long battery life, and industrial-grade aeronautical aluminum-alloy clamp and bungee cords for easy installation. The camera can be purchased for \$220. brinno.com



10

11



11. Tile Adhesive for Thin Panels

Bostik's new Bosti-Set adhesive is designed for use with thin porcelain tile panels and claims to reduce installation time. According to the company, the adhesive and sound-reduction membrane instantly grabs and holds panels with just one coat and allows panels to be repositioned for up to 30 minutes with no slip or sag. Recycled rubber particles mixed into the lightweight, VOC-free adhesive reportedly provide sound abatement. Pricing has not been announced. bostik.com



12

12. A Lightweight Roofing Underlayment

Weighing in at 23 pounds per 250-foot roll, CertainTeed's new RoofRunner synthetic roofing underlayment has a high-traction surface designed for wet or dry walkability. The maker says the material resists tearing caused by stretching, high winds, and foot traffic, and because it grips the roof's surface, it won't pull against mechanical fasteners. It's impermeable but reportedly withstands 90-day UV exposure. Pricing not available. certainteed.com

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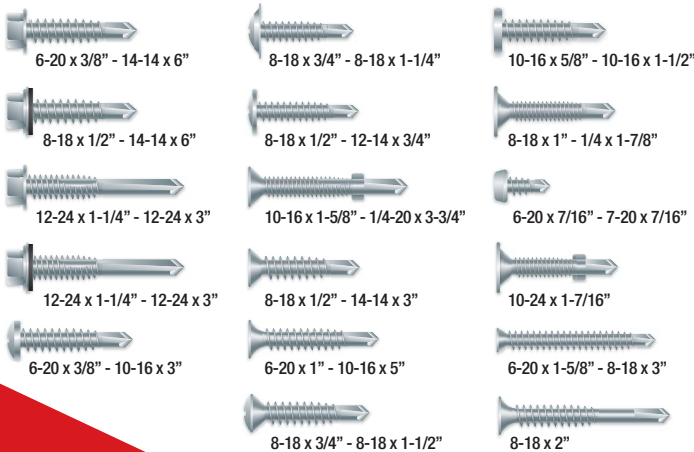


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Steel head, all-titanium handle, and a better grip.

The Martinez M1 (at left) is smaller than the Stiletto TiBone (at right). The M1 has an all-titanium handle, a replaceable steel head, and a replaceable grip, while the TiBone is all titanium with a replaceable steel face. Though the head on the M1 is slightly heavier than the TiBone's, the M1's smaller size keeps its weight at 15 ounces.

The M1 Titanium-Handled Hammer

BY TIM UHLER

Mark Martinez, the inventor of the Stiletto TiBone hammer, called me last December to introduce his newest invention: the Martinez Tools M1 Titanium Handle hammer. I've been using a Stiletto TiBone since 2002 and was eager to try out the new hammer design, which promised to cure some of the issues I have with the TiBone.

The TiBone is an all-titanium hammer with a replaceable steel face, and I've been recommending it for years. But it's not perfect: The hammer should not be used to strike hardened-steel, like cat's paws (as Stiletto's warranty clearly states); the replaceable face often twists so that it no longer aligns with the nail slot; the magnet can fall out (especially if you ignore the warranty and strike a cat's paw); and the grip wears out eventually.

Still, the TiBone's pros have always outweighed its cons. When the grip wears out, I can send my hammer back and Stiletto replaces it with a hammer that has similar wear, but a new grip; that's always been good enough for me. Also, the TiBone is lightweight—which has taught me to swing faster, not harder—and virtually indestructible. And it has minimal vibration in use. Finally, I love its side nail puller.

THE M1 HAS A REPLACEABLE HEAD

After using the M1 for the past several months, I can say unequivocally that it addresses each of the TiBone's problems that I listed above. In contrast to the TiBone, the M1 has a titanium handle and a replaceable steel head. To compensate for the heavier steel head and keep the hammer's weight at 15 ounces, the M1 is slightly shorter than the TiBone; the length took some getting used to at first, but once I adjusted to it, I preferred it.

