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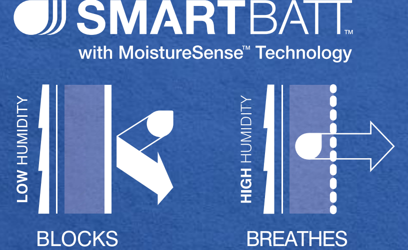

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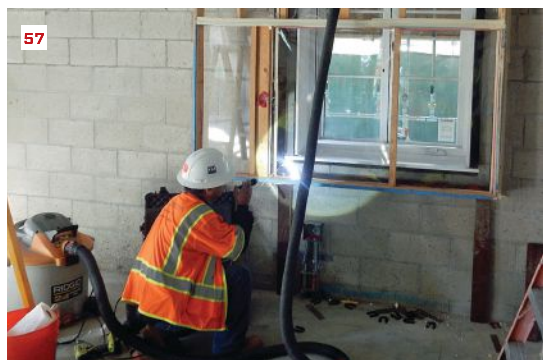

On the cover: Tom Meehan, a tile specialist from Harwich, Mass., nails cement backerboard to the back wall of a shower, carefully keeping the nails well above the top of the threshold. See the story on page 39. Photo by Roe Osborn.

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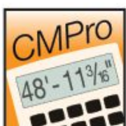

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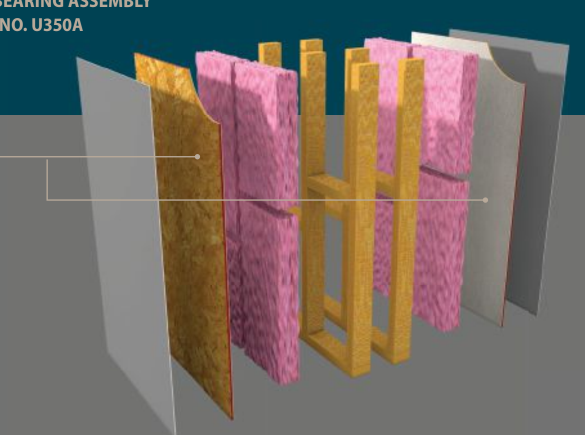

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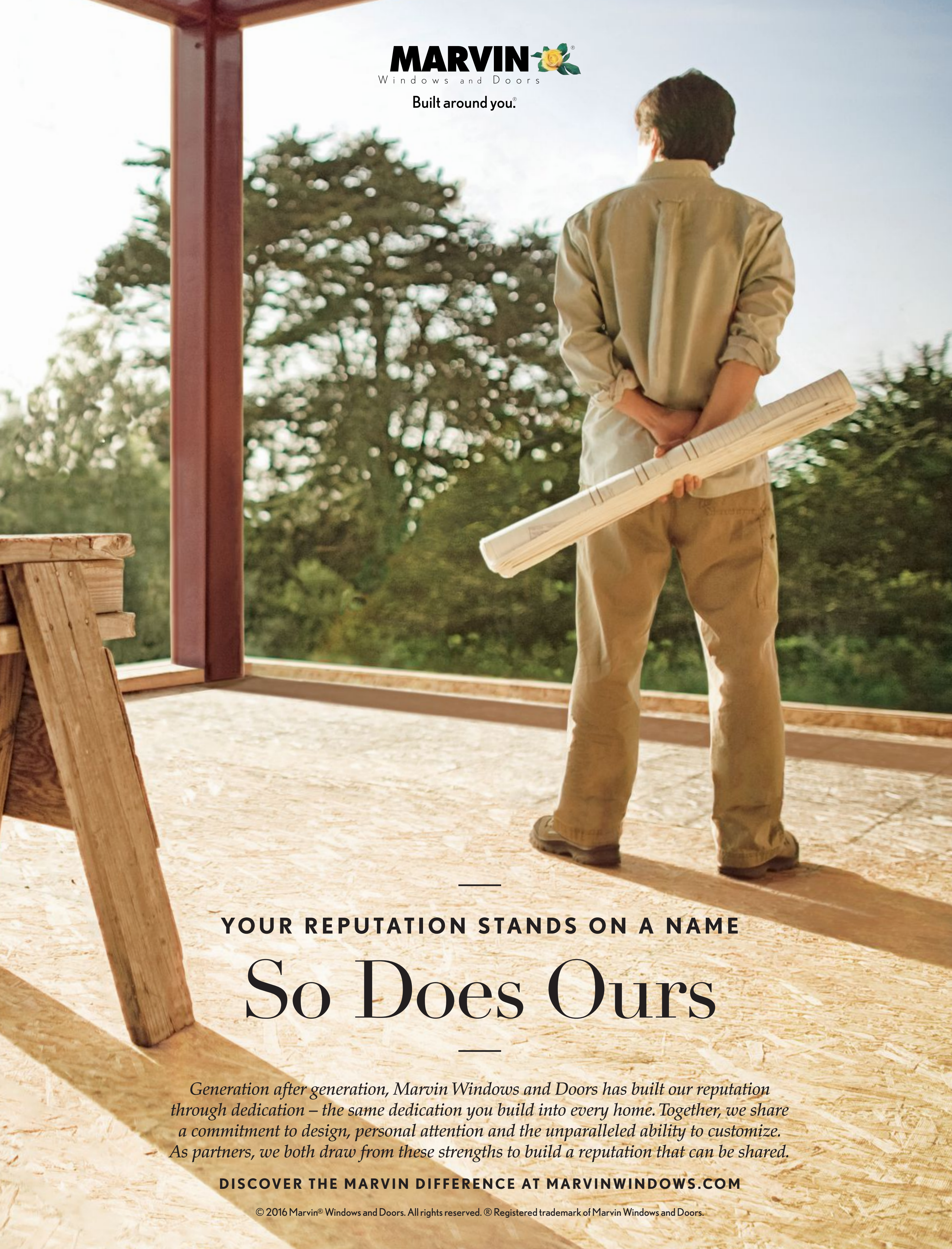
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BY SUE BURNET

