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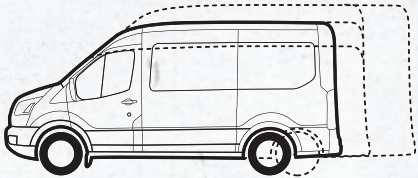


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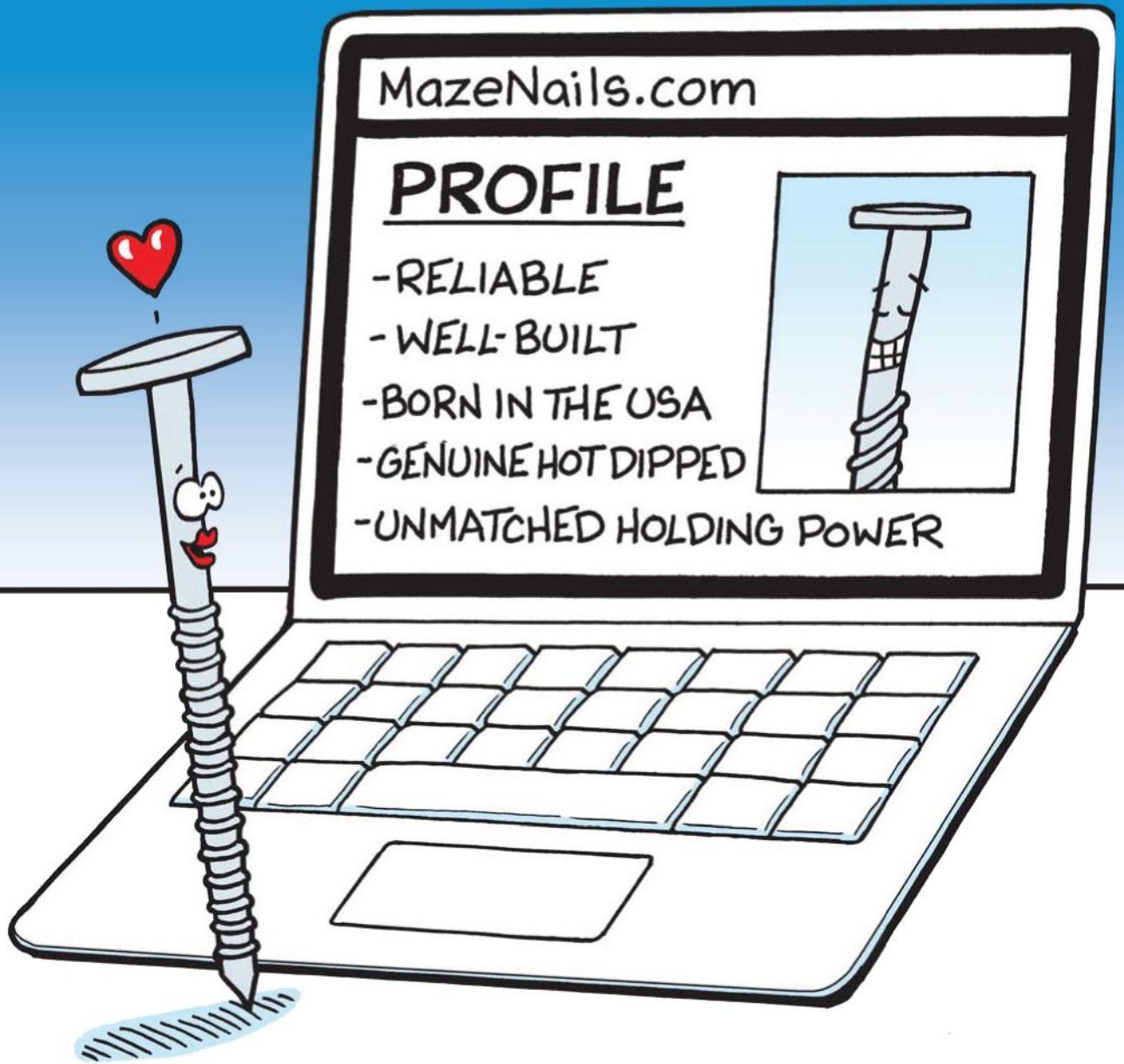
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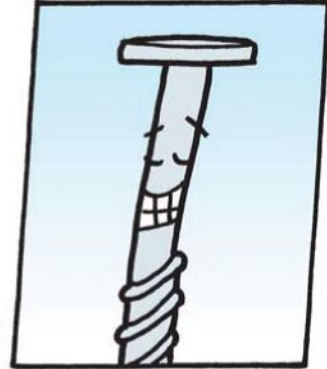
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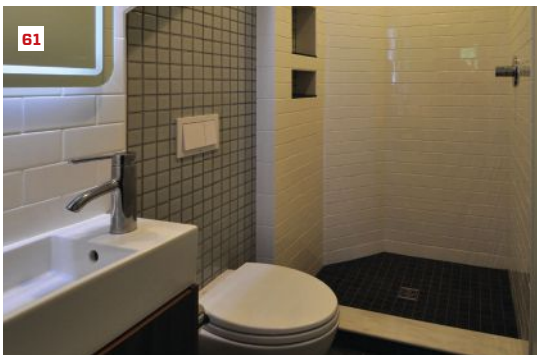
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On the cover: Hardwood flooring contractor and consultant Howard Brickman marks the lengths of boards to complete two courses of prefinished wood flooring in a home in eastern Massachusetts. Photo by Roe Osborn.

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Reader Feedback

The following excerpts are taken from comments in response to the JLC articles referenced.

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Letters

“METAL SIDING AND ROOFING – 10 REASONS IT’S AWESOME,” BY MATT RISINGER (ONLINE, 9/11/15)

Kirk (online, 9/13/15): Metal siding is much less resistant to impact and hail damage. It also provides no thermal resistance, and on siding, the greater flexing as the material expands and contracts with the ambient temperature is more likely to create problems with weather-sealing.

Penetrations for vents and plumbing and other services require multiple hole cutters, one for the metal and another for the shear-wall material, unlike with wood or CDX plywood siding. Metal for siding offers no advantages over other materials; though for roofing, it does provide distinct advantages, and companies making solar-panel installation products have developed new attachment mechanisms specifically for metal panel roofs.

It is also misleading to talk about added fire protection with metal siding, as fire enters homes through the windows or by starting a roof on fire, with windows the primary point of entry. The siding does not have a material impact on fire resistance and is certainly not superior to fiber-cement siding in this respect.

Clayton DeKorne responds: Your assertions about the impact resistance of metal roofing are unfounded. Most 26-gauge steel roofing will qualify for Class 4 impact resistance, the highest available. While flat metal panels can be deformed by hail, the corrugated panels used on Risinger’s project add stiffness; dents are rare and difficult to see.

As for thermal resistance, the combination of a light-colored panel with the radiant barrier created by an air space behind the panel over foil-faced foam significantly reduces solar gains. This is as important for exposed walls as it is for roofs—and the same rules apply. And while it’s true that the thermal response for metal is higher than for wood or fiber cement, the corrugation absorbs any movement across the panel

width. Panels can expand and contract in length, but this is where installation over purlins (those used to create a rainscreen and air space for the radiant barrier) come into play—the purlins deflect and rotate slightly as the panels expand and contract, causing little or no harm to the roof or siding system.

The rainscreen system behind the metal siding also means that penetrations through the siding are easier to seal. No matter how much you caulk or seal the face of your exterior skin, water will get past it. But with the rainscreen, if water gets behind the metal skin, it simply drains away.

As for fire resistance, I’m guessing you don’t live somewhere prone to wildfire. Certainly embers landing on a combustible roof are a leading cause of ignition to a building from wildfire. But we’re talking about metal siding *and* roofing here. And it’s true, glass can explode, primarily due to a difference in temperature between the interior and a raging wildfire, particularly at the edge of glass. The University of California’s Wildfire Mitigation Guide recommends installing dual-pane windows (these are pretty much standard in most climate zones now). The outer pane often serves as a thermal shield to protect the inner pane. The guide explains that “the inner pane is allowed to heat up more slowly and uniformly, and therefore may not fail even if the outer pane does.”

The University of California guide also identifies the siding as a factor in mitigating wildfire:

“A common way for combustible siding to ignite by flame is contact from burning vegetation, combustible mulch, or other combustible materials (firewood, lumber, etc.) stored near the home. All of these adjacent combustible materials very likely would have been ignited by embers.”

A potential contributing problem with wood and wood-based siding products is fungal decay, particularly when present along the bottom edge. When dry, decayed wood is more easily ignited.”

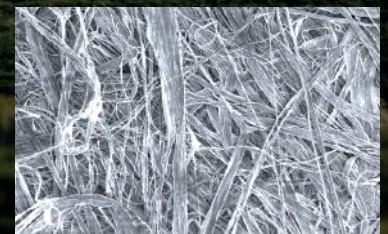


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Q During a recent ICF pour, I received some “bad” concrete that caused defects such as voids that I found after removing the window bucks. Are there any special guidelines to follow when pouring an ICF foundation?

A Rick Arnold, author of *Working With Concrete* and a frequent presenter at JLC Live, responds: The typical concrete mix for a foundation wall includes 3/4-inch aggregate. But when you’re working with ICFs, it’s better to order the concrete with 1/4-inch aggregate, also referred to as “pea stone.” It is the same size aggregate usually used for flat work. ICFs ordinarily have a complex network of webbing and rebar installed inside the forms, and the smaller aggregate moves more easily in and around that maze to ensure better and more complete placement with no voids.

In my experience, most ICF wall defects are caused by placement practices; in other words, human error. But if your problems were indeed caused by a problem with the concrete, my first guess would be that one or more of the loads delivered were “hot.” It is common practice in my area for concrete trucks to leave unused concrete from an earlier job in the truck. That concrete then is mixed in with the new batch and delivered to the next site, creating what is known as a “hot” load. Depending on the amount of “old” concrete and how much time has passed since the first load of the day for that truck (there could be remnants of a couple of earlier batches in the truck), the concrete that you pour into the forms could set up in less than 20 minutes. If you didn’t know about the hot load and figured that you had plenty of time to vibrate and straighten the walls, you’d be in big trouble.

As a concrete contractor, I always asked the driver if there was any “old” concrete in the batch, especially if timing on the pour was critical. Most drivers will volunteer the information without being asked. If the load is “hot,” you can still place it correctly without defects; you just have much less time in which to do it.

You can also ask the ready-mix company to add a plasticizer, which will help the concrete flow more easily without the addition of water and is fine for ICF work. By the way, adding water can make concrete flow more easily, but it will reduce the strength of the concrete.

That said, here are some things to keep in mind when working with ICFs:

- Construct or alter the window bucks so that you have



ICFs typically have an intricate network of rebar and webbing that concrete must flow around to fill the forms properly.

plenty of access through the sill section. This lets you both fill and visually check that problem area.

- Never fill more than a third of the wall height at any time.
- Always start at the corners and work toward the middle of the wall.
- Always have some sort of vibration method on hand, even if it’s just a couple rubber mallets.
- If you use a mechanical vibrator, don’t use it too long in one spot.
- Always plan to have extra crew on hand so that you can pour continuously. Moving too slow can cause cold joints between batches, which can reduce the overall strength of the wall.
- Make sure to have on hand plenty of extra equipment, such as concrete chutes, shovels, and the like.

Finally, schedule the truck arrivals ahead of time to keep the pour progressing at an even pace. Scheduling is largely under the control of the dispatcher, but a few words to the ready-mix office ahead of time can help to ensure timely delivery and the correct interval of time between truck arrivals.

Should the exit plumbing be pressure-tested for leaks in today's super-tight houses?

A Steve Demetrick, a residential builder and remodeling contractor in Wakefield, R.I., responds: The integrity of the waste plumbing is definitely something to be thinking about when you're building any kind of house, including a super-tight one. We recently completed a new Certified Passive House in Rhode Island, and we made sure that the exit plumbing was pressure-tested before

attaching it to the sewer line (the attachment point to the sewer line was outside of the air barrier of the house).

Along the same lines, it is also wise to pay attention to any water line traps in a tight house, especially the smaller lines from minisplits that are hard piped into the drain lines. These traps are typically made from smaller-diameter pipes that only drain water during the summer. A long, dry winter can easily dry out one of these traps and allow sewer gases into the house under the right air pressure conditions.

I'm aware of this phenomenon from working on large summer homes in my area. A couple of times, clients who live elsewhere for nine months of the year wondered why their house smelled like sewer gas after I had remodeled one of the bathrooms over the winter. In every case, a trap in a different bathroom—which hadn't been used for all those months—had dried up and was letting sewer gas into the home. Summer homes with smart caretakers don't usually have that problem.

But for the gases to be drawn into the house, there has to be negative pressure inside. In a properly built super-tight house, the ventilation system should be balanced. A balance between the amount of intake air and exhaust air will minimize areas of negative pressure in the house, minimizing the chance of sewer gases entering the house.

For super-tight houses, it may be worth mentioning that if a trap does dry out, the gas won't necessarily flow into the house. In order for air to flow into the house, you need two openings—in this case, one would be the sewer line, and the other would be a hole somewhere else in the house—along with a pressure difference between the inside of the house and the outside. If this situation existed, it would create suction on the open sewer pipe and draw gases inside.

But that other hole and the pressure difference are less likely to exist in a super-tight house. To give you some perspective, when you open a window in a Passive House in the winter in New England, the cold air doesn't rush into the house, as it would in a normal leaky house. These houses are so tight that the air doesn't have anywhere to go.



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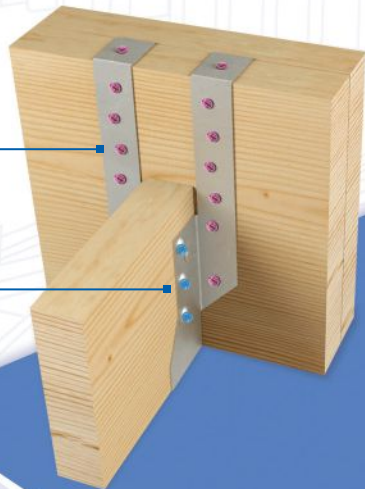
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Q&A / Texturing Over Old Drywall

Q I am currently working on a project that has old, untaped drywall that was never finished and has turned yellow. What is the proper procedure for texturing and finishing over drywall in this condition?

A Myron Ferguson, a drywall contractor in Middle Grove, N.Y., and a presenter at JLC Live, responds: A few years ago, I taped and finished a cathedral ceiling that had remained untouched for a whole summer. The drywall had yellowed quite a bit, but I really didn't think that it would be a problem. I taped the seams and primed the ceiling with regular latex primer, and then applied the texture over that.

When the texture dried, I was surprised to see that yellow was bleeding through everywhere on the ceiling except where the seams had been taped. I figure that because the texture went on very wet and then took a while to dry, it must have drawn the yellow through the primer.