The M1's new steel head has a number of advantages over the TiBone's head. For one, the M1's can easily be replaced, for about \$50. You can buy the hammer with a milled face and buy a smooth face if you need one and not have to buy two hammers. The one-piece steel head also means the nail slot will always work. The nail slot is large enough for a duplex nail head—something that doesn't matter much to me, but is an example of the thought that went into this hammer's development.

One difference from every other hammer I've ever used is that the face is slightly angled. The concept is based on how a hammer

lands on a nail: Because the hammer is swung in an arc, the head hits the nail at a slight angle. So, in theory, having the face slightly angled is meant to compensate for the arc and translate into a more even strike on the nail. I haven't noticed the improvement, but again, it shows the level of attention paid to the tool's design.

AND A REPLACEABLE GRIP, TOO

The company that makes the M1's grip also makes grips for Taylor-Made Golf and Harley-Davidson, using what Mark Martinez describes as a proprietary silicone compound. The grip has a slight tacky quality, and after using the hammer in rain and snow and with a variety of gloves, I've found that the "tackiness" improves with wear and is really comfortable. Martinez explained that it prevents over-gripping, which can lead to problems with soft tissue like tendons and ligaments. Since I turn 40 at the end of this year, I am keen to take care of my body.

Another advantage of the M1 grip is that it's replaceable. For \$30 and 30 seconds, you can change out the grip; all it takes is cutting off the old grip and sliding on the new one, which locks onto the handle. While I had originally planned to cut off the curved grip and put on the straight grip Martinez sent me, I love my current grip too much, so I'm going to wait until it wears out before making the switch.

The M1 also has the side nail puller that I love so much. For the month before this review was posted, we were building footings and stem-wall foundations and then stripping them. The side nail puller is great for pulling duplex (or other) nails without breaking the handle—and I don't have to carry a pry bar as I work my way around a foundation.

THE BOTTOM LINE

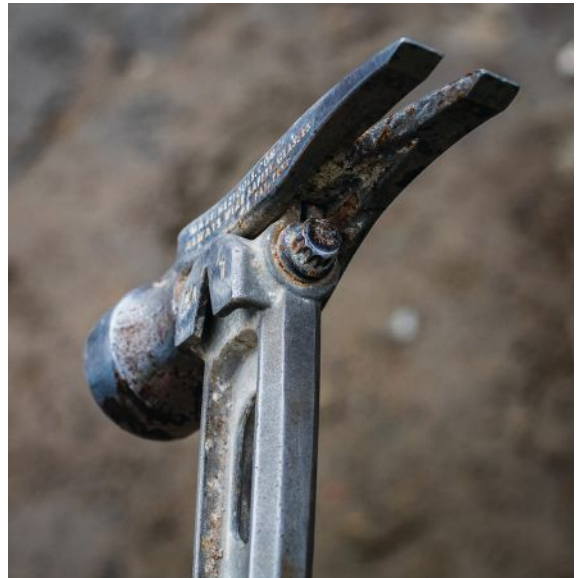
We don't swing a hammer to drive nails all that often; we use guns so often that we typically go through only 40 pounds of sinkers a year (for a two-man crew). But we use hammers for a lot more than driving nails. For example, my technique for pulling nails relies on using the metal handle of my hammer.

I prefer the lighter weight of the TiBone and M1 because it is better for my elbow and shoulder and less weight in my bags. And with the metal handle, I don't have downtime due to broken handles. The downside to a lighter hammer is that it doesn't persuade materials to move very well. But we always have a sledge rolled out, and we keep at least one Fiskar 3-pound maul out at all times, for tapping a glulam into place or a wall to the line.

Between the TiBone and the M1, I absolutely recommend the M1. It did take about a month to get used to it being a little shorter, but when I went back to the TiBone after that month, the TiBone felt too long. I prefer the M1 for other reasons, as well. I like the grip and the way the head is attached; I also like that I don't have to buy a new hammer if the head breaks or is too worn or if the grip wears out.