Standing on the Front Line

At the SkillsUSA competition (which we wrote about in August), we met Zach Fields, who co-presented a seminar called "Exploring the Impacts of Effective Industry & Education Collaboration." Zach had recently been hired as the Director of School Relations with The Construction Education Foundation of Georgia (CEFGA), a position he says is like standing on the front lines of skills education in our industry.

A MODEL TRAINING PROGRAM

CEFGA is a non-profit with more than 70 accredited training and education facilities throughout the state of Georgia. More than 7,000 high-school students receive training each year in their programs. In addition, CEFGA holds a large job fair for the industry each year called the "World of Construction." In 2015, more than 7,000 people attended this event, which features interactive displays and industry reps and is centered around Georgia's SkillsUSA Championship.

With more than 20 years of combined experience in teaching and construction, Fields currently works with about 150 programs in the organization's training and education facilities. One of his primary responsibilities is to support instructors that are involved with the state's high-school trade programs. He also acts as a liaison between the students in the programs and the building industry. He said that his primary goal is "trying to transform and elevate technical education in Georgia." It's an uphill battle, but Zach is determined and said: "Once someone breaks through and starts an initiative, it's much easier for others to follow."

Contractors need to form partnerships with teachers to help improve trade education.

Photo: Zach Fields

HOW CAN WE HELP?

Asked how the everyday contractor can make a difference, Fields responded that the way we can have the biggest impact is to form partnerships with the teachers in the industrial arts programs at schools in our respective areas. Getting involved is the crucial first step. Most contractors are experiencing an upswell of work with the improving economy, so taking the time to get involved can be difficult. But as Fields said, "This industry is all about people who solve problems and who get things done on a daily basis. And that's precisely what we need to do with the education of our youth."

Some of his suggestions for contractors are to work as an assistant to teachers when they need extra hands and eyes to handle a large group of kids; be a guest speaker or teacher for a specific area of expertise; or connect the schools with suppliers to help out with materials and tool needs. Another way for a contractor to help out is to become a member of a school's advisory board for trade programs.

One of the biggest challenges that the construction industry faces is the image and perception of construction-related jobs. Contractors can help by going to job fairs and career days and speaking to students, parents, and counselors to dispel the myths about jobs in the construction industry.

In many ways, Georgia may be ahead of other states on these issues, but hopefully CEFGA is a microcosm of what the industry is seeing all around the country. Fields summed it up: "Partnership is key; we just need to get out there and start, and get involved on the front lines." He believes that begins in the nation's schools.

Many folks reading this column find themselves on these front lines of education in our industry, and *JLC* would like to talk to more of you. We want to hear your suggestions about other programs or initiatives that you have seen or are involved with that have been effective in your area. By creating this dialogue, we hope to continue to move the needle on education.

Sue Burnet and her husband, Greg, own Toolbelt Productions (toolbeltproductions.com).

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Q Seeing Doug Horgan's photos of corroded aluminum flashing in "Repairing a Stone Patio Over a Living Space" (Jul/16) left me concerned about using metal flashing with concrete. What is the best type of flashing to use with concrete?

A Bill Palmer, an engineer and the editor-in-chief of *Concrete Construction,* a sister publication of *JLC,* responds: The aluminum flashing shown in Horgan's article had been in contact with a concrete sub-deck, which caused it to corrode. This corrosion will occur under certain conditions.

First, there has to be some chloride in the concrete. Most concrete does not have chloride in it when placed, unless the chloride is added as an accelerator in cold weather (which is a fairly common practice). As the name implies, an accelerator speeds up the curing process and reduces the risk of frost damage. Calcium chloride is an excellent accelerator, and when used in most residential concrete applications, it does not pose a problem—unless there is aluminum present, either embedded (as in aluminum conduit) or in contact with the concrete surface, as with flashing.

There also has to be some steel (or other dissimilar metal) in the concrete. Most placed concrete in residential construction contains steel in the form of rebar—either for structural reinforcement or for crack prevention. And there has to be some moisture present, as well, to allow the galvanic reaction to proceed between the aluminum and the steel. This reaction causes the aluminum to deteriorate.