So, in your case, I'd start by taping the drywall seams. Then, depending on how badly the drywall has yellowed, choose what type of stain-blocking primer to use. If the yellow bleeds completely through the joint compound on the taped seams, I would seal it with an oil-based stain-blocking primer. But if the compound has covered up the yellow, you could probably get away with a water-based stain-blocking primer. When the primer has dried completely, apply the texture.

I always prime after applying a texture, so you will need to apply a second coat of primer anyway. If the yellow continues to bleed through after the texture is applied, I'd use a stain-blocking primer a second time; at this point, the latex version would most likely be fine. Just make sure the primer is totally dry before applying the finish paint.

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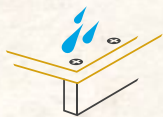


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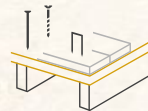
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BY TED CUSHMAN



Pinning Rock Wool to Sheathing

Fireproof, rot-proof, and stable, rock wool (also called “mineral wool”) has a lot to recommend it. In recent years, some builders have come to prefer rock wool not just for cavity insulation between studs, but also for exterior-applied insulation over wall and roof sheathing, as part of a rainscreen wall assembly or a hot roof. The material is free-draining, allowing it to serve as an insulation layer over a water-shedding WRB (weather resistant barrier), whether the WRB is a high-performance housewrap or a fluid-applied membrane.

In Wayland, Mass., the crew of Auburndale Builders is including Roxul rock wool in the superinsulated roof and wall assemblies for a high-end custom Passive House. The home’s walls will achieve about R60, including 10 inches of Johns Manville Spider spray-applied fiberglass in the double-stud wall, plus 4 inches of Roxul applied between the sheathed wall and the home’s brick

vener exterior cladding (1). The roof will top out at better than R130, including Spider sprayed into the wood I-joist rafter cavities, plus R32 for 8 inches of Roxul applied over the structural roof sheathing (2, 3).

On the wall, the 4-inch layer of Roxul supplies a thermal break between the 10-inch-deep double stud wall and the brick veneer, with no thermally conductive framing interrupting the insulation. A layer of Delta-Dry Stucco and Stone ventilated rainscreen between the brick and the Roxul provides a drainage space and protects the assembly against vapor drive from wet brick; and a taped layer of Siga Majcoat fabric over the CDX plywood sheathing ensures the airtightness and water resistance of the stud wall.

In Passive House terminology, the terms “vapor control layer” and “air control layer” describe the functions of sheet material such as the Majcoat membrane

On the Job / Pinning Rock Wool to Sheathing

applied over the wall's plywood sheathing. In high-performance superinsulated walls and roofs such as these, the location of membranes and insulation within the assembly has to be carefully considered.

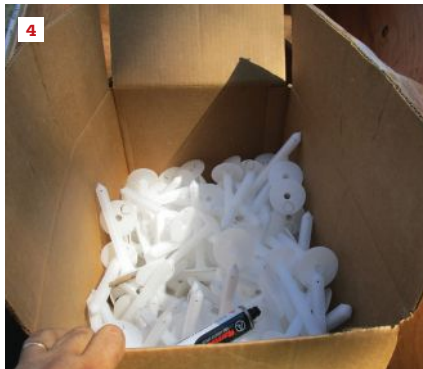
In theory, the plywood sheathing itself, with seams taped, might be able to serve as an air control layer for a building. But when the goal is Passive House levels of airtightness (0.6 air changes per hour at 50 pascals of pressure, or 0.6 ACH50), that turns out not to be the case—at least not for this house, production manager Mike Dutra told *JLC*. The team's first blower-door test took place on a rainy day, after plywood sheathing had been installed and seams taped, but before the Majcoat was applied. With the house under positive pressure, Dutra said, air was visibly bubbling through the wet plywood. With the fan reversed, Dutra said, water seeped in “like it was raining inside the house.”

Blower-door readings confirmed the evidence of the naked eye: Metered airflows during the test were well above the required 0.6 ACH50 threshold. But applying the Majcoat cut the leakage rate below 0.4 ACH50. The overlaid Roxul will keep the Majcoat membrane warm, in case any interior moisture should reach that plane in the wall and threaten to condense.

To fasten the Roxul to the plywood, the crew is using the innovative InsulFast system from Ramset. It includes both the InsulFast gas-fueled nail gun and the InsulFast plastic fastener, which looks like a giant plastic nail with a hollow shaft (4) and connects with virtually no thermal bridging. Each plastic fastener comes with a preinstalled stainless steel spiral-shank nail at the tip of the tube. The installer jams the plastic nail into the batt at the intended location, slides the gun's driver rod into the shaft, and pulls the trigger to drive the nail (5). Fuel canisters slip into a receiver in the gun's frame (6).

To cut the batts, Auburndale's crew and subcontractors are using a special machete-shaped handsaw manufactured by Hultafors (available at reconnw.com) (7). At outside corners, the installer can first fasten the Roxul batt, then slice it off at the desired angle (8).

Ted Cushman is a senior editor at JLC.



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Window Heads Done Right

BY MARK PARLEE

On a recent job, we pulled off the existing casing around the windows. These boards were held on with little more than a caulk line, because the existing T1-11 siding underneath the casing was all but completely rotted away **(1)**. The windows themselves—vinyl-clad Andersen 400 units—were still in excellent condition.

This was a classic case of window heads gone bad. We see it all the time: Without any flashing, water that runs down the siding is drawn into the crevice between the unflashed head casing and the siding and just sits there. In our climate, it never really dries out, and rot is inevitable.

To fix the heads, we cut out the rotted material and applied a standard window L-flashing. This metal flashing had a 2-inch back leg, came out horizontally 1 ¼ inches, and ended in a hemmed drip lip. We taped the back leg of the flashing metal to the wall sheathing using 3M All-Weather 8067 tape. Over that, we applied our new casing—in this case, a piece of LP SmartSide Trim, which is an OSB-type product. The existing casing had a 45-degree end cut—a bit unusual, but the owner wanted to keep it.

Over the casing, we applied another piece of 24-gauge galvanized metal. This also had a 2-inch back leg, came out over the top edge of the casing, and turned down in a

drip lip **(2)**. We taped the back leg to the existing siding, then covered the old siding with a new weather-resistant barrier—a layer of Tyvek StuccoWrap—which we brought over the back leg of the flashing.

We applied a new layer of T1-11 siding, holding it a full ⅜ inch above the head flashing. While ¼ inch is allowed, we've seen the surface tension of water bridge ¼ inch. No one will notice the larger, ⅜-inch gap as long as the siding is cut dead straight across the top.

To finish the job off, we caulked everything in with a high-quality polyurethane caulk. We were careful to seal the siding at each end of the head—a detail that acts much like a kick-out flashing on a sidewall to direct water to the outside **(3)**.

The whole thing was painted out with two coats of Sherwin-Williams Resilience exterior acrylic latex. Resilience dries rain-fast in 30 minutes, so my painter can apply multiple coats in one day. We always spec a satin finish, which seals better and is self-cleaning; it won't hold dirt and ends up looking better over the life of the job.

Mark Parlee, a building-envelope consultant and builder in Urbandale, Iowa, specializes in exterior renovations and envelope solutions.

Photos by Mark Parlee

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BY MELANIE HODGDON

Making Variable Markups Work

Last month, we looked at different ways to price yourself out of a job. There's nothing arcane about pricing jobs correctly, but there are some nuances with using variable markups on T&M jobs, which I promised to address this month.

ACCURATELY "BLENDING" MARKUPS

A client of mine recently approached me with a challenge. His firm generally sells jobs using a contract price and applies a uniform markup on all estimated costs. But due to a variety of circumstances, he was contemplating selling a new, potentially complicated job to a finicky and price-aware customer as T&M instead. This customer was tangentially involved in the industry himself and was therefore very savvy about pricing. My client's question was: For this customer, what was the best way to present and defend his pricing on subs and materials while still maintaining his desired margin?

To further complicate the situation, my client anticipated numerous change orders of an unknown "mix" of costs. He had already decided that he was going to apply the same markup on materials and subs, but he wasn't sure what hourly rate to charge on labor. He did, however, have an excellent grasp of his burdened hourly rate (\$40/hour), which allowed him to identify his markup and margin on labor depending on what he decided to charge this customer for labor. While he had decided to share his markup on materials and subs with the customer, he planned to simply present his hourly labor charge-out rate without explanation.

To examine various markups and margins on labor, we created a simple spreadsheet (at right). This gave a quick idea of what different hourly charge-out rates would yield. But in order to see what the results of various "blends" of markups and labor rates would produce, we went a step further with a spreadsheet that permitted my client to enter the known burdened hourly rate, and then to play "what-if" scenarios using different charge-out rates on labor. He could also use the spreadsheet to test different markups on subs and materials and find what "mix" of labor vs. subs and materials would work.

This spreadsheet (see top of next page) shows the results of "trying out" a labor rate of \$78 and a 30% mark-

up on subs and materials on a project whose estimated cost is \$100,000. Whether or not the pricing "works" is dependent on the percentage of labor costs vs. subs and materials costs, which is represented in the columns "% of Total Costs Due to Labor" and "% of Total Costs Due to Non-Labor."

The column on the far right is formatted to show satisfactory results in green (those in which the calculated margin met or exceeded the target margin) and unsatisfactory results (those in which the calculated margin fell short of the target) in red. As long as the costs of labor comprise at least 40% of the total job costs, the job price should theoretically produce gross profit to match or exceed the target margin of 35%.

A second version of the spreadsheet (see bottom of next page) shows the results of keeping the estimated costs the same, but using a labor charge-out rate of \$65 while reducing the markup on subs and materials to 20%. In order to meet the target margin under these revised conditions, labor costs would have to comprise at least 80% of the total job costs.

You can download a copy of this spreadsheet by visiting JLConline.com (search "Making Variable Markups Work") and play with your own blend of markups for different types of jobs. Be sure to use your own burdened hourly labor rate for an accurate accounting of your projected gross margin.

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

Varying Labor Charge-Out Rates

Calculated burdened hourly labor: \$40

Hourly charge-out amount	\$50	\$60	\$70	\$80
Gross profit per hour	\$10	\$20	\$30	\$40
Markup on labor	25%	50%	75%	100%
Gross margin on labor	20%	33%	43%	50%

A base rate of \$40 includes both hard and soft costs—all that labor actually costs. The markup on top of this covers gross profit—a necessary amount in the running of a sustainable business.

Scenario 1: Labor Must Comprise 40% of Total Job Costs

Under these conditions (namely, a \$78 charge-out rate and 30% markup on subs and materials; see box at right), the labor costs must comprise at least 40% of the total job costs. For this type of job, the sales price should produce gross profit to match or exceed a target margin of 35%.

Enter total estimated costs of the project	\$100,000.00
Enter your burdened hourly labor cost	\$40.00
Enter your hourly labor chargeout rate	\$78.00
Then your markup on labor is	95.00%
Enter your intended markup on non-labor costs (%)	30.00%
Enter target margin as a %	35.00%

% of Total Costs Due to Labor	% of Total Costs Due to Non-Labor	Estimated Cost for Labor Portion of the Project	Estimated Cost for Non-Labor Portion of the Project	Total Estimated Cost of Project	Sale Price of Labor Portion of Project	Sale Price of Non-Labor Portion of Project	Total Sale Price of Project	Projected Gross Profit on Project	Projected Gross Margin on Project
0	100	\$0.00	\$100,000.00	\$100,000.00	\$0.00	\$130,000.00	\$130,000.00	\$30,000.00	23.08%
5	95	\$5,000.00	\$95,000.00	\$100,000.00	\$9,750.00	\$123,500.00	\$133,250.00	\$33,250.00	24.95%
10	90	\$10,000.00	\$90,000.00	\$100,000.00	\$19,500.00	\$117,000.00	\$136,500.00	\$36,500.00	26.74%
15	85	\$15,000.00	\$85,000.00	\$100,000.00	\$29,250.00	\$110,500.00	\$139,750.00	\$39,750.00	28.44%
20	80	\$20,000.00	\$80,000.00	\$100,000.00	\$39,000.00	\$104,000.00	\$143,000.00	\$43,000.00	30.07%
25	75	\$25,000.00	\$75,000.00	\$100,000.00	\$48,750.00	\$97,500.00	\$146,250.00	\$46,250.00	31.62%
30	70	\$30,000.00	\$70,000.00	\$100,000.00	\$58,500.00	\$91,000.00	\$149,500.00	\$49,500.00	33.11%
35	65	\$35,000.00	\$65,000.00	\$100,000.00	\$68,250.00	\$84,500.00	\$152,750.00	\$52,750.00	34.53%
40	60	\$40,000.00	\$60,000.00	\$100,000.00	\$78,000.00	\$78,000.00	\$156,000.00	\$56,000.00	35.90%
45	55	\$45,000.00	\$55,000.00	\$100,000.00	\$87,750.00	\$71,500.00	\$159,250.00	\$59,250.00	37.21%
50	50	\$50,000.00	\$50,000.00	\$100,000.00	\$97,500.00	\$65,000.00	\$162,500.00	\$62,500.00	38.46%
55	45	\$55,000.00	\$45,000.00	\$100,000.00	\$107,250.00	\$58,500.00	\$165,750.00	\$65,750.00	39.67%
60	40	\$60,000.00	\$40,000.00	\$100,000.00	\$117,000.00	\$52,000.00	\$169,000.00	\$69,000.00	40.83%
65	35	\$65,000.00	\$35,000.00	\$100,000.00	\$126,750.00	\$45,500.00	\$172,250.00	\$72,250.00	41.94%
70	30	\$70,000.00	\$30,000.00	\$100,000.00	\$136,500.00	\$39,000.00	\$175,500.00	\$75,500.00	43.02%
75	25	\$75,000.00	\$25,000.00	\$100,000.00	\$146,250.00	\$32,500.00	\$178,750.00	\$78,750.00	44.06%
80	20	\$80,000.00	\$20,000.00	\$100,000.00	\$156,000.00	\$26,000.00	\$182,000.00	\$82,000.00	45.05%
85	15	\$85,000.00	\$15,000.00	\$100,000.00	\$165,750.00	\$19,500.00	\$185,250.00	\$85,250.00	46.02%
90	10	\$90,000.00	\$10,000.00	\$100,000.00	\$175,500.00	\$13,000.00	\$188,500.00	\$88,500.00	46.95%
95	5	\$95,000.00	\$5,000.00	\$100,000.00	\$185,250.00	\$6,500.00	\$191,750.00	\$91,750.00	47.85%
100	0	\$100,000.00	\$0.00	\$100,000.00	\$195,000.00	\$0.00	\$195,000.00	\$95,000.00	48.72%

Scenario 2: Labor Must Comprise 80% of Total Job Costs

For a more labor-intensive job, we kept the estimated costs the same, but increased the labor charge-out rate to \$65 and reduced the markup on subs and materials to 20% (box at right). Under these conditions, the client could still meet his target margin as long as labor costs comprised at least 80% of the total job costs.