The cost—\$225 (plus \$10 shipping) for either a smooth or waffle face—is not cheap, but it's the last hammer you'll ever buy.

Tim Uhler is a lead carpenter for Pioneer Builders, in Port Orchard, Wash. He is a contributing editor to JLC and Tools of the Trade.



Replace the head, keep the handle. The M1 features a replaceable head held on by a $\frac{3}{8}$ -inch bolt. The bolt spreads two wings as it's tightening, locking the head onto the handle. Fifteen-ounce smooth- and milled-faced heads are available now, and a smaller finish head will be available soon.



Even if the head goes, the nail puller stays. The M1 handle features a side nail puller like the TiBone's. Because it's attached to the handle, it's independent of the replaceable heads and so is always there, no matter what head configuration you use.

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Festool ETS EC 125/3EQ

BY TIM LEAHY

I have owned Festool sanders for more than 10 years, starting with the larger ETS 150 with a 6-inch diameter. I then added a smaller, 5-inch-pad model to my toolkit. A combination of excellent ergonomics and vibration makes these sanders “must haves” for any type of finishing operation.

Earlier this year, I was invited to try the new ETS EC 125/3EQ coupled with a CT Mini dust extractor. The sander is powerful, thanks to the EC-TEC brushless motor, but it remains smooth and vibration free. Fitted with the dust extractor, the sander throws off almost no dust, which I especially appreciate when I’m restoring and repairing high-end cabinetry and paneling in the field.

Compared with my older ETS 125 3, this newer version has a lower profile that can get into smaller spaces. The pad clears the handle a bit more, too, making it possible to sand right to the edge of work, no matter my hand position.

The sander accepts all Festool abrasives, including Granat and Rubin. I use Granat paper for most of my work on unfinished wood and for refinishing. The paper is long-lasting; I get little if any loss of abrasive particles from the paper, and it rarely clogs up if the finish being sanded is cured.

When I used the sander on a master-suite closet system that consisted of cabinets made of soft maple cases and paint-grade face frames, drawer fronts, and doors, I started with #180 to remove pencil lines, smudges, and milling marks. The sander performed well, yielding a smooth surface ready for paint. Then I used #220 to smooth the primer coat and #400 between finish coats.

On a job restoring older barn doors made of heart pine, I needed a more aggressive removal, and the sander didn’t disappoint. After infrared paint removal, we needed to prepare the surface for a clear finish. The #100 made quick work of leveling the wood to a uniform appearance and texture. Subsequent sanding with #120 followed by #150 smoothed it perfectly, without sanding marks.

The only drawback I found to the sander is its balance when fitted with the vac hose. Because of the sander’s light weight (otherwise a good thing), the hose tends to pull down on the rear port area a bit when I sand a horizontal surface. This can cause the pad edge to create a swirl. Likewise, when I do overhead work, the hose pulls on the port, putting pressure on the front edge of the pad. This isn’t a deal breaker, though: Simply working the tool with both hands solves the problem. Cost: \$385. festoolusa.com

Tim Leahy is the director of Architectural Finishes at Kirby Perkins Construction, a Newport, R.I.-based company that builds custom homes and preserves and restores historic properties throughout southern New England.

Lightweight and adjustable. The sander weighs 2.65 pounds and has speed settings that range from 6,000 to 10,000 rpm. The pad clears the handle so it can reach into inside corners regardless of your hand position.



Modular Tool Tracker

Playing off the tool-tracking functionality in its OneKey App, Milwaukee recently introduced an independent tool tracker module that can be attached using epoxy, screws, or rivets to any of your tools, tool boxes, or equipment. The device has a low profile of 1/2 inch and is weather, water, dust, and impact resistant. The unit communicates via Bluetooth with the OneKey App that is in range (within 100 feet). The device is powered by a replaceable 3-volt lithium-ion coin cell battery, which the manufacturer says has a runtime of one year.