As for the basic question of what types of flashing can be used with concrete and masonry, Heckmann Building Products, which makes flashing for masonry construction, recommends against using aluminum as flashing with brick or concrete. If metal is to be used as flashing, stainless and galvanized steel are better choices. Stainless steel is one of the least reactive metals, but it can be difficult to cut and bend, and some of the lower grades of stainless might be more reactive than you would think. Copper is a good option too—but it is expensive.

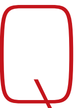
The truth is that any metal flashing will eventually corrode if left in contact with concrete. Some metals, such as aluminum, corrode much more quickly, especially in an area that will see salt for de-icing in the wintertime. If using heavily galvanized steel, spray any cut surfaces with zinc paint and isolate the flashing with peel-and-stick membrane at joints and corners.

Another metal flashing that is used with concrete and masonry in many parts of the country is lead. Lead flashing is non-reactive for the most part, but it comes with its own intrinsic challenges because of its toxicity. Yet another option is to avoid metal flashing altogether and to use a PVC or rubberized-asphalt product.

Finally, be as careful with products that will be used with masonry, such as brick or block, as you are with concrete. Although mortars are made of different materials, the issues of corrosion are still present, and highly reactive metals such as aluminum should be avoided.

Aluminum flashing should never be used in applications where it is in contact with a concrete surface.

Photo: Doug Horgan



I enjoyed John Spier's article on installing pre-hung doors. What about when the floors will be carpeted?

A John Spier, owner of Spier Construction, a building and remodeling company on Block Island, R.I., responds: In my article "Hanging Pre-Hung Interior Doors" (Jul/16), I discussed the process I've developed for installing interior doors in a fast and efficient manner. Because of space constraints, I did not address the particular situation of when a floor is to be carpeted.

The scenario for carpeted floors starts much the same as with other types of flooring: checking the opening for level across the threshold, as well as front to back on the threshold. But carpeting tends to be more forgiving than other flooring materials, so those assessments are just for general reference. From that point on, my approach to installing the doors is very different, though it is still fast and efficient.

The process I use takes advantage of the fact that the installers like to tuck the carpeting under the door jambs and the baseboard, which gives the installers a bit of a "fudge factor." If you leave a jamb 1⁄16 inch short on a wood floor, it sticks out like a sore thumb. But with carpet, that discrepancy is hardly noticeable. For that reason, I cut both jambs to a length that keeps them roughly 3⁄8 inch off the subfloor. I also make sure that there will be plenty of space to keep the bottom of the door clear of the carpet.

After cutting the jambs to length, I set the hinge jamb on a 3⁄8-inch-thick shingle butt. I shim and nail that jamb, plumbing it in both directions with a long level.

Next, I release the door slab from the strike jamb and slide a shim or two under that jamb, adjusting the height until there is an even gap between the top of the slab and the head jamb. If the hinge jamb is plumb and the slab is square, then the top of the door should be level. When I'm satisfied with the height of the strike jamb, I insert shims behind the jamb and nail it off, adjusting the jamb until it aligns perfectly with the door stop.

At this point, the only other difference with installing a pre-hung door for a room that will be carpeted is that I keep the shims and the nails close to the floor on both sides. Keeping the shims and the fasteners low helps to prevent the carpet installers from moving the jambs out of position when they come along with their knee-kickers.

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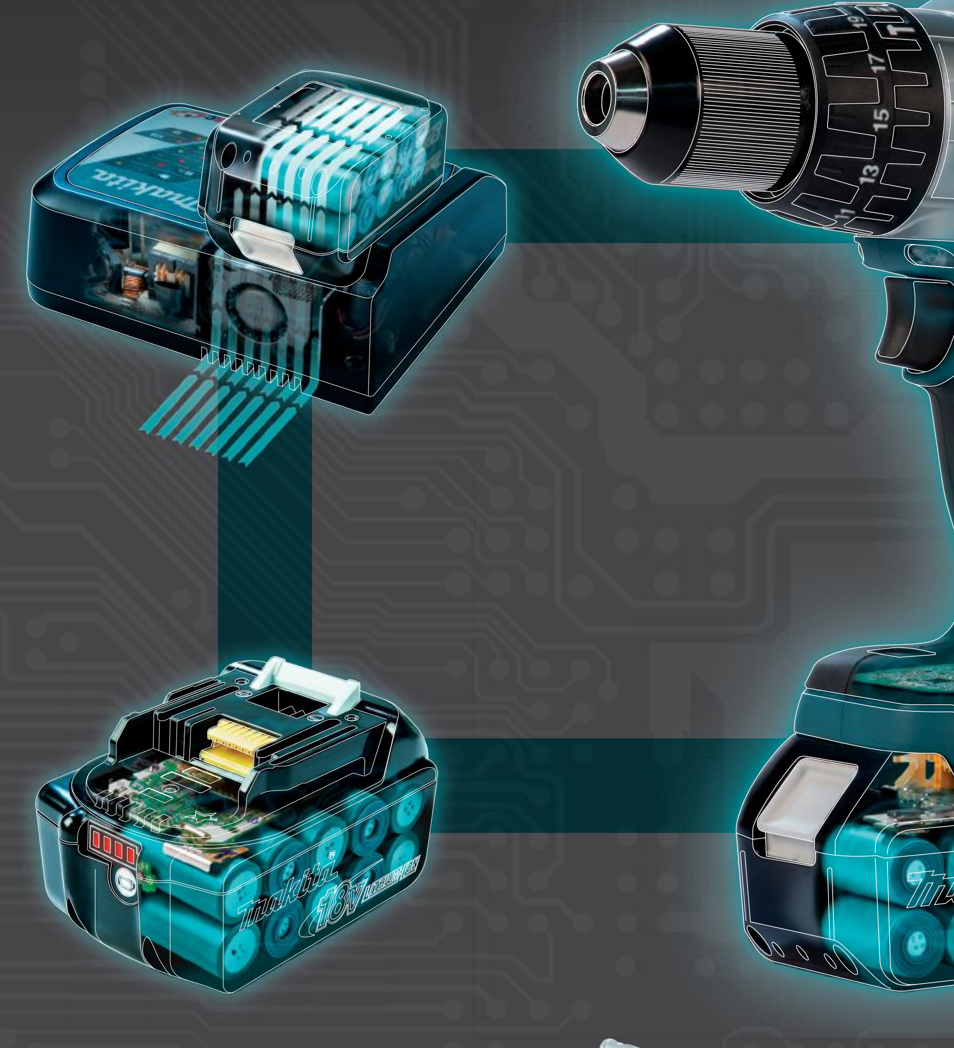