Enter total estimated costs of the project	\$100,000.00
Enter your burdened hourly labor cost	\$40.00
Enter your hourly labor chargeout rate	\$65.00
Then your markup on labor is	62.50%
Enter your intended markup on non-labor costs (%)	20.00%
Enter target margin as a %	35.00%

% of Total Costs Due to Labor	% of Total Costs Due to Non-Labor	Estimated Cost for Labor Portion of the Project	Estimated Cost for Non-Labor Portion of the Project	Total Estimated Cost of Project	Sale Price of Labor Portion of Project	Sale Price of Non-Labor Portion of Project	Total Sale Price of Project	Projected Gross Profit on Project	Projected Gross Margin on Project
0	100	\$0.00	\$100,000.00	\$100,000.00	\$0.00	\$120,000.00	\$120,000.00	\$20,000.00	16.67%
5	95	\$5,000.00	\$95,000.00	\$100,000.00	\$8,125.00	\$114,000.00	\$122,125.00	\$22,125.00	18.12%
10	90	\$10,000.00	\$90,000.00	\$100,000.00	\$16,250.00	\$108,000.00	\$124,250.00	\$24,250.00	19.52%
15	85	\$15,000.00	\$85,000.00	\$100,000.00	\$24,375.00	\$102,000.00	\$126,375.00	\$26,375.00	20.87%
20	80	\$20,000.00	\$80,000.00	\$100,000.00	\$32,500.00	\$96,000.00	\$128,500.00	\$28,500.00	22.18%
25	75	\$25,000.00	\$75,000.00	\$100,000.00	\$40,625.00	\$90,000.00	\$130,625.00	\$30,625.00	23.44%
30	70	\$30,000.00	\$70,000.00	\$100,000.00	\$48,750.00	\$84,000.00	\$132,750.00	\$32,750.00	24.67%
35	65	\$35,000.00	\$65,000.00	\$100,000.00	\$56,875.00	\$78,000.00	\$134,875.00	\$34,875.00	25.86%
40	60	\$40,000.00	\$60,000.00	\$100,000.00	\$65,000.00	\$72,000.00	\$137,000.00	\$37,000.00	27.01%
45	55	\$45,000.00	\$55,000.00	\$100,000.00	\$73,125.00	\$66,000.00	\$139,125.00	\$39,125.00	28.12%
50	50	\$50,000.00	\$50,000.00	\$100,000.00	\$81,250.00	\$60,000.00	\$141,250.00	\$41,250.00	29.20%
55	45	\$55,000.00	\$45,000.00	\$100,000.00	\$89,375.00	\$54,000.00	\$143,375.00	\$43,375.00	30.25%
60	40	\$60,000.00	\$40,000.00	\$100,000.00	\$97,500.00	\$48,000.00	\$145,500.00	\$45,500.00	31.27%
65	35	\$65,000.00	\$35,000.00	\$100,000.00	\$105,625.00	\$42,000.00	\$147,625.00	\$47,625.00	32.26%
70	30	\$70,000.00	\$30,000.00	\$100,000.00	\$113,750.00	\$36,000.00	\$149,750.00	\$49,750.00	33.22%
75	25	\$75,000.00	\$25,000.00	\$100,000.00	\$121,875.00	\$30,000.00	\$151,875.00	\$51,875.00	34.16%
80	20	\$80,000.00	\$20,000.00	\$100,000.00	\$130,000.00	\$24,000.00	\$154,000.00	\$54,000.00	35.06%
85	15	\$85,000.00	\$15,000.00	\$100,000.00	\$138,125.00	\$18,000.00	\$156,125.00	\$56,125.00	35.95%
90	10	\$90,000.00	\$10,000.00	\$100,000.00	\$146,250.00	\$12,000.00	\$158,250.00	\$58,250.00	36.81%
95	5	\$95,000.00	\$5,000.00	\$100,000.00	\$154,375.00	\$6,000.00	\$160,375.00	\$60,375.00	37.65%
100	0	\$100,000.00	\$0.00	\$100,000.00	\$162,500.00	\$0.00	\$162,500.00	\$62,500.00	38.46%

The STRONG, SILENT TYPE

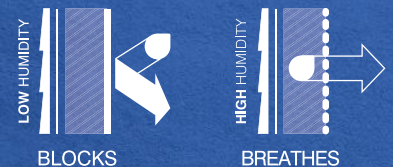


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BY HARRISON MCCAMPBELL



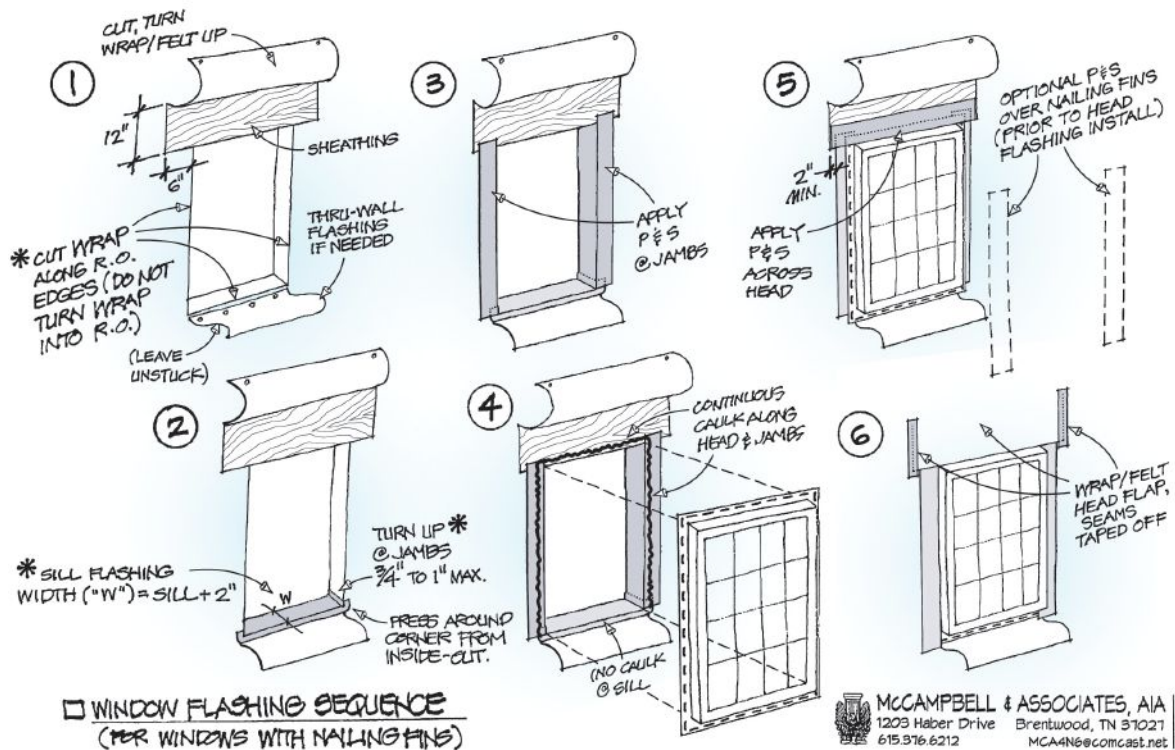
Rethinking Window Flashing

As a consulting architect specializing in moisture protection of buildings, I've seen my fair share of water damage around windows. Often the installers had carelessly assembled the pieces—peel-and-stick flashings, housewrap, and the window itself—resulting in extensive damage at the sill-jamb intersection, typically at what I call the “X-Y-Z” points **(1)**.

While poor workmanship is common, sometimes I come across damage during forensic investigations where it appears workers have attempted to follow manufacturer's guidelines, but leaks still occurred. In these cases, I suspect the flashing material was stressed beyond its material limitations where installers had stretched it across the “X-Y-Z” juncture at the sill, and

despite all attempts to apply patches in the corner, the installation failed. Contributing to the failures are mistakes like using housewrap as the primary flashing, not installing the products “shingle-fashion,” and relying on adhesive products, such as tape and peel-and-stick, to remain sticky forever.

Another problem is that while code says to follow the manufacturer's instructions, the question is often: Which set do you follow? First, there may be a method given by the peel-and-stick flashing-tape manufacturer. There are also likely to be instructions from the housewrap manufacturer. There may be a detail from an architect. And, of course, the window manufacturer has its method. So, whose method takes precedence?



Before wading into this question, let me first present the way I urge installers to flash windows. I can then get back to the stickier issue of “selling” it to all parties involved.

FLASHING MY WAY

The illustration above is the type of drawing I typically provide to the owners and contractors on the jobs I get involved in. Most of the photos shown in this article are from a job that is typical of a lot of the jobs I have been involved with—large apartment complexes with around 200 to 300 windows. On a job this large, quality control is difficult, but the drawing helps make each step clear to everyone, which is half the battle.

Housewrap. Most window-flashing instructions tell you to cut the housewrap in an inverted “V” and turn the housewrap in along the sill and jambs (2). In doing so, the housewrap becomes the primary jamb flashing. In my opinion, this is wrong. If

peel-and-stick is not adhered directly to the rough openings’ wood surfaces, water has the potential to travel between the wood surface and the housewrap. The whole point of using a peel-and-stick flashing is to protect the innermost wood components.

Instead, I recommend cutting the housewrap flush with the window’s rough opening at the jamb and sill (3). At the head, I recommend providing a square cut (as opposed to the conventional method of angle-cutting the housewrap) at least 6 inches horizontally beyond the rough opening and 12 inches above it (see step 1, illustration above). This method keeps the cuts away from the opening and allows the ends of a peel-and-stick to adhere directly to the sheathing.

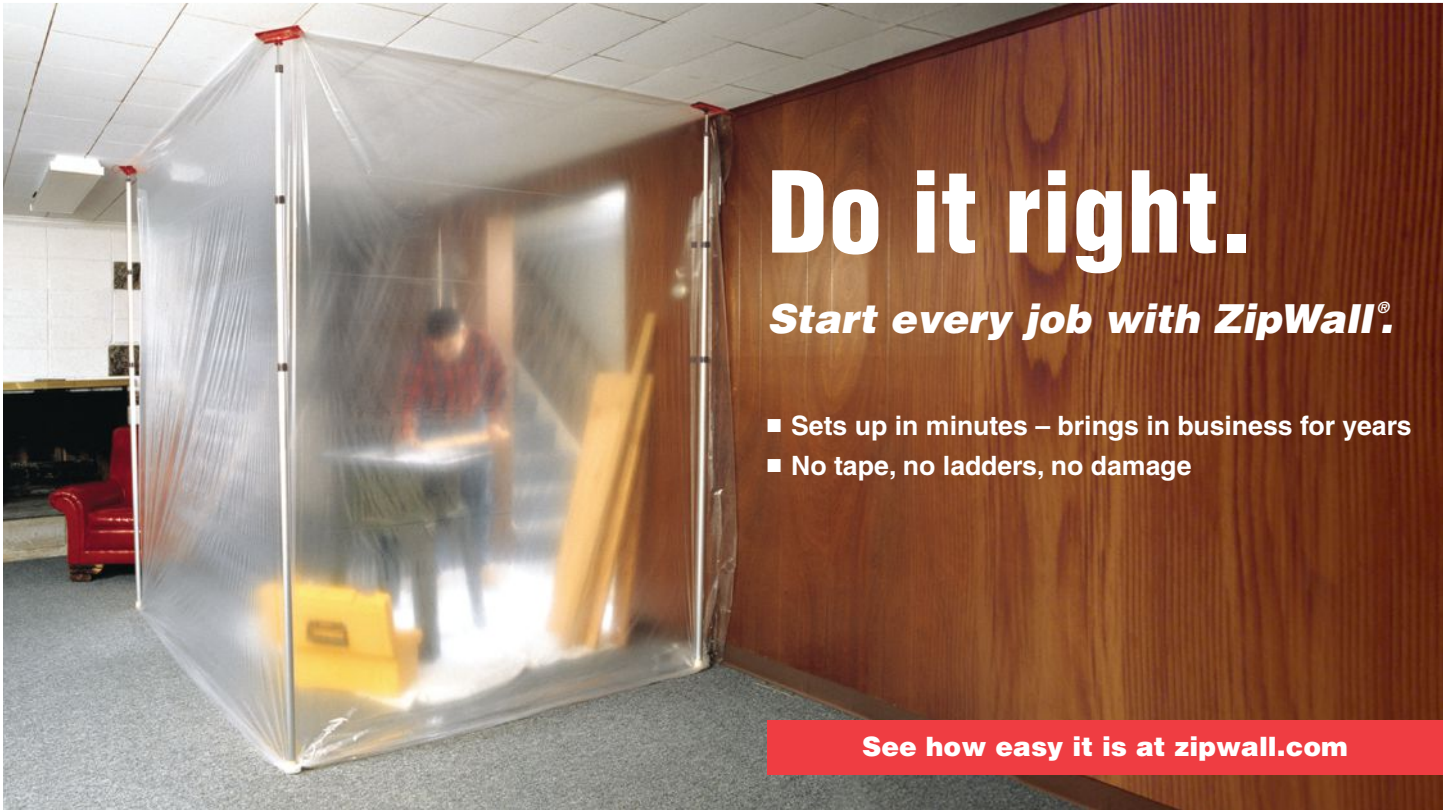
Sill flashing. Whether you’re using a flexible flashing or a straight peel-and-stick, most window flashing instructions call for turning the sill flashing up the jambs a full 6 inches. This seems excessive. Is this done to protect the sills against ponded water? I submit that if water ever rises to that height

on a jamb, there are plenty of other issues to be concerned about other than a window leak. Compounding the matter, most window flashing instructions show (though do not specifically call out) the sill flashing lapping over the housewrap below the opening approximately 6 inches.

Doing all this with flexible flashing often results in lots of wrinkles (4), and I suspect it overstresses the material limits, if not of the flashing itself, certainly of the housewrap it’s lapping onto.

With straight flashing, the recommendation is to avoid all this material stress by taking a utility knife and cutting the flashing at a 45-degree angle from the corner (5).

For me, this unravels all the good intended by turning the tape up in the first place. Cutting the peel-and-stick essentially exposes the “X-Y-Z” corners. And applying a “patch” to cover this exposed corner just provides another avenue for water to hit against an adhered edge and attack what it’s trying to protect. Also, the patch



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(usually a “bow tie” shape is recommended) is stretched beyond its material limitation. This has the potential to cause more wrinkling and fish-mouthing, and increases the likelihood of the flashing delaminating from the sill.

Instead, I recommend turning the jamb edges up no more than 1 inch (6), and lapping the housewrap no more than 2 inches. I believe this is enough to cover the critical “X-Y-Z” corners, and allows enough vertical height to be lapped by the jamb flashing. It’s also enough length to lap the top of the moisture barrier or a separate through-wall flashing sheet, if one is needed for masonry veneer.