Once connected to the OneKey App, each Tick can be tracked within the app. A Tick can be assigned numerous attributes manually: manufacturer, product description, model number, category, person, trade, location, tool number, serial number, status, purchase information, and service reminders. The app also monitors the lifespan of the battery (I installed one a month ago on a tool and it now reads 90%).

The Tick automatically communicates with the respective registered OneKey App each time it comes in contact with it, providing “last seen” status on a map within the app that you can also view in satellite mode. You can report a Tick missing; doing so will put it in a “discoverable” mode that will ping nearby OneKey Apps, and then provide its location. A single Tick costs \$30; 4-Pack, \$100; 10-Pack, \$220; 50-Pack, \$1,000. The app is free.

Chris Ermides is a senior editor at JLC and the editor of Tools of the Trade.

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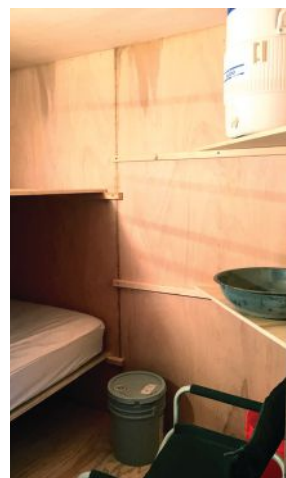
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BY TED CUSHMAN



One Step Up From a Tent

Mark Huber is a custom builder and remodeler based near Seattle. But in his free time, Huber likes to give back to the community—most recently, with a simple solution to the basic shelter needs of the area’s homeless people.

Several Seattle-area homeless encampments have been provided with “tiny homes” for temporary housing. But Huber saw a drawback: Setting even the smallest units on site required a truck and a forklift. Inspiration came when Huber was helping his daughter pack for a move. “She had a little sauna spa made out of six panels, with a little radiant heater,” he told *JLC*. “Two people can disassemble it in about half an hour, put it on a truck, move it someplace, and put it up in a backyard or anywhere. So I thought, why can’t we come up with something like that for these little homeless buildings? We could build them off site and then bring them in and assemble them with little effort.”

In their present version, Huber’s small shelters are framed using 2x3s in the floor panels, and 2x2s in the wall panels. Cavities are insulated with R-10 foil-faced foam and the frames are skinned with plywood on both faces ($\frac{3}{8}$ -inch resawn plywood on the outside, and $\frac{1}{4}$ -inch AC plywood inside). Roofs are framed with 2x4s cut on a taper to create the slope, skinned with plywood, and roofed with 45-mil TPO roofing. Huber folds the roofing over the edge of the panel and screws it to the side to form a simple drip edge.

To set a shelter up, two people carry the panels to the site and assemble the unit with screws: “We overhang the plywood on the side panels about $2\frac{1}{8}$ inches, and on the bottom we overhang it about 3 inches,” Huber said. “Then we use metal roofing screws with a small washer on them to fasten the panels together, so the panels are held together by this overlapping plywood. To attach the roof panel, I have a 2x2 cleat on the inside wall that I screw up through into the roof.”

The simple shelters aren’t meant to be permanent homes, said Huber: “It’s not your final destination. This is the first step out of a tent, into someplace a little bit more secure.”

But that first step matters, he said: “If you ever ask a homeless person what they want the most, it’s a good night’s sleep. Someplace where they feel secure, and safe, and dry. When I step inside that unit, I have a bed and a mattress, and I can lock the door, sit down, and take a breath and collect my thoughts. I don’t have to worry about survival, or whether it’s going to rain, or whether somebody might steal my stuff. It’s the first step towards adding structure to people’s lives. And that’s what they need to be able to move on to the next step.”

Ted Cushman is a senior editor at JLC.

Photos: Alaska in Motion

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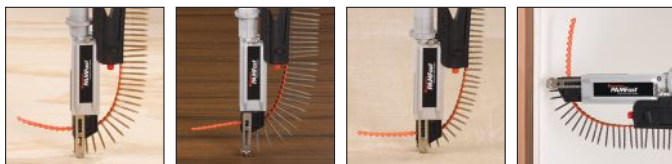


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