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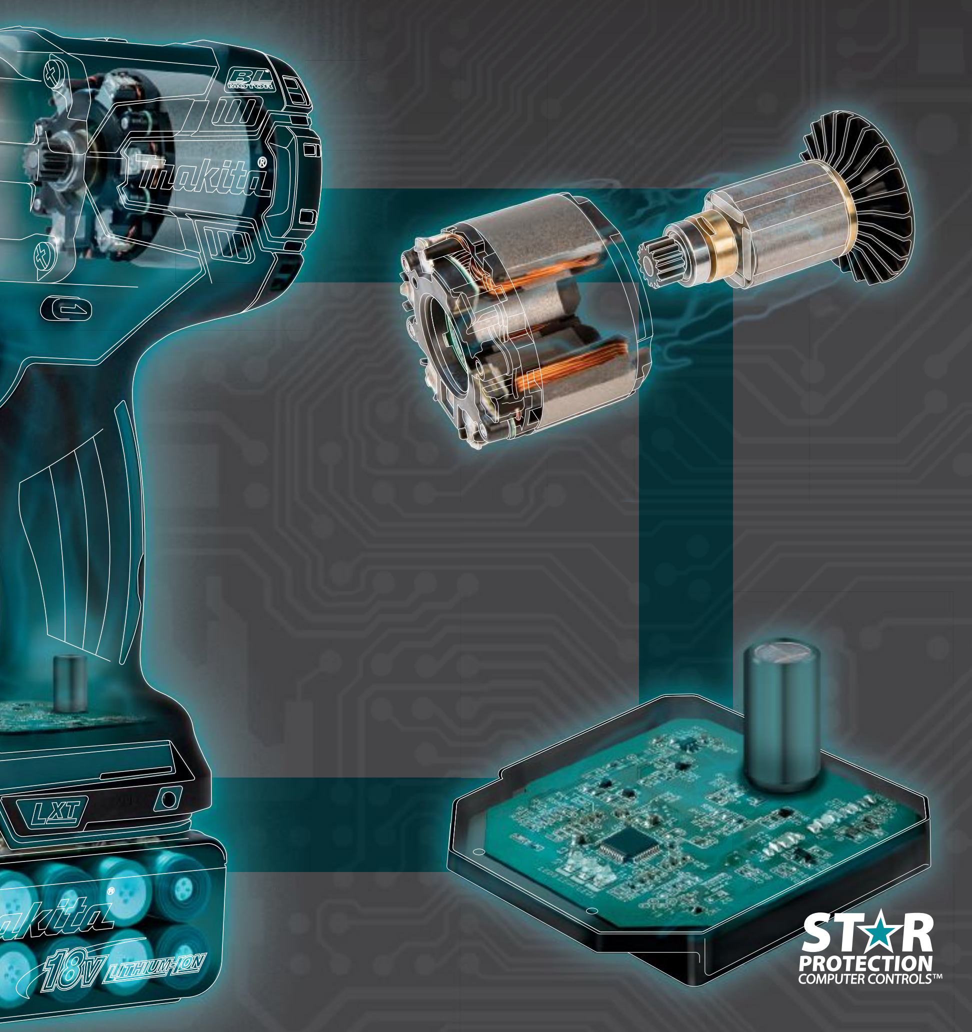

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RUN-TIME (AMP Hours)	6.0Ah	5.0Ah	6.0Ah FlexVolt™	2.0Ah FlexVolt™	9.0Ah UNAVAILABLE†	5.0Ah
WORK (Watt Hours)	108	90	108		162	90
WORK OUTPUT (Watt Hours X2)	LXT® X2 18v 18v 36v 216	180	UNAVAILABLE†		UNAVAILABLE†	
LABOR (Charge Time)	55 MIN.	45 MIN.	1 HR. Only with FlexVolt™ Fast Charger		UNAVAILABLE†	1 HR. 50 MIN.