I prefer using a flexible sill flashing, which allows the critical corners to be formed more easily and increases the chances of the sill flashing staying flat. On a recent project, I compromised and allowed the builder to install straight flashing, applying it with a 1-inch lap onto the jamb (without cutting the corner). One of the biggest prob-

lems using flat flashing tape at the sill is that it tends to retract when being applied to two disparate planes, because of its relatively rigid polyethylene backing. Extending up only 1 inch, the resulting corner was difficult to achieve, but passable—though not without some wrinkles and fish mouths (7).

Jamb flashing. For the jamb flashing, I recommend installing a straight peel-and-stick flashing adhered to the trimmed-off housewrap on the face, and to the wood in the rough opening (8). Where the jamb flashing laps the sill flashing, the lap is not perfect (there are still wrinkles), but it is sufficient; any water that finds its way to the flashing will “shingle off.”

Once the jamb flashing is in place, the window unit is installed and the window flanges caulked (but not at the sill) and fastened to the wall.

Head flashing. The head flange is covered with a straight peel-and-stick. This flashing must adhere directly to the wall sheathing. Make sure it extends past the

outer edges of the window, preferably past the outer edges of the sill’s flashing tape (9). The last step is to fold the housewrap back down over the head flashing, and tape the slits in the housewrap closed.

WARRANTY VS. LIABILITY

The biggest push-back to this method I get from contractors—both the general and subcontractor installers—is the argument that following this way will void manufacturers’ warranties. I argue that avoiding the liability associated with water damage is far more important than any warranty (which is usually next to impossible to redeem). I don’t always get my way, but often I can persuade the owner and the building inspector that my way offers the least chance of failure.

Harrison McCampbell is a consulting forensic architect in Brentwood, Tenn., specializing in moisture-related construction defects. You can find him online at MCA4N6.com.

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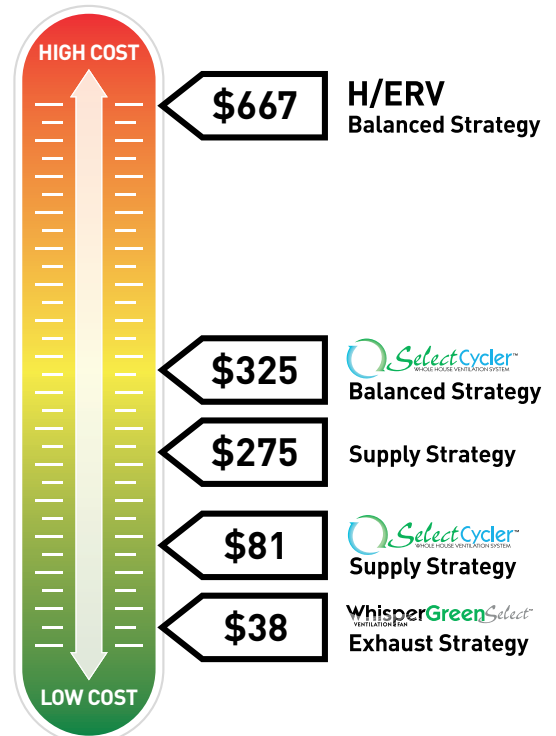
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BY TED CUSHMAN

The Trouble With High-Efficiency Heat

In the winter of 2014, homeowners in the Raleigh, N.C., area encountered an inconvenient truth. In the depths of a cold snap, their new, 90% efficient condensing furnaces were shutting down, depriving their homes of heat at the very moment when heat was most needed.

What happened? Condensate draining from the furnaces had been piped through an outside wall to drain onto the ground. With temperatures in the teens, the sidewall pipes were freezing, the drains were backing up, and switches inside the furnaces were locking out the equipment.

The experience came as a surprise—as it has for other homeowners in the South, where high-efficiency furnaces are relative newcomers. But freezing condensate drains aren't just a Southern problem. In Northern states, where hard freezes are a winter reality, outdoor condensate drains are less common—and so, naturally,

are freeze-ups. But it does happen, even in states like Michigan or New York.

North Carolina codes have changed to allow furnace condensate to drain through house plumbing into municipal sewers, as is the rule in most Northern states, instead of outside onto the ground. But draining condensate into plumbing drains, basement floor drains, or foundation sumps doesn't solve all the problems—because furnace condensate can damage any of those drain systems.

CORROSIVE CHEMISTRY

Although furnace condensate is mostly water (which, along with carbon dioxide, is the main product of gas combustion), it's not pure water. Gas combustion also produces nitrogen compounds, which collect in the condensing water vapor and turn the condensate into a dilute solution of nitric acid. Over time, the acid eats away at metal and even dissolves some plastics. And if it sits in a drain and evaporates, the effluent concentrates into an even more potent brew.

And it's not just a trickle of condensate, says home inspector Richard Aiello, of I-Spy Home Inspection, in Boston, Mass. "It's a lot of water," he says. "If I'm in the house running the furnace for an hour, I hear the condensate pump go on a couple of times while I'm there."

Mike Bernasconi, a 40-year veteran of the heating industry, now manufactures a condensate neutralizer called Neutra-Safe, designed to make condensate safe before it's directed into a drain pipe. Bernasconi says, "One gallon of condensate is produced for every 100,000 Btus of input, providing the appliance is operating in full condensing mode." That means a typical furnace could easily produce 2,000 gallons or more of the acidic fluid every year.

That could be a problem for the house, Richard Aiello points out. New PVC plumbing isn't vulnerable to furnace condensate, but cast-iron drain pipes are. "In an old house, even if there are new PVC plumbing drains, there could be old cast-iron lines in the basement, and the drain line that runs from the trap and the cleanout to the street is cast iron," says Aiello.

If the condensate is directed into a floor drain, Bernasconi notes, "It could sit in the trap and rot out the floor drain, and then who knows where it goes? I've seen it eat through a concrete footing."



Furnace condensate is highly corrosive and gets stronger from evaporation. Here, a trickling condensate drain has eaten away a basement floor drain grille—just as it could destroy an underfloor cast-iron drain pipe or even a municipal sewer under the street.

Photo: Mike Bernasconi

“You have to look at the big picture,” argues Aiello. “The old pipes under the street are cast iron. And eventually everybody’s going to have a condensing system. Well, now you’re talking gallons and gallons of the stuff running through the city systems, and all these pipes are going to start corroding and they’re going to have to start digging up the streets.”

Plumbing codes require corrosive fluid to be neutralized or diluted before it’s sent into the drain. But many HVAC installers aren’t complying with the rule. Some don’t understand it. Aiello recently inspected a remodel with an air conditioner and a condensing furnace that shared a condensate drain. Both units produce condensate, but the air conditioner’s condensate is harmless atmospheric humidity, not corrosive combustion products. “The guy put a neutralizer on the condensate for the air conditioner, but not the furnace,” says Aiello. “So he kind of had an idea that he had to do something, but ...”



Photo: Billy Sweet

WATER HEATERS

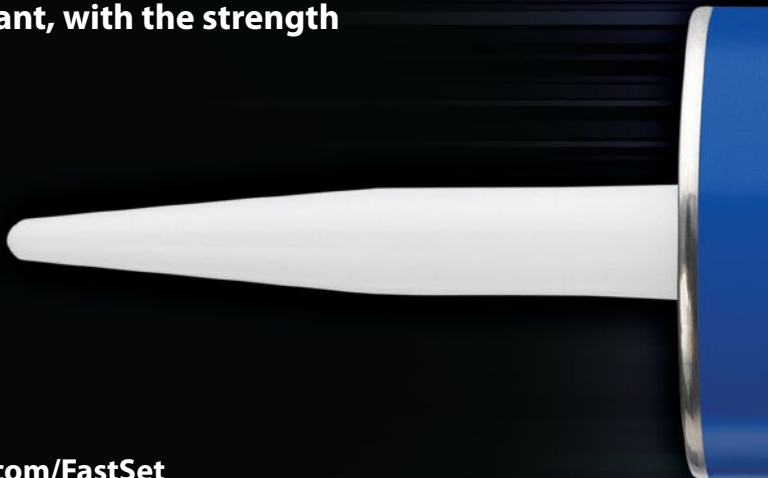
Acidic combustion products also figure in another kind of trouble: the widespread

Condensing acidic exhaust vapor from a water heater has attacked this chimney interior after the old, non-condensing furnace was replaced with a sidewall-vented unit. The water heater by itself can’t heat up the flue enough to keep it dry.

THE SPEED YOU NEED

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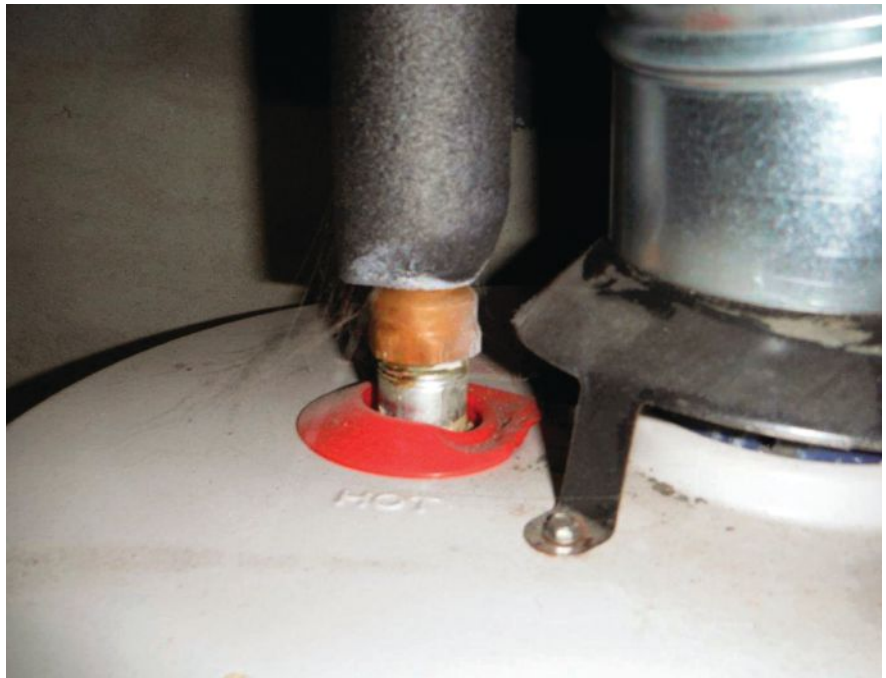
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problem of orphaned water heaters. When an old, low-efficiency furnace is taken off a chimney and is replaced with a modern, sidewall-vented unit, the old water heater is sometimes left alone on the big chimney. By itself, the water heater is unable keep the big flue hot—so flue gases condense more readily on the sides of the flue, attacking the masonry (see photo on facing page).

Chimney damage often starts long before the furnace is taken out of the equation, says Boston chimney sweep Billy Sweet—“but then the water heater operating alone accelerates that.”

Sweet’s biggest concern isn’t the chimney damage—that, he says, can be repaired. The bigger risk is back-drafting caused by a weak draft in an over-sized flue. “Deterioration of the flue is not good. It’s bad,” he says. “But nobody died from that. But if the flue gases flow back into the house, and the water heater re-breathes that? Eventually carbon monoxide can be generated. That’s the most dangerous part of it.”

Ted Cushman is a senior editor at JLC.



In a tell-tale sign, hot combustion gases backdrafting from the vent hood of this water heater have melted the red plastic water-line marker. This water heater, left alone on a large chimney, does not create enough draft to properly vent up the flue.

Photo: Joseph Aletto

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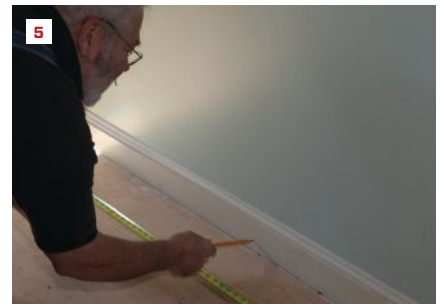
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FLOORING



Installing Prefinished Strip Flooring Skip the sanding but take more time for a careful install

BY HOWARD BRICKMAN

Several years ago, I wrote an article (“Installing Hardwood Strip Flooring,” Mar/99) on the basics of installing solid ¾-inch unfinished strip flooring. I went into great detail about making sure the jobsite and subflooring had dried completely before the installation. I also talked about checking the flooring’s moisture content to make sure it was at the proper level for your area of the country. Those basics *always* apply to *all* wood flooring installations—especially in new work and especially with unfinished strip flooring.

But I’ve often been asked to retrofit strip flooring in existing homes in rooms that are already finished. In the past, the only option was unfinished flooring, and the homeowners had to endure

the hassle of sanding and finishing after the installation. These days, prefinished strip flooring has been gaining popularity—in fact, it now makes up more than half of the market. The prep work is the same as for unfinished strip flooring, but the installation requires more care because of the prefinished surface. The best part is that the job is done when the last board is nailed in—no noisy, dusty, and smelly sanding and finishing.

PREPPING THE SUBFLOOR

For this job, the energetic homeowners had painted the walls and trim of the master bedroom. The old carpet on the floor needed to

Photos by Roe Osborn, except where noted

INSTALLING PREFINISHED STRIP FLOORING



be replaced, so they decided to remove it and put in a wood floor. When I arrived, the carpet had already been removed, exposing a layer of ¼-inch underlayment plywood that had been put down before the carpet was installed.

The first thing I did was to check the flatness of the floor using an 8-foot aluminum straightedge (1). I never expect a floor to be perfectly flat, especially in older homes. Because any variation will telegraph to the finished floor, I make sure there is no more than a gradual ¼-inch variation in 8 feet. Note that I'm checking for flat and not level. A long level can make a good straightedge in a pinch, but don't be distracted by the bubbles. If the subfloor needs to be fixed, explain to the homeowner that if not corrected, the imperfections will be seen on the surface of the new floor after installation is completed.

I also check the moisture content of both the flooring and the subfloor with a pin-type moisture meter (2). In the late New England summer, when this floor was installed, it would have

surprised me to see any red flags. The moisture level of both the flooring and the subfloor was about 8%—well within acceptable limits.

The subfloor had been nailed off, but not nearly enough nails had been used. As I walked around the floor, a couple of areas were squeaky and I marked them before driving any nails (3). Next, I drove nails until I located a joist; then from that point, I ran a joist layout. At each joist, I drove screw nails every 6 inches to firmly anchor the subfloor (4). When I was finished, I rechecked the squeaky areas to make sure I'd quieted them down.

One very important step is marking the joist layout for the first and last courses of the floor. These marks will guide the placement of the face nails to ensure a solid attachment. Because I was running these courses against the finished baseboard, I marked the layout with light, erasable pencil marks (5).

By the way, one sure way to locate the joists is to start on either side of heating vents.



START STRAIGHT TO STAY STRAIGHT

Regardless of the flooring project, it is imperative to make the first course of flooring absolutely straight. The process is complicated by having to scribe the first course to a baseboard that is most likely not straight. To create a straight line, I stretch a string across the starting edge about 4 inches away from the baseboard at either end. Before I install the plywood guide for the first course, I make a quick gauge from a scrap of wood. I check the baseboard to see how far off it is and note the farthest point as I go (6).

The next step is screwing down the plywood guides. Having noted the farthest point of the scribe, and knowing the width of a board and the 3/4-inch thickness of my scribe block, I set the guides in relation to the string. Again I make a simple gauge from a wood scrap, this time with a notch that butts against the string and sets the guide at the proper position (7).

With the plywood guides in position, I pick out enough perfectly straight boards for the first and last courses against the wall (8). I

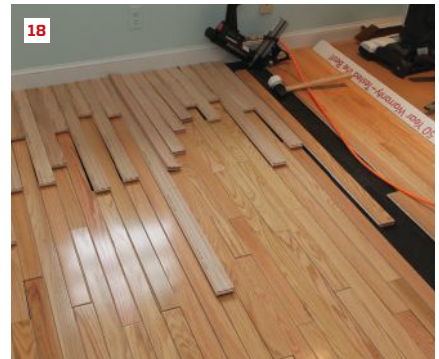
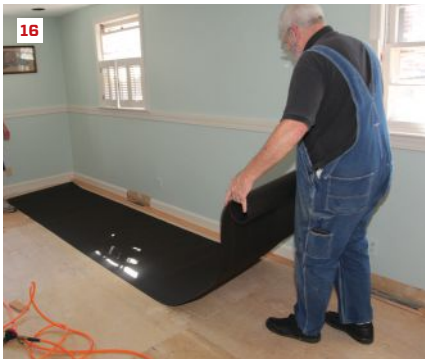
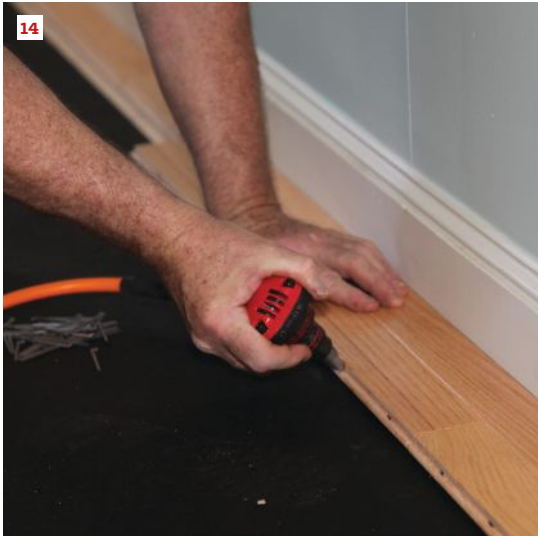
set the boards against the plywood guides and cut the last board to length. Then I use a scrap of flooring with the edge cut square as a scribe block and mark the first course so that it will fit perfectly against the baseboard (9).

To make my cuts with minimal dust, I use a Festool Track Saw. I take the starting boards one at a time and snug them against scrap pieces of flooring that will support the saw's track. I set the track so that it just covers the line (I don't try to be precise at this point). Then I set the blade at a 5-degree bevel and make my cut (10). Now I use a block plane to fine-tune the edge precisely to the pencil line (11). Because of the bevel, the plane needs to trim off only a small amount instead of the entire thickness of the board. As a result, the boards fit perfectly against all the variations of the baseboard.

ATTACH THE FIRST COURSES

When all the pieces for the first course have been scribed to fit against the baseboard, the plywood guides are no longer necessary

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so I remove them. I also remove the string, but I keep the nails in place so that I can check the straightness of the first course after it's installed.

I bed the pieces for the first course one at a time in an adhesive made especially for wood flooring by the Bona Company (12). This adhesive sticks tenaciously to both the flooring and the subfloor, but it stays flexible and doesn't get brittle and hard like other construction adhesives.

Because there is no room for the flooring nailer until you are at least three courses (5 to 6 inches) from the wall, the beginning courses must be hand-nailed. Many folks like to use pneumatic finish nailers, but most don't fire nails with a large enough gauge to hold the flooring properly. Instead I use a nail spinner, which essentially holds a finish nail and turns it into a drill bit. The spinner leaves the nail about 1/2 inch out, so then I hammer the nail in as far as I can without damaging the finished surface of the wood (13) and set each nail down to the flooring's surface.

I drive two nails at every joist for the first course, one face nail and one nail into the tongue. I set the face nails just below the surface and come back at the end to fill the holes. It's imperative that the first course be securely fastened. It has to stay put while absorbing the force from the installation of all the nails for the next three or four courses of flooring. On this particular job, I road tested Powernail's Power Palm nailer (14). It drives the same cleat nails normally used in flooring nailers, but just one nail at a time. The palm nailer worked so well that I never picked up the nail spinner again for this job until face-nailing the final course.

When you nail the majority of the boards with a flooring nailer, the mechanics of the machine help to snug the boards together. You don't have this advantage for the beginning courses. It's always a temptation to tap on the tongue with a hammer, but that can damage the tongue and make it even more difficult to tap the next board into position. Instead, I grab a sacrificial scrap of flooring that I can bang on as hard as I want to snug up the boards (15).



BUILDERS PAPER UNDER THE FLOORING.

I am a firm believer in putting down 15-lb. felt paper before installing a wood floor. The felt paper serves a number of functions. Its biggest job is to increase the friction between the flooring and the subfloor, which helps to resist lateral movement if any shrinking or swelling occurs. The sticky surface of the felt lets it adhere to the subfloor and to the wood flooring, which helps to eliminate any springiness or movement. Finally, many wood-flooring manufacturers make using 15-lb. felt paper mandatory for their warranties.

A secondary function of 15-lb. felt is slowing the movement of water vapor. Being impregnated with asphalt, felt paper does not absorb moisture, but retards moisture instead. Just be aware that if there is excessive moisture present, underlayment papers will not prevent swelling or cupping.

Because red rosin paper does not have any of the qualities mentioned above, it should never be used under wood flooring. To keep

the felt paper from rolling up on itself before you install the flooring, always roll it out upside down (16). I almost never need to staple it in place.

THE FINE ART OF RACKING

The first courses are always the most tedious and the slowest because you need to hand-nail each board. Once the first three courses are completed, it's time to ramp up the process with a flooring nailer. But in order for the installation process to move quickly, the flooring must first be racked.

Racking is laying out the flooring beforehand in roughly the same pattern as it will be installed (17). The flooring is boxed in random lengths, so start by grabbing the first couple of layers out of the box and laying the boards end-to-end with the tongue facing out. As I set up the courses, I try to stagger the seams by at least 8 to 10 inches from one course to the next.

For racking purposes, the courses don't need to be tight at the

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ends or one course to the other. Be sure to use up short lengths as they come out of the box. If you put short pieces aside as you go, you may need to use them all at once, which will make the butt-seam pattern look too busy in one area. It's also good practice to mix boards from several boxes together so that any slight variations in color are distributed randomly throughout the floor.

At the ends, pick boards that are a few inches longer than you'll need (18). Don't try to be too precise at this point. When the courses are installed, you want to have plenty of material to work with for the end pieces. I always place the end pieces upside down and flipped end-for-end. That way they are already in position to be marked for cutting as the installation progresses.

THE INSTALLER'S TWO-STEP

With the racking done, the nailing can go quickly (19). The installer's foot work is just as important as his ability to swing the mallet at this point. Soft-soled non-marring shoes are a must.

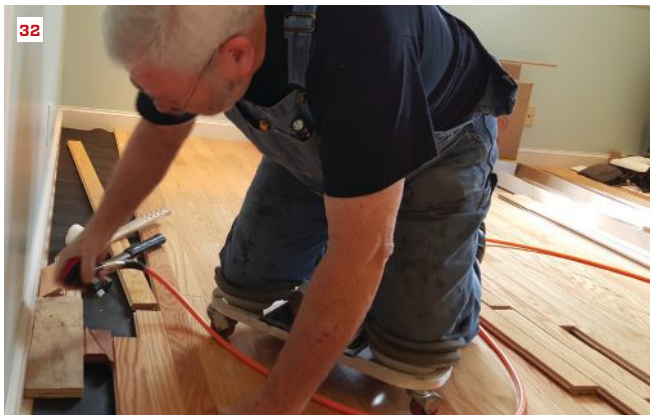
For each board, I reach over with my right foot and grab the next board out of the rack. I drag the board over at a slight diagonal (20), and bring it in tight along the edge. At the same time, I apply a little pressure in the direction of my toe to engage the end seams of the boards. Then I tap lightly against the edge tongue (21) and give the end a slight tap (22), and I'm ready to nail.

THE END GAME

Repeating these same steps, I move across the floor, installing several courses at the same time in a stair-step fashion (23). When I've gone across the entire floor, installing as many boards as I can, I go back to finish the ends. Ordinarily, the person racking is also responsible for cutting the end pieces to length. In this case I was happy to have the racking help, but took care of the ends myself.

At the end, I grab the board for the course I'm completing, put it on edge, and mark the length on the finished face (24). Because the boards have been reversed, my mark is on the end of the board that

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needs to be cut. I mark three or four courses and then square the mark across each board (25). Next I put the boards together with the cut lines lined up. I set the saw track in place and cut the ends, again at a slight back bevel (26). As I set each board into place, I try for a snug fit without forcing the board. If the fit is too tight, I fine-tune it with a rasp so that the board goes in without pushing the baseboard over.

THE OTHER SIDE OF THE ROOM

Around closet doorways that are parallel with the flooring, I install the flooring to within a board width of the door jamb. Using a thin-kerf handsaw set on a scrap of flooring, I cut off the door trim as well as the door stop (27). (An oscillating cutter would work as well, but I feel that I have better control of my handsaw.)

I scribe the pieces to fit under the jambs on either side of the doorway, marking out the width and all of the various places where the piece changes shape (28). I cut the pieces with a jigsaw, paying special attention to the cuts that will be exposed. When the piece is cut, I tap it into place, again using a scrap to protect the end of the board (29). With both jamb pieces installed, I now mark and cut the

piece to fit between them. I cut the tongue end of the board so that it slips into place easily (30).

At the other wall, I install boards as close as I can with the floor nailer and then install all but the last board nailing by hand (31). For this project, I was happy to have that palm nailer. Wedges can be a help fitting this course into place (32). When all but the last course is installed, I set the pieces for the final course directly on top of the course before. Then using a scribing block made from a full-width scrap, I mark the scribe cut for the final course (33). As with the beginning pieces, I make a rough cut at a bevel near the scribe line and fine-tune the fit with a plane.

It's a little trickier getting these pieces into place because they need to rotate in so the tongue and groove can engage. The cut against the wall must be beveled so that the bottom of the board doesn't catch on the baseboard. After the last board is tapped into place, I drive and countersink face nails at each joist. Finally I fill the holes with colored putty, and pack up my tools and head home.

Howard Brickman is a flooring contractor and consultant based in Norwell, Mass.

Photos 31 and 32 by Jeremy Beaulieu



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HIGH-PERFORMANCE WALLS



Major Surgery for a Failing Fat Wall Modern materials and proper details restored the double stud wall to a high-performance system

BY JIM BRADLEY

I'm a builder and remodeler in northern Vermont, specializing in home performance. My company, Caleb Contracting, does a lot of energy-efficiency retrofit work on existing homes, with many of those jobs referred to us from the state's energy-efficiency utility, Efficiency Vermont.

Some jobs can be accomplished for a few thousand dollars with basic air-sealing and a little added insulation. But sometimes when we investigate a home's envelope and HVAC systems, we find major issues that require extensive work to correct. In this story,

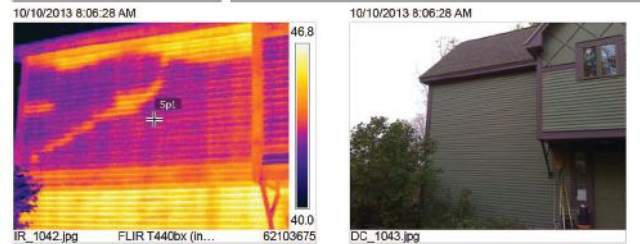
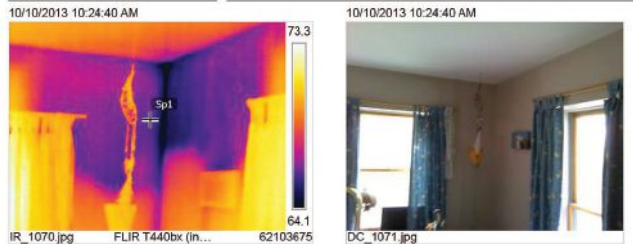
I'll walk through one of our more extreme jobs.

The single-family country house shown here dates to the early 1980s and was framed with double stud walls 12 inches thick. The homeowners called us because they had some comfort issues and high energy bills. I'm sure they were hoping that simple measures would improve their situation, but when we took a good look at the house, we found serious flaws—failing insulation, severe moisture damage, mold, rot, and pest infestation.

Fixing those problems required significant reconstruction of

Photo: Jim Bradley

MAJOR SURGERY FOR A FAILING FAT WALL



Infrared scans of the home's walls revealed an extreme example of settled cellulose insulation (1), as well as clear evidence that rodents had made tunnels within the walls (2). Removing the moisture-damaged OSB sheathing from the wall exterior confirmed that the insulation had settled badly (3).

the house walls. Before we were done, we needed to tear off the home's siding and sheathing, remove its wall insulation, and rebuild the whole wall assembly from the back side of the drywall out. Not only did we install new Roxul batt and dense-packed cellulose insulation, we installed new smart vapor-control membrane, new vapor-open sheathing, and a new weather-resistive barrier. To top it off, we replaced the home's old, damaged siding and trim with a rainscreen cladding system constructed from more durable materials.

It was much more work than the owners had originally contemplated. But the thorough effort was necessary to keep their home from continuing to deteriorate.

The good news is that with smart design based on sound building science and the appropriate use of modern materials, we were able to turn this house back into the high-performance dwelling that it was originally intended to be—and with reasonable confi-

dence that these systems will perform extremely well for at least another 50 years.