WORK OUTPUT (MEANS MORE WORK PER CHARGE)

LXT® X2 18v 18v 36v

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- 5.0Ah 18v — **180** WATT HOURS
- **FlexVolt™**** **2.0**Ah 60v (actual 54v) / **6.0**Ah 20v (actual 18v) — **108** WATT HOURS
- **M18™**** **9.0**Ah 18v — **162** WATT HOURS
- **M18™**** **5.0**Ah 18v — **90** WATT HOURS

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BY DAN WATSON

Photos by Dan Watson

Replacing Rotted Beams on a Seaside Condo

On a recent project that was typical of a lot of the structural repairs we do along the southern coast of New Jersey, we encountered serious rot in many of the dimensional and engineered wood beams. The beams were not detailed well for protection from the driving coastal rains we encounter in this region. It's a tough environment for wood: Not only do we get lots of wind-driven rain, but the ocean air is high in humidity year round. When wood doesn't have a chance to dry, it will rot quickly—and engineered materials with all their adhesives are no exception. Waterproofing for these conditions is not just about deflecting water away from the building; you also need to create a way to drain the building assemblies and allow air to flow over the wetted structure to promote drying.

THE PROBLEM

The problem was originally discovered by one of the condo-unit owners, who saw water pouring out of the aluminum capping that covered a beam above his second-floor balcony **(1)**. We were contacted to investigate the leak and discovered mold and rot in the beam under the capping **(2)**. The balcony on which we were standing was supported by a similar beam, in the first-floor ceiling of the carport. We also removed the cladding from this beam, and discovered similar conditions **(3)**.

Because the complex was less than 10 years old, the homeowner warranty would cover the repairs, so the insurance

company was contacted. Since the beams are considered common elements and are not the responsibility of the individual owners, but of the condo association, all the beams in all three buildings of the complex had to be stripped of cladding and examined. Once the cladding on the remaining beams was removed, it was discovered that many of them were in very poor condition.

A consulting engineer was hired to examine the beams and surrounding structure to determine which beams needed to be replaced and which were still structurally sound. In the final tally, nine engineered beams and two dimensional-lumber beams had to be replaced. Based on the engineer's findings, one of the unit's beams was so deteriorated that the structure was deemed unsafe to inhabit and would need to be temporarily shored for the rental season. The engineer provided a temporary shoring plan, and we were able to support both the balcony and the third-floor bedroom without limiting access or use of the areas.

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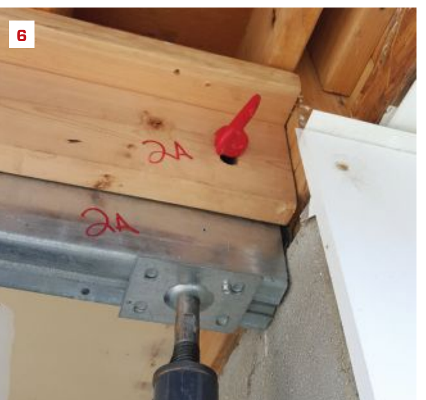
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THE CAUSE

The beams were clad with aluminum trim coil that was trapping water at the bottom of the assembly. Bad as that detail was, it might have been all right if the top of the beams had been protected, but that was definitely not the case.

The second floors of the buildings have a decorative band around the perimeter that forms a break in the siding and consists of a 2x8 capped in aluminum trim coil. Where this band passed in front of the beams, it was applied over the sheathing and housewrap. This allowed water into the trough created by the capping under the beam **(4)**.

Some of the lower beams had OSB sheathing on the front of them, which made them protrude past the front edge of the fiberglass balcony. This allowed the water running off the balcony to flow directly into the capping. All the buildings lacked gutters, as well, so when it rained, roof runoff flowed straight down the vinyl siding.

Once we had the list compiled of the beams that needed to be replaced, we hired an architect to specify new beams and create a replacement plan. The existing structure had been built with a combination of both treated and untreated glulams and Parallams, which would be replaced with exterior-rated Parallam beams.

JOBSITE SETUP

We worked on two units at a time with a four-man crew. We accessed the second-floor balconies from 12-foot planks on pump jacks, and for the lower beams, we primarily worked off rolling staging.

On previous projects of this type, we constructed temporary 2x4 walls under every beam we replaced, to support the floor load above. This was time-consuming and produced a lot of waste. The temporary walls were also very intrusive, limiting access and work space.

To avoid this frustration, we recently started building modular supports, which have worked great. These consist of a bottom beam to distribute the load across the floor; adjustable Lally columns; and an adjustable support beam across the top **(5)**.

The bottom beam is a 2x12 plate with a 2x4 on edge making an upside-down T. Over this, we put an upside-down U made with two 2x4 sides and a 3/4-inch-plywood top. Essentially, we have three 2x4s for bearing on a 2x12 plate, but the assembly is sectional, so it's not too heavy to move from job to job.