INVESTIGATION

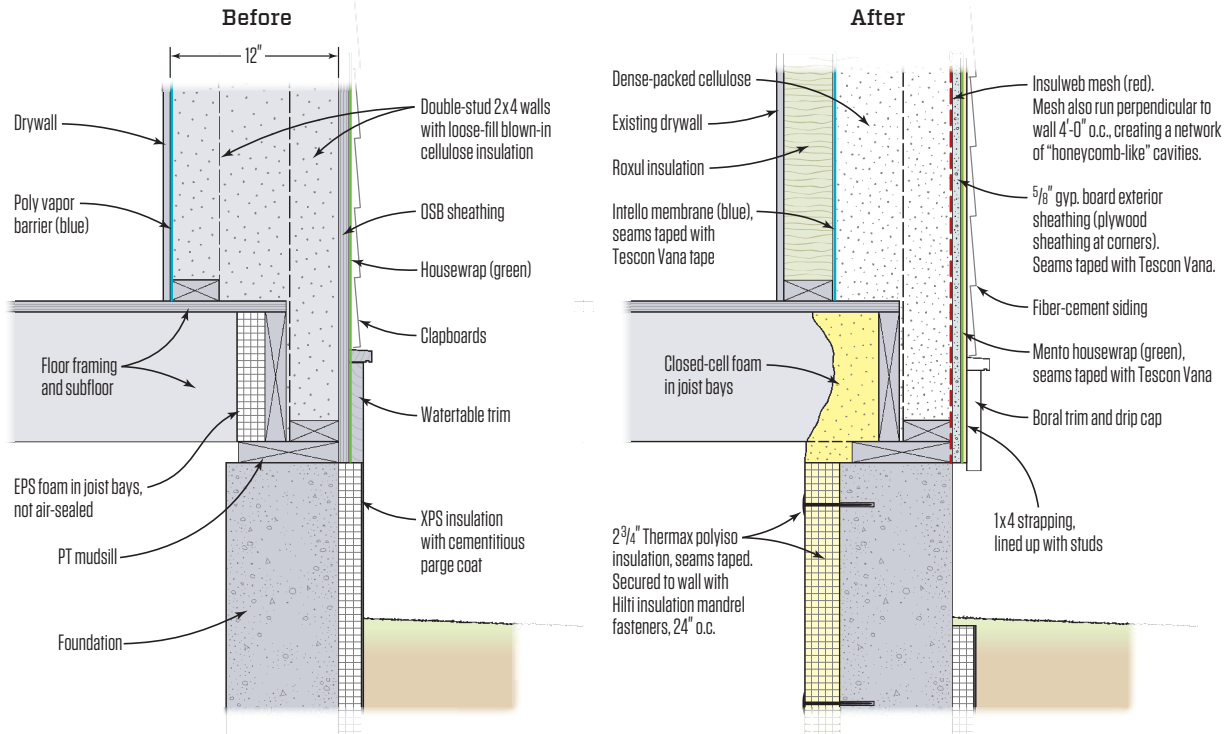
Our routine examination of a house includes a visual inspection, a blower-door test, and an infrared camera scan to identify heat-flow issues. In the case of this house, the visual inspection showed damage to the foam perimeter insulation around the basement foundation, caused by ants who made their home in the insulation, and by woodpeckers who were hunting the ants.

In the attic, we found 20 inches of blown cellulose insulation in good condition, but we noticed some air leakage around the ceiling access hatch (nothing particularly difficult to remedy).

The blower-door test indicated a moderate amount of air leakage—1,366 cubic feet per minute (CFM), which worked out to 3.25 air changes per hour at 50 pascals of pressure (ACH50). This was

Photos: 1&2, Jim Bradley; 3, Tim Healey

Major Surgery for a Failing Superinsulated Wall



Simple in concept, the home's existing double stud wall (left) had failed in practice. Damp cellulose insulation in the open cavity had settled. The author rebuilt the assembly (right) by installing Roxul batts in the inboard stud bays, sealing that inner wall with a smart vapor barrier, and creating a contained honeycomb structure in the outer wall to hold dense-pack cellulose at 3.5 pounds per cubic foot. Vapor-open sheathing with a taped weather barrier and rainscreen siding lets the wall dry outward.

surprisingly good for a house of early 1980s vintage. The blower door helped us pinpoint some typical air leaks, visible as hot or cold spots in our infrared camera images.

In themselves, the air leaks would not have been difficult to address. But the infrared scan of the walls also revealed another kind of serious trouble: major settling of the insulation, which we could see on the infrared images from the outside of the house as red heat blooms in the walls, and from the inside as blue cold areas.

My report to the homeowners read, "All exterior walls were found to have significant settling of the cellulose insulation. We suspect that the cellulose, when installed in the 1980s, was not installed under pressure (dense-pack) as is the current practice. Some walls have seen as much as a 40% reduction in the insulation coverage through settling. There were also areas, notably the front wall of the master bedroom, where rodent pathways were visible

on the infrared camera image. Upon direct inspection, the air in the double stud wall cavity in the gable end of the living room was found to have a relative humidity 10% higher than the ambient humidity in the room (64%). This high humidity in the wall cavity near the insulation indicates that the insulation itself is damp, which is a possible invitation to the carpenter ants that have plagued the structure."

The dampness inside the wall was the result of a double vapor-barrier assembly, consisting of a poly liner behind the drywall on the interior wall, plus oriented strand board (OSB) sheathing with a standard housewrap on the exterior. While OSB may be structurally equivalent to plywood in the building code, the two types of structural panel don't have the same moisture transmission characteristics—OSB is less vapor permeable. Depending on the adhesives and the conditions of manufacture, OSB can have a perm rating low enough to be considered a vapor barrier

MAJOR SURGERY FOR A FAILING FAT WALL



Built in 1983, the house had typical styling and materials from that era (4). Stripping off the siding revealed the usual OSB sheathing and housewrap, both in a deteriorated condition (5). Ants had tunneled into the foam insulation around the home's foundation (6), pursued by hungry woodpeckers. With the siding removed, the author found that he could flake away the moisture-damaged OSB sheathing with his fingers (7).

(sometimes as low as 0.1 perms). In this case, it appeared that the assembly amounted to a vapor “sandwich”—common practice that is still being replicated today throughout the country.

My recommendation to the homeowners was to remove the home's siding and sheathing and remove and replace all the damp, settled insulation. In rebuilding the wall, I proposed to install vapor-control membranes, airtight but vapor-permeable sheathing, and an effective drainage plane before re-siding the structure.

Windows were a question mark, but as the job progressed, the owner made the decision to replace the windows too.

Our investigation had revealed a particularly bad case of the building-science and construction failures that we commonly encounter in our market. It was an extreme example, but this type of problem is not an outlier. In my area, situations like this are becoming the norm, especially in houses built from the 1980s to the present. This house was a reminder of how important it is for us as

building professionals to keep educating ourselves on the most current and field-tested building-science principles, techniques, and materials, so that the structures we build and renovate will continue to offer a healthy and safe environment that is durable as well as energy efficient.

DEMOLITION

In order to protect the existing walls against the weather as we worked, I decided to demo and rebuild the house one wall at a time, sheltering each exposed wall with tarps until we had made the assembly rain-resistant again. As we stripped off the siding and sheathing, we uncovered damp, settled insulation, confirming the evidence of our infrared photos. We were also able to inspect the sheathing and framing directly, and we found that the sheathing was deteriorating from dampness and decay (you could easily pull the OSB apart with your fingers). Most of the wall framing was still

Photos: 4, Jim Bradley; 5, Matt Burstein; 6&7, Tim Healey



The author's crew stripped the compromised OSB sheathing off the stud wall (8), and vacuumed the damp, settled cellulose out from the double stud cavity (9). The team attempted to preserve the existing windows in place, but the failure of the OSB meant that the windows would have to come out in order to repair the sheathing (10). The wall's condition was worst at its base (11), where it rested on the ant-infested perimeter insulation and floor framing.

sound, but the floor framing was not; we discovered that we would need to remove and replace portions of the first-floor band joist where the wood was rotted and infested with ants.

After opening up the walls, we vacuumed out the moisture-damaged and settled cellulose insulation, along with its load of animal droppings, urine, hair, insects, and mildew. That contaminated material and its load of allergens got pumped into disposal bags inside the dumpster.

Interestingly, as we exposed the back side of the drywall on the inner wall frame, we could see how the original builder had carefully air-sealed wiring penetrations and electrical boxes. The home's builders were evidently well-intentioned and had made a serious effort to do a good job—but they were working without a full understanding of the building science involved or of the properties of the materials they employed.

We also removed the poly vapor barrier from the back side of the

drywall. The plastic on the inside of the house had caused more problems than it solved, as is commonly the case. Later we would achieve the poly's vapor-control objective using a more advanced material that was more carefully detailed and placed in a more appropriate location within the cross-section of the wall.

RECONSTRUCTION

When we work on any existing house, we keep three objectives in mind. We look at the situation first from the standpoint of health and safety: We want our work to make the house healthier and safer. We don't want to disturb asbestos, for example, or turn the house into a mold factory by introducing moisture issues. Second, we consider the structural soundness of the house: We want to restore the building to a structurally sound condition, and make sure it will stay that way. Energy efficiency is our third priority: We are aiming to cut the home's energy bills—and we

MAJOR SURGERY FOR A FAILING FAT WALL



The crew installed a smart vapor barrier over batt insulation (12), stapled Insulweb open-weave fabric on the wall (13), and repacked the wall with borate-treated cellulose at 3.5 pounds per cubic foot (14).

will—but not at the price of introducing moisture issues or structural problems.

In this case, the house already had moisture issues that were a health and safety risk and that were damaging the building's wall structure. So we needed to rebuild the home's walls with a structurally sound system that not only provided excellent energy performance, but also preserved the walls against moisture intrusion, while allowing the walls to dry out freely.

In designing the system, we worked with Floris Buisman of 475 High Performance Building Supply (foursevenfive.com). The experts at 475 are a good resource for design advice in addition to being a U.S. source of some European-made components that aren't widely stocked in this country. With Floris' help, we came up with a wall system in which we have a high level of confidence.

Batts plus dense-pack. The existing house walls were framed as a double 2x4-stud-wall system, and the builders had attempted to fill that entire cavity with loose-fill cellulose insulation.

We had a different plan: We would install Roxul rock wool batt insulation within the inner wall frame and seal up that portion of the wall with a smart vapor-barrier membrane (Pro Clima Intello), applying the membrane to the outboard face of the inner wall studs and taping all the seams. Then we would dense-pack the remaining thickness of the wall with National Fiber cellulose (nationalfiber.com)—this time making sure to pack the insulation in at sufficient density to prevent future settling.

The outside wall was laid out at 16 inches on-center, but the inside wall framing varied—in some places the studs were spaced at 16 inches on-center, and in other places at 24 inches on-center. The irregular framing complicated our planning because we didn't know how much of which size insulation to order until we opened up each portion of the wall and could look at the cavities.

Smart vapor barrier. After insulating the inner wall, we applied Pro Clima Intello smart vapor retarder to the studs to seal the inner cavities and to create a new airtight vapor-control layer for the wall. Intello keeps moisture from entering the wall, but still allows the wall to dry out readily, and with careful taping of the seams, it prevents air infiltration. But to work properly, the membrane needs to be installed with care. In this retrofit situation, the hand labor of attaching the Intello and taping the seams was fussy and complicated—not only did the crew have to work the material into place through the outer stud wall, but they also needed to fit the reinforced sheets around the irregular framing of the inside wall, including various

Photos: Tim Healey



After resheathing the newly insulated walls with vapor-open Gold Bond gypsum board (15) and taping the seams with Tescon Vana tape (16), the crew covered the sheathing with Solitex Mento 1000 (17).

scabbed-on pieces that were part of the original window openings.

Open-weave baffles. With the inner wall insulated and the vapor-control membrane installed, the next step was to dense-pack the outer 8 inches of the wall with cellulose. We wanted to be sure to achieve a good dense-pack so the cellulose wouldn't settle the way it had before.

In that regard, there were two issues to consider. First, we didn't want to repeat the mistake of trying to blow cellulose into an entire open wall all at once. Double stud framing is difficult to dense-pack because the center portion of the wall is open along the whole length of the wall. You're essentially trying to fill one whole side of the house with insulation at a time. That's too much volume; you can't achieve high enough air pressure that way to compact the insulation to the required 3.5 pounds per cubic foot. So we had to find a way to divide up the walls into smaller segments.

The second concern was the airtightness of the cavities. We planned to cover the outside of the wall with ProClima Mento, an airtight, vapor-open membrane. In the past when we've dense-packed walls covered in Mento, however, we've learned that the wall cavities can be so airtight that there's no escape path for the air from the insulation blower. This creates so much back-pressure that the insulation doesn't get sufficiently compacted, and settling occurs. In Mento-covered walls, we've actually needed to return with the insulation blower a second time to fill the voids at the top of the wall after the insulation had settled.

For this job, we addressed both of these problems with a single material—Insulweb from Hanes Engineered Materials (insulweb.com). This is the same fabric that is commonly used for dense-packing walls from inside the house.

Insulweb doesn't stretch, and its open weave lets air escape easily—it's designed for achieving high-density insulation packing. We installed the Insulweb as ribs or baffles across the thickness of the walls at 2 feet or 4 feet on-center to keep the insulation contained within smaller bays. Then we stapled more Insulweb across the whole face of the outside wall. This created a honeycomb system of subdivided bays in the wall.

Now we could work our way along the wall with the blower hose, packing each bay at full density. And when we were done, we could inspect the whole wall for voids or soft areas, so we wouldn't need to come back—not next week, and not 10 years from now.

Vapor-open sheathing. Now that the wall was fully insulated, we needed to replace the failed OSB sheathing we had removed during demolition. We don't usually use OSB for sheathing—we prefer plywood because it's less



Over the vapor-open Solitex Mento 1000 weather-resistant barrier, the crew applied 1x4 strapping to create an air channel behind the new fiber-cement lap siding (18).

prone to deterioration from moisture, and it's more vapor-open, so it allows walls to dry out more readily. But for this wall, we chose an even more vapor-open material: 5/8-inch Gold Bond eXP gypsum board sheathing from National Gypsum (nationalgypsum.com).

Gold Bond is moisture-resistant and has a fiberglass coating that boosts its structural capacity as wall bracing. It's designed for attaching to the outside of wall framing, and can be left exposed to the weather during construction if necessary. Best of all for our purposes, it has a perm rating of 20 perms—more permeable than plywood, and much more permeable than OSB. This optimized our wall system for drying to the exterior.

Gold Bond is approved for wall bracing in the IRC, but plywood has a higher shear capacity for helping a wall resist the lateral load of wind pressure. So at the corners of the house, we used 4 feet of 5/8-inch plywood instead of the gypsum board, for increased racking resistance.

Strictly speaking, we didn't need to tape the seams between Gold Bond panels, because we were planning to cover the gypsum board with a drainage-plane membrane that would have taped seams. But the weather while we were completing this work was unpredictable, with a frequent threat of thunderstorms. So we went ahead and taped the seams of the Gold Bond sheathing with Pro Clima Tescon VANA tape, a vapor-open but waterproof construction tape, to eliminate the risk that wind-driven rain would get through the cracks in the half-completed walls and wet the freshly installed cellulose insulation.

Drainage-plane membrane. Over the top of the taped Gold Bond and plywood sheathing, we installed a drainage plane of Pro Clima Solitex Mento 1000. Mento is highly vapor-permeable (rated at 38 perms), but it's watertight, so it can perform as the wall's weather-resistant barrier. We taped the seams of the Mento using Pro Clima Tescon VANA tape, a vapor-open, waterproof, airtight,

Photo: Matt Burstein



The crew installed insect-screening vent baffles at the base of wall between strapping pieces (19), then applied rot-proof, bug-proof Boral synthetic trim board to the wall (20, 21). Later, they would side the wall with HardiePlank fiber-cement lap siding.

and extremely tenacious tape. With the Mento installed, we were ready for our rainscreen cladding system.

SIDING AND TRIM

Our rebuilt wall system's sheathing and weather-resistant barrier are vapor-open, allowing moisture to escape toward the outside. The siding and trim have to allow that moisture to escape all the way to the outdoor air. So we installed a rainscreen siding system, with HardiePlank lap siding (jameshardie.com) nailed over 1x4 strapping. We used Boral TruExterior composite trim (boralamerica.com) for the frieze board and water table, the corner boards, and the cornice and rake trim. HardiePlank is a fiber-reinforced cement composite, and Boral TruExterior is a composite of fly ash recovered from coal-burning power plants and combined with polyurethane. Neither material is vulnerable to rot or insect damage.

HardiePlank carries a 15-year warranty that covers the color coat on the material, as long as the siding is installed according to the manufacturer's instructions. That warranty applies even when the material is applied directly to the housewrap, with no air space behind it. By installing the boards as we have over a 1/2-inch air space, we think we may be able to expect even longer service.

To preserve the warranty on the HardiePlank, we were careful to install it according to the manufacturer's instructions. For example, you must leave all the field joints uncaulked, but put flashing behind each of those joints. Some builders use housewrap behind the field joints, but we like to use a metal coil stock with a black finish. That way if the gaps widen at all, they won't be obviously visible to somebody driving by on the street.

Jim Bradley is a BPI-certified home-performance contractor, builder, and remodeler based in Vermont.

Photos: Tim Healey

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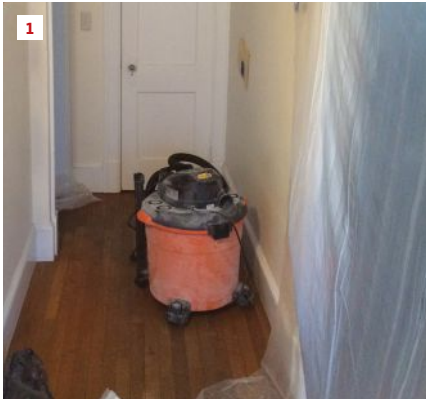


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BATHS



A Tiny but Roomy Bathroom Using the right products makes the most of limited space

BY DANIEL LEWIS

Recently I designed a kitchen remodel for a client who happens to be my son, Jon. During the planning stages for the complete remodel, we decided to make modifications that would improve the circulation patterns and expand the kitchen in the home, built almost 100 years ago. The existing path from the kitchen to the living room was rather circuitous, with access via a narrow hallway next to the stairs (1). By removing an existing half-bath and a brick chimney, we created much more open and direct access to the living room and dining room.

At that point, the narrow hall next to the stairway was no longer needed. The hall was only 45 inches wide—common for a half-bath—

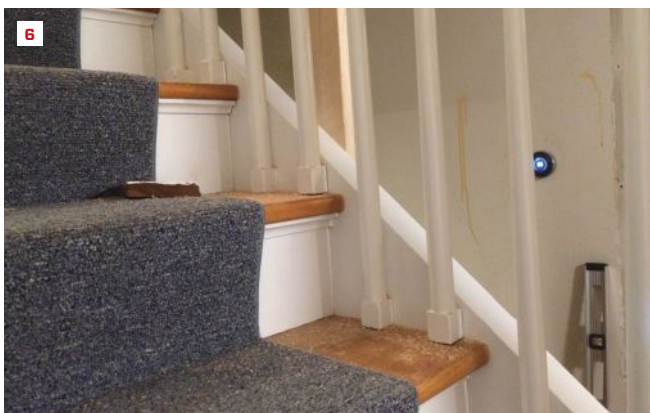
but with the clever use of the right products, we were able to fit in a shower as well, creating a very functional, albeit small, full bath (2).

START WITH A TINY TOILET

The placement of walls and fixtures in the bathroom needed to be planned within a fraction of an inch, and Jon worked out the entire design—including framing, plumbing, and tile details—in SketchUp before demolition began (3). Working out all the details up front and envisioning potential pitfalls saved us a lot of time and frustration down the road during construction.

The first challenge was finding a toilet that fit. Building codes

A TINY BUT ROOMY BATHROOM



typically require 24 inches between the front edge of a toilet and any obstruction, and most standard-size toilets are 25 to 29 inches long. These require more than 4 feet of total space—too wide for our 45-inch-wide ex-hallway. Plus we needed room for the plumbing and a path to the drain line below.

The solution was a wall-hung toilet. I'd used them in commercial applications. Commercial models typically require a sizable wall cavity and use flush valves rather than conventional tanks. But in my research, I found a modern residential wall-hung toilet from Toto with a tank that fits within a standard 2x6 or 2x4 stud wall. Plus, this wall-hung commode projected only 21 inches from the wall, but for it to pass code, we still needed to come up with some creative framing and wall finish.

FRAMING SMALL

To maximize floor space, we had to minimize the thickness of our walls. A staircase opened into the existing hallway, and all but the bottom few steps would be closed off by the new bathroom. Before framing the wall, we sawed the tread returns flush with the original skirt board below the treads (4). We then fab-

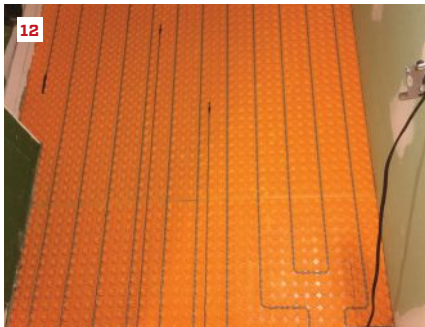
ricated a new skirt board with a 2-inch-wide horizontal cap to maintain the 1½-inch minimum clearance between the finished wall and the railing (5). The modified skirt attached along the outside of the staircase (6). In the area behind the sink, 2x4 studs on the flat extended to the ceiling and attached to the cap of the skirt board (7).

Despite these efforts, the room was still not wide enough for proper clearance in front of the toilet, so we created a slight recess for the toilet tank in the wall framing below the slope of the stairs (8). The toilet mounted to the wall with a steel frame that attached to 2x4 studs on either side. By pushing those studs back flush against the back of the wall finish of the basement stairs, we gained an additional 4 inches of space in front of the toilet, which gave the toilet the clearance that we needed for code.

SINK AND SHOWER

Although there are small pedestal sinks on the market, we decided that a vanity cabinet would be helpful—even if it was small. The solution for the sink actually came from Ikea. That company specializes in small spaces and carries a sink that projects only





10 5/8 inches from the wall. Even better, the sink is equipped with a side-mounted faucet.

Because the toilet was wall-mounted and did not touch the floor, it seemed only right that the vanity cabinet should be wall-mounted as well. A custom cabinet—essentially a modified kitchen-wall cabinet—fit the bill (9).

The odd layout of the bathroom meant that our only option for the shower was to custom-build it. To maximize the shower's depth and width, we applied the tile backerboard directly to the wall studs (10), angling one corner of the shower to gain extra clearance around the new kitchen island on the other side of the wall. The tile installer built two nooks into the wall of the shower to eliminate the need for shelving or organizers that might take up valuable space in the shower (11). We installed a combination bathroom vent/light above the shower for general lighting.

Because of the diminutive size and location of this bathroom, we did not tie the room into the home's heating system. Instead, all the warmth needed will be provided by a heated tile floor. We went with Ditra Heat from Schluter. With the toilet and the vanity mounted on the wall, the layout for the heat mat was a simple rectangle (12).

To minimize the potential for moisture damage—especially given the proximity of the fixtures to the walls—we carried the tile from the shower to behind the toilet and around the sink. Because the sink had no vanity top, we caulked the sink rim directly to the tile backsplash, which allowed any splash water to flow back into the basin.

PLUMBING CHALLENGES

Placing the new bathroom in the old hallway may have suited the revised layout of the home's floor plan nicely, but the location presented serious challenges for plumbing the fixtures. The bathroom was situated in the middle of the house away from any existing drains or vents, and the new wall where the fixtures were mounted was narrow and offset from the second-floor wall above. Plus, the existing framing in the floor and the ceiling was obstructive in every way imaginable.

We spoke with the plumbing inspector and our plumbing contractor, Paul Gilbert, from DF Plumbing in Belchertown, Mass., and came up with a routing scheme. First, Paul installed a new waste arm to the toilet across the basement from the home's main line. The toilet vent comes off the waste arm and runs up the wall at the short end of the sink. The sink drain exits the same side of the vanity (13), and a vent for the sink extends up and joins the toilet vent, with the drain running under the floor and back to the waste arm.

After some creative routing around the light fixture (14), the vent line makes its way through the ceiling framing and joins the shower vent. The vent finally ties into an existing vent in the first-floor ceiling near the bathroom. In our case, wet venting was not an option because the Massachusetts plumbing code requires 2-inch piping for wet vents, and our existing vents were only 1 1/2 inches.

Daniel Lewis is an architect based in Northborough and Centerville, Mass. daniellewisarchitect.com

BY LAUREN HUNTER



1

1. Vaulting Into Innovation

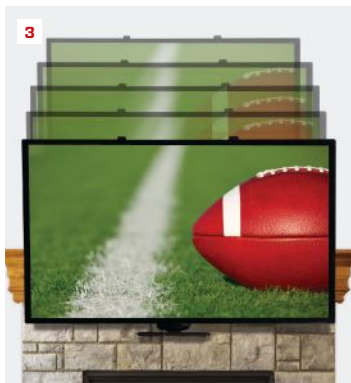
Deckorators has developed a new method for fabricating composite decking to maximize its strength-to-weight ratio. The process creates a wood-fiber-like texture without any wood content. According to the manufacturer, its Vault decking is impact-resistant, does not absorb moisture, and has low thermal expansion. The 5 1/2-inch boards are available in two colors—dusk and mesquite—with slotted or solid-edge profiles. Fascia is also available, in both colors and in white. Pricing will vary. deckorators.com

2. Solid Shim

The SmartWedge is a plastic shim available in a variety of widths and sizes. It has small teeth on both faces, and when installed in pairs, the wedges lock together to create a solid base for a door or window. Depending on the style, SmartWedges can be snapped off or cut to length with a utility knife. They're available in small packs starting at about \$8 and in contractor-size "Trans Packs"—which include a high-quality reusable tub—starting at \$75. smartwedge.com



2



3

3. Great View

MantelMount, a specialized bracket for flat-screen TVs that are mounted above a mantel, sets the TV at a 9-degree downward angle for viewing and has an extension arm that can lower the TV up to 24 inches for eye-level viewing. The easy-install unit includes paintable bracket covers and a heat-sensing handle that changes color when its temperature exceeds 110°F. Priced at \$400, MantelMount accommodates TVs from 48 inches to 80 inches. mantelmount.com



4

4. Pave the Way

Highly porous, flexible, and durable paving material Porous Pave is poured in place like concrete. The XL formulation uses 50% recycled rubber chips and 50% stone aggregate with a binding agent, while XLS uses 100% recycled rubber chips with a more elastic binder. With 29% void space, the material allows stormwater to pass through the surface into an aggregate base. The slip-resistant material doesn't allow standing water or puddles to form. Available in eight colors, pricing ranges from \$9 to \$13 per square foot depending on installed depth. porospaveinc.com

Products

5. Cold Temp Tapes

The offerings in EchoTape's new Insulation Tape line are suited for low-temperature applications. There are three versions, providing a variety of functions for different cold-weather situations and for bonding to different materials. According to the manufacturer, the high-performance, flame-retardant, cold-weather acrylic adhesive coating provides excellent adhesion, tear-resistance, and low-temperature performance for all the tapes. Check with retailers for pricing. echotape.com

6. Wide-Span Screen

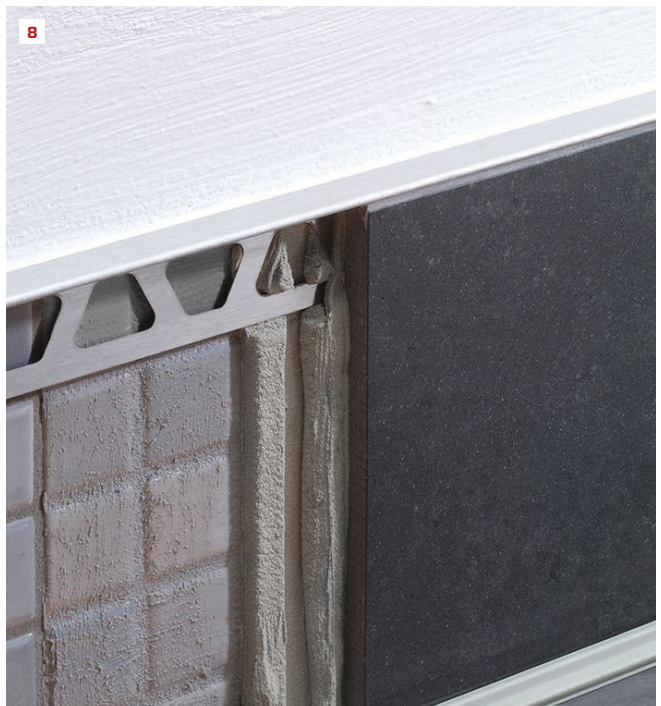
Marvin has added a new feature to its Ultimate Multi-Slide door. The latest addition to the Scenic Doors line is now available with a sliding screen door, which provides protection against leaves, bugs, and other nuisances. Sliding screens are available in widths up to 12 feet with a single screen, or up to 24 feet wide with double screens. The flat mesh uses no cords or pleats, so homeowners can retain impressive views through the wide-span openings. Pricing will vary by region and door size. marvin.com

7. True Flexibility

Boral has expanded its TruExterior trim and siding profiles. Made of polyash—a blend of polymers and fly ash—the boards feel like cementitious material, but offer the workability of wood and the moisture resistance of PVC. Siding options include shiplap, V-rustic, cove, or Dutch lap; channel for horizontal or vertical installation; and a forthcoming bevel profile. TruExterior materials are paintable but require no priming of ends or gluing of joints. All profiles come in 16-foot lengths. Pricing varies by profile, with the new bevel siding ranging from \$1.05 to \$1.45 per linear foot. boraltruexterior.com

8. Tile Trim

Kitchen facelifts just got a little easier with Schluter System's Schiene-Step EB profile. The metal band can be used to finish countertop and stair edges where tile will be installed, and to facilitate tile-over-tile applications. Suitable for natural stone or ceramic tile, the perpendicular finishing edge creates a sleek look and protects the tiles from damage. Choose from different thicknesses depending on the application, with retail pricing from \$70 to \$115 per 8-foot length. schluter.com





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Products

9. Angles & Planes

Contemporary details highlight Moen's Via bath collection, featuring a D-shaped base and a sophisticated angular design. On the WaterSense-certified lav faucets, red and blue temperature indicators on the underside of the handle reflect onto the spout for subtle detailing. The collection includes different configurations for the Moen Posi-Temp pressure-balancing valve, with a standard or Eco-Performance 1.75 gallon-per-minute showerhead. Pricing is being determined. moen.com