The top support beam is made with light-gauge steel that fits into an upside-down-U pocket consisting of a 2x12 plate and two 2x6s on edge. We drilled slots in the 2x6s and a hole in the steel beam for a pin **(6)**. The top plate is screwed to the ceiling framing, and then the beam is slid in and hangs until the posts are installed. For this project, the posts were set at just under a 12-foot span. We have a third pole for the center if needed to support loads across longer spans.

To prevent damage to the fiberglass decks

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on this job, we laid down slip-resistant canvas drop cloths and 5/8-inch plywood for a working surface, which we installed before setting our temporary supports.

THE SOLUTION

After removing the aluminum capping, siding, and soffits, we discovered that much of the surrounding sheathing and some of the framing was also compromised **(7)**. We had included most of this in our scope of work, as we had assumed that if the beams were wet, the areas around them would be also.

Removing the beams required cutting through a lot of nails, many of which were hidden or difficult to access. In the upper beams, there were toenails that secured the trusses above and the 6x6 posts and king and jack studs below. A couple of the beams also held drywall screws, which led to drywall repairs and repainting on interior walls.

On the lower beams, we removed and disposed of the hangers, as well as toenails, that secured the balcony joists. (We would later replace them with stainless steel hangers and fasteners because we were close to the ocean.) The plywood for the fiberglass balcony was nailed into the top of the beam, and finish nails secured a 1-by fascia board to the exterior face of the beam. The beams sat on bearing walls at each end and were nailed off to these wall plates.

In addition to all those fasteners, we had to cut or remove multiple straps between the beam and surrounding framing, along with lag bolts that attached the balcony railing posts. To cut the fasteners, we relied on a combination of reciprocating saws, oscillating tools, and grinders.

After all of the fasteners were out of the way, we were able to cut the old beams out. Some of them came out in two pieces and were easy to remove, while others had to be cut into multiple pieces and required much more time and effort.

Once we had a clean space **(8)**, fitting the new beams required some finesse. The old beams had compressed at their bearing points, and the new beams did not always have the necessary clearance. But this is where the adjustable columns used for our temporary supports came into play and made the job simple: We were able to slightly lift the structure with the screw jacks to gain the space we needed.

Once the new beams were in place **(9)**, we partially loaded them before nailing them off and removing the temporary supports.

To protect all the new beams from water and prevent a repeat of the rot, we installed Home Slicker, a matrix-type rainscreen, to the exterior side of the beam **(10)**. We then installed 2-inch-wide strips of 3/4-inch marine plywood before attaching a 2x8 band. This assembly allows for unrestricted water flow for rainwater or snow melt that makes its way past the siding and flashings, and it provides plenty of room for air flow for drying.

On the inside of the beam, we installed Tyvek housewrap to isolate the aluminum trim coil from the pressure-treated beams. On the bottom of the beam, we installed vented soffit to allow water out and air in; and for both the exterior and interior sides of the upper beams, we used L-shaped bends of aluminum capping **(11)**. On the exterior, we installed a Z-bend that was taped to the sheathing under the housewrap and bent over the top edge of the band board. This will force any water that makes its way behind the siding to the outside above the beam. On the lower beams, the capping was slid between the fiberglass fascia and the beam to limit water getting between the cladding and the beam.

All damaged sheathing was replaced with water-resistant Zip sheathing before the housewrap was repaired and the siding reinstalled. While removing the siding and soffits, we had labeled all the pieces, which made putting them back together much easier.

Dan Watson is a remodeling contractor based in Glendora, N.J.

Cripple-Wall Failure

BY TED CUSHMAN

In 30-plus years as a house mover in the San Francisco Bay Area, Phil Joy has accomplished some impressive feats. He once dragged a three-story Victorian several miles overland from Napa, Calif., to the water, then floated the house by barge down to the town of Benicia and set the building down on a new foundation. For moves through narrow streets with overhanging obstructions in Berkeley and Oakland, Joy has sliced houses in half—sometimes vertically and sometimes horizontally—and then spliced them together again when he reached the destination.

But some house lifts are just that: lifts. Tens of thousands of old wood-framed houses in the Bay Area were built with their first floors raised on short cripple walls set on shallow concrete footings. In earthquakes, failure of these cripple walls is common—enough so that reinforcing cripple walls against lateral forces is a whole niche of its own in the San Francisco market. (*JLC* has covered cripple-wall reinforcement before: see "Seismic Retrofit for Cripple Walls," Apr/06.)

But it doesn't take an earthquake for some cripple walls to fail. Recently, Joy has been called to lift two houses for which cripple walls had collapsed, seemingly without provocation. In one case, in Oakland, the house was vacant after the owners had passed away; while the family was deciding how to handle the building, it simple toppled off its cripple wall in the middle of the night.

In another case, in Berkeley, the homeowner was at home watching television when he felt the house slip and heard the wrenching noise of gutters and underfloor plumbing giving way. Suddenly, he found himself taking an unplanned elevator ride: In a few seconds, the house shifted over 3 feet and fell 3 feet, crushing utility pipes and underfloor equipment against the ground. In each case, the owners called Phil Joy.