10. Easy Digital Measurements

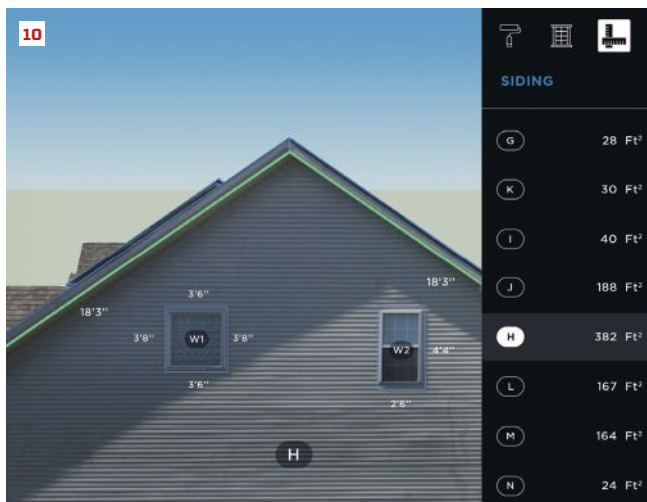
Adapted from military software, the Hover service lets contractors take just eight photos of a home and receive accurate size and area measurements of the home's windows, roofing, siding, and more. It's not an app that calculates dimensions; rather, contractors upload their photos to Hover, whose staff turns around the measurement report within 24 hours. Hover integrates with a variety of manufacturers' products, allowing users to showcase details such as siding colors and window grid options as part of their on-site sales. Hover is easy to use, with measurements guaranteed to be within 5% accurate. The app is free, and reports cost around \$50 each. hover.to

11. Security Hub

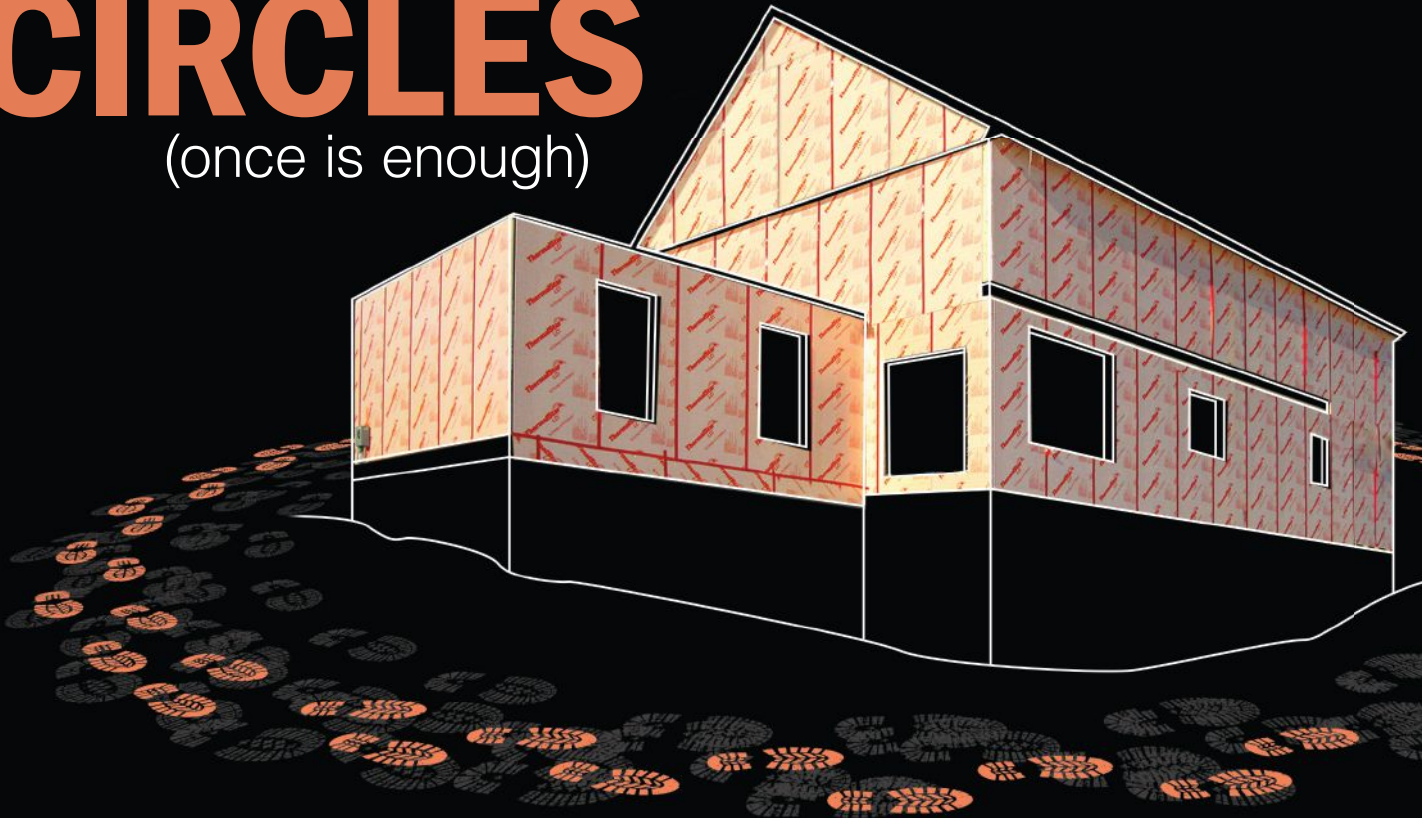
Unlike many other home automation systems, the White Rabbit Smart Hub eliminates the hassle of manually arming and disarming a security system by taking advantage of sensors that detect which users are present in the home. The system can arm when a user leaves and disarm when a user's enabled device returns back to the sensor area. The Smart Hub can lock and unlock entry doors, open and close garage doors, and raise and lower window shades based on user presence and preferences, all accessible through mobile and desktop platforms. The White Rabbit Smart Hub retails for around \$300, with subscription monitoring for an additional fee. whiterabbitalarm.com

12. Warm, Dry Basements

Ideal for finishing basements, DriCore's Smartwall system uses OSB framing, 3 1/2-inch rigid EPS insulation, and 1/2-inch drywall to create pre-assembled interlocking wall panels. The primed drywall acts as a vapor barrier, and the insulation in each panel features two vertical and three horizontal chases for wiring. Panel pricing ranges from \$60 to \$90 online. dricore.com



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Weigh In!

Want to test a new tool or share a tool-related testimonial, gripe, or technique? Contact us at JLCtools@hanleywood.com



A Multi-Use Leveling Base for Extension Ladders

BY SCOTT BURT

If your work involves much use of extension ladders, then you've likely encountered awkward set-up locations. The PiViT Ladder Tool from ProVision is a safe, convenient, and cost-effective solution (provisiontools.com).

A stout, wedge-shaped implement made of durable polypropylene, the PiViT weighs in at 14 pounds. It is 22 inches long, 16 inches tall, and 10 inches wide, and is highly portable and functional. With a robust, non-skid housing (rated to 500 pounds), the PiViT is stable when positioned under a ladder foot, allowing the user to ascend with confidence.

My paint company has used this tool for years, most commonly when laddering in stairways and on roof pitches. With the PiViT, instead of planking off a step-ladder at the bottom of a stairway and setting an extension ladder on the plank to reach the top of walls and

ceilings, we can ladder up in a safe and simple manner—while reducing the amount of set-up gear we carry.

On roof pitches, there aren't many good ladder footing solutions short of rigging up a makeshift jig and hoping for the best. The PiViT's anti-skid design grips most roofs that we work on securely enough for us to eliminate the jigs.

The PiViT can be used in other ways as well, such as for a ladder stand-off or staging, though I prefer to use tools specifically designed for those purposes. As with any tool, it's important to follow the company's instructions and safety precautions carefully.

Priced at \$83, the PiViT pays for itself quickly.

Scott Burt owns Topcoat Finishes, a high-end residential paint company in Jericho, Vt.

Heavy Metal Blades

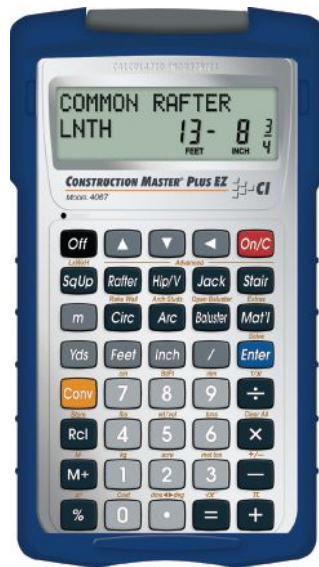
BY LUIS PERALTA



Recently, we had to make room for a new boiler in a large basement mechanical room (about 1,200 square feet), and the ceiling was a snarl of abandoned galvanized water lines, ancient cast-iron drain lines, dozens of steel hangers, odd pieces of angle-iron, plus existing heating pipes, which needed to be rerouted. We started with the usual bimetal blades in our recip saws, but after an hour of teeth-rattling work, we were desperate for an alternative. That's when a friend turned me on to Diablo's Steel Demon carbide recip-saw blades. They're a bit pricey—about \$11 for a 6-inch blade; \$15 for a 9-inch one. But they proved worth it on this job. We cut all day with two saws running two 6-inch blades, and the blades still seem to have life in them. The blades cut slower than bimetal ones, but they never snagged or rattled the saw. For this overhead work, that was a lifesaver.

I wouldn't use these thick carbide blades for light-gauge metal, like steel studs. But for heavier metal, they would be the first blade I'd grab.

Luis Peralta is a building manager in Brooklyn, N.Y.



The Construction Master Plus EZ includes all the features of the Construction Master, along with a prompting function that guides you through calculations step-by-step.

Is the Construction Master Plus EZ Easy to Use?

BY ERIC MCDONALD

I've been using a Construction Master for years now. As a framer by trade, I have gotten good use out of the tool on every job I've worked on that required formulas or calculations that go beyond what can be done with a simple calculator. But the Construction Master did take some time to actually master, mainly because of the complexity of the functions it performs. If you don't use it every day, it's tough to memorize all of the input paths and their order. So I was intrigued when given the Construction Master Plus EZ, and asked to review it. "EZ?" I thought. "Okay, I'll bite." So I used the so-called EZ version for the past couple of weeks and here's what I found.

The Construction Master Plus EZ Calculator looks very similar to my old Construction Master calculator, with the same durable case that has held up very well over the last 10 years. It does all the things a regular calculator can do and also has a prompting feature (this makes things easy) that walks you through the calculation you're trying to make. I found the prompting feature useful in many ways. I don't

always remember the formulas for different material lists; this calculator has them programmed in so it's just a matter of entering the dimensions that it asks for, and I'm all set. I chose a problem to solve, and the calculator told me what information it needed to give me the solution.

I like to check my math before I start cutting a complicated roof. I figure up my common rafters for the different spans, establish heel heights, different pitches, ridge heights, and so on, then I'll go back, using the square up function on the calculator and see if there are any mistakes. I've been using one form or another of this roof cutting method for many years. This calculator makes it a little easier, and in my business a little easier means I get more done by the end of the day. I haven't had this tool very long, and I already prefer it to the old Construction Master. It's very easy to use and I would recommend it as a calculator (\$60). It's not yet available as a phone app.

Eric MacDonald is a framing contractor in Altamont, N.Y.

Photo, top left: Chris Ernides

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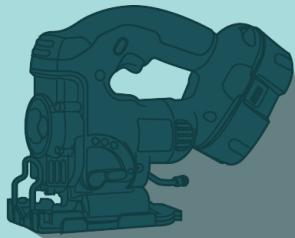
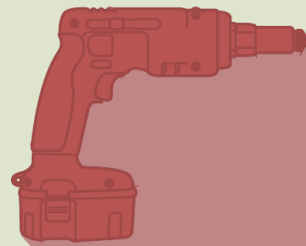
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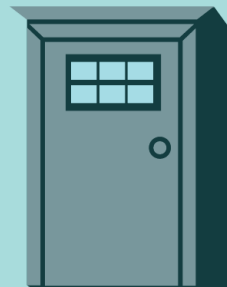
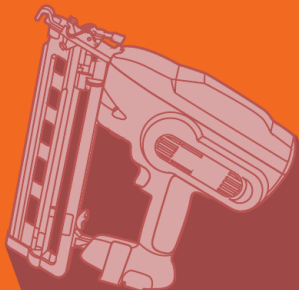


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b. Legitimate Paid and/or Requested Distribution		
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h. Total (Sum of 15f and 15g)	61,417	59,196
i. Percent Paid and/or Requested Circulation	97.8%	94.2%
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a. Requested and Paid Electronic Copies	1,328	341
b. Total Requested and Paid Print Copies (Line 15C) + Requested/Paid Electronic Copies	60,667	55,546
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d. Percent Paid and/or Requested Circulation (Both Print and Electronic Copies)	97.9%	94.2%

17. Publication of Statement of Ownership for a Requester Publication is required and will be printed in the November 2015 issue of this publication.

18. I certify that all information furnished on this form is true and complete. Signature and title of Editor, Publisher, Business Manager, or Owner

— Rick Strachan, Group President Publisher, 9/22/15

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BY TED CUSHMAN



The Traveling Timber Frame

Most vendors who come to an outdoor trade show set up a tent, or maybe a booth inside a tent. Timber framer and custom builder Richard Krouse brings along a barn. And why not? The barn's not just his booth—it's also his product.

JLC caught up with Krouse at the Common Ground Fair in Unity, Maine, an annual event put on by the Maine Organic Farmers and Gardeners Association (MOFGA). As the name implies, MOFGA and its annual get-together are mostly focused on locally produced food and handicrafts. But the fair also plays host to a goodly collection of construction companies and related trades. This year, for example, *JLC* had a chance to talk with reps from Portland-based Revision Energy, Vassalboro-based Duratherm Windows (and sister company York Spiral Stair), Pittston-based house-moving contractor Jewett Builders, and Belfast zero-energy builder and developer GO-Logic, among others.

Based in Arundel, Maine, Krouse and his company, R. A. Krouse, go back a long way with MOFGA and the Common Ground fair. Krouse built the 60-foot-by-80-foot

custom frame for the organization's main gathering hall at the fairgrounds back in 1999 (1). This year, Krouse set up a simple, 18-foot-by-20-foot frame with the help of son Christopher Krouse, carpenter Toby Swanson, and an occasional MOFGA volunteer. Chris and Toby assembled roof bents on the company's flatbed truck (2), and gave the timbers a quick lick of linseed oil just before assembling the frame (3). Wife Toni Krouse came along to help decorate the booth and schmooze with fairgoers (4). After the fair, the crew banged the frame apart (5), loaded it back on the truck along with their scale model (6), and headed home.

After a busy three-day weekend greeting fairgoers, the Krouse family was more than ready to pack up and go home. Nobody decided to buy Krouse's show barn on the spot (which sometimes does happen, he said). But the weekend's fine weather had brought more than 10,000 people out to the fair, and Krouse had made plenty of good connections.

Ted Cushman is a senior editor at JLC.

Photos by Ted Cushman

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