"Right now it seems like we're having an epidemic of hundred-year-old buildings falling down," Joy told *JLC* in an email. "This is due to flawed underfloor framing. The buildings typically have redwood V-rustic siding on the lower 3 feet. They don't have plywood sheathing. The V-rustic siding below the floor line doesn't have much shear capacity to begin with, and the redwood rusts the nails. So when the nails rust, the houses have a tendency to lean over and slowly fall down."

Lifting a house that has fallen off its cripple wall is challenging, Joy told *JLC*. "There's no way to get beams under the house, since it's on the ground. But we

developed a process where we put 8-inch angle irons on the side of the building under the floor joist, and rock up one side with our hydraulic step jacks. After we rock up one side, we install a steel beam about 4 feet in from the side of the building."

Beam location is determined by the floor-joist size and the weight of the building, Joy said (after decades in the industry, he has a feel for how a building will balance). "If the beams are too far in under the building, it will sag on the outside; if the beams are too far out, it will sag in the middle; if the beams are in the right position, everything is perfectly straight."

Once he has one side of the building levered up off the ground, said Joy, "we start the process on the other side: rock the building up, and put in another steel beam. Now that we have two steel beams underneath the building, we hook up to the unified jacking machine and raise it straight up, and then roll it back over the foundation on rollers."

No two houses fall in the same direction, Joy said, so re-aligning each house with its foundation is an art. Homes often have to be pivoted, which requires the rollers to be placed in a radial fan configuration that lets the house spin as well as move laterally.

When the house is up off the ground and properly aligned, a foundation contractor can come in to replace the concrete footings, and a framing contractor can rebuild the cripple walls. The new work, of course, is typically superior to the original failed structure: Current seismic codes require engineered footings and cripple walls capable of withstanding earthquake forces.

Ted Cushman is a senior editor at JLC.

Many existing cripple walls in the San Francisco Bay Area are deteriorated to the point of collapse. "V Rustic" lap siding is rotted **(1)**, and nails are corroded **(2)**. To lift a house after its cripple walls fail, Joy has to lever the building up one side at a time **(3)**. When the building is raised and oriented over its footing, he suspends the house on cribbing to allow reconstruction of the foundation and cripple wall **(4)**.

COASTAL BUILDER USES NEXT GENERATION ROOF DECKS TO HELP FORTIFY HOMES AGAINST STORMS

ZIP System® sheathing and tape streamlines installation and helps reduce water intrusion risk.

When General Contractor John Price moved to Gulfport, Mississippi, and began work with premier residential and commercial developer Sapphire Homes, he noticed significant rainfall as a crucial jobsite variable year-round. According to Price, even outside of the June-to-November hurricane season, rain can be a daily reality on build sites in the coastal city, and that can spell trouble for roofs. Price looks to roof deck products that help achieve quick rough dry-in and ensure long-term durability under potential storm threats in his storm-prone coastal area.

"From light showers to tropical storms, oceanfront builds in Gulfport need to stand up to heavy downpours and high winds during and after the build." Price said.

To provide added protection beyond that of traditional oriented strand board (OSB) and felt roof deck assemblies, Sapphire Homes uses ZIP System® roof sheathing and tape to build a more resilient sealed roof deck. Plus, it helps homeowners meet voluntary resilient building standards that can help reduce wind insurance premiums.

"I used to use OSB and felt, but not anymore," said Price. "Instead of using the traditional method of boards and a weatherproof layer, ZIP System sheathing and tape has the moisture barrier built in. It's a much more advanced product."

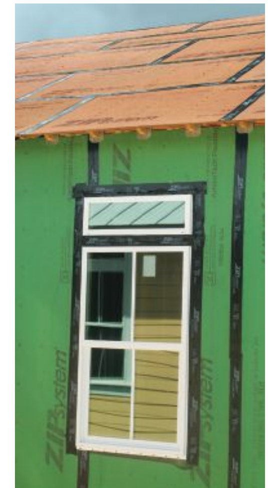
ZIP System sheathing and tape is an innovative structural roof and wall system with an integrated water- resistive barrier that streamlines the weatherization process.The system helps Sapphire Homes get projects dried in quicker in the rain-heavy Gulf Coast area.

"It can rain every other day in the coastal areas," Price said. "That's not a problem during a build when you're using ZIP system products. If you're in the house looking up, you can see there aren't any gaps between the boards. And there's no discoloration that would indicate water intrusion that you often see with alternative roofing products. Even after heavy rains, the roof interior looks good as new, so we're confident it is sealed tightly."

Sapphire Homes strives to distinguish their company in their coastal market, as a builder homeowners can trust to have long-term durability as a top priority. Owner Jason Garner explained this had to be a core part of the company's brand after the area's history of devastating hurricane damage including destruction from Hurricane Katrina in 2005.

"Though it's been over 10 years since Hurricane Katrina, waterfront areas have been slow to re-build because of insurance costs," said Garner. "By creating more 'insurable' homes by following voluntary building guidelines created to help engineer storm-resistant homes, we hope to help lead this community back to enjoying the natural amenities of waterfront home ownership."

Sapphire Homes follows FORTIFIED Home™ guidelines to make each of their projects as strong and weather resistant as possible. The FORTIFIED Home program was created by the Insurance Institute for Business & Home Safety (IBHS) to help offer disaster protection for homes in areas susceptible to natural disaster. Formulated after over twenty years of research, FORTIFIED Home offers a set of design and construction standards that goes above building code requirements to help homes resist damage from natural hazards. Homes are inspected by third-party, FORTIFIED Home Evaluators, which can enable homeowners to receive insurance and other benefits. The bronze, silver and gold categories build upon each other, but the main focus of the first level – bronze – is fortifying the roof.



"The roof is the most vulnerable part of the entire house," Price said. "In areas prone to storms, high winds and hurricanes, shingles are likely going to blow off. In traditional homes, the last line of defense against water intruding through the roof deck is a weatherproof barrier – usually a thin layer of felt – and that will probably blow off, too. Once it does, water can pour in and ruin drywall, flooring and almost everything else on each level of your home. If your roof fails to keep the water out, you're going to experience significant and costly damage to the rest of your house."

"With ZIP System sheathing and tape, when shingles blow off you have a built-in layer of protection that's not going anywhere," he added. "Because the weatherproof barrier is fused directly to the panels and acrylic tape seals the seams, your roof and house are much better protected."

ZIP System sheathing and tape comes with a 180-day Exposure Guarantee and is available in 7/16", ½" or 5/8" panel thicknesses. With a unique tongue-and-tongue edge profile, panels install easily and are self-spacing. Introduced in 2006 for exterior wall and roof applications, ZIP System sheathing and tape is changing how professionals achieve tight building envelopes.

From top left: General Contractor John Price leads residential and light commercial projects for Gulfport, Mississippi-based Sapphire Homes. With many coastal projects, the company used ZIP System sheathing and tape for sealed roof decks and exterior walls to mitigate risk of water intrusion.

"We build to a higher standard to meet FORTIFIED Home guidelines because that's the company we want to be," Price said. "We use ZIP System sheathing and tape because it's a superior product. We want to go above and beyond, and ZIP System products help us do that."

For more information, visit ZIPSystem.com/roof

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BY MELANIE HODGDON

When the Office Resists Change

Thinking like business people. It's one of the biggest challenges for a lot of construction-business owners, especially if they have been used to thinking like carpenters for most of their careers. Almost every time I guide this transition, I encounter resistance. It's not easy to change the way we approach the world.

Sometimes, however, the resistance to change is coming not just from the business owner who is stuck thinking like a carpenter, but also from the contractor's support team. Anyone involved in the construction process can get stuck in his or her way of thinking, which is rooted in experience that often has nothing to do with how small residential construction companies are run.

A recent meeting with an owner and his staff uncovered this wrinkle. In this instance, it was strong and vocal resistance from the bookkeeper.

All too often, bookkeepers are held responsible for setting up financial software and procedures for entering data. But very few have a background in construction accounting, or have a complete understanding of estimating and job costing, or even mastery of the software. As a result, they're set up for failure from the very beginning. As with owners, bookkeepers can face the prospect of improvement (read "change") with emotions ranging from grateful relief to defiant resistance.

FEAR FEEDS RESISTANCE

To help foster understanding, I set up a first meeting with the contractor and his office staff, and that's when we encountered the resistance. Afterward, my client expressed his dismay: "I don't understand. Why would anybody not want to improve, especially when they are getting paid while they're being trained?"

The following are the factors, drawn from my experience with this transition, that most often contribute to the staff's reluctance to consider suggestions for improvements:

- Office staff are often afraid that changes will compromise the value of the company's accounting files and are protective of the owner's need to have accurate information.
- Staffers often have developed methods of doing things that are idiosyncratic rather than strategic. Because what they've set up is based on their preferences rather than on strategy or logic, their special knowledge is required in order to make sense of data. This can be a form of job protection.
- The staffers may enjoy being the information provider. Easy access to simplified reports threatens their role of gatekeeper and controller. These folks may wish to retain power and prestige.
- Staffers may lack competency with the software and clarity regarding the owner's objectives. (Note: It is rare indeed that owners are able to identify and clearly convey their requirements to their office staff, who may be forgiven for failing to produce what hasn't been defined.) These individuals are scared of change because it will mean giving up familiar habits they have developed, the results of which are at least predictable (even though they are also often inaccurate or irrelevant).

If staffers have the company's best interests at heart, they will eventually buy into improvements and find new ways to bring efficiency and accuracy to the job. In many cases, they will even find enhanced satisfaction through being able to deliver the reports sought by the owner. If the resistance continues, then it's time to consider whether or not that person is capable of becoming an enthusiastic team player. If they can, their value to the company increases. If they can't, their continued presence and negativity will likely become an impediment to morale—and to the business.

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

> If change means giving up familiar habits, individuals may be scared of it, even when they know their habits lead to inaccurate and irrelevant results.

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Skylights

BY TOM STRUBLE

Why Is My Vinyl Siding Separating?

I've been a siding installer since the 1970s and have had my own business since the 90s. In the early days of my career, we didn't work on much new construction. Mostly, we installed aluminum—usually right over the existing siding. By the mid-80s, new developments were popping up, and most of the houses in those communities were sided in vinyl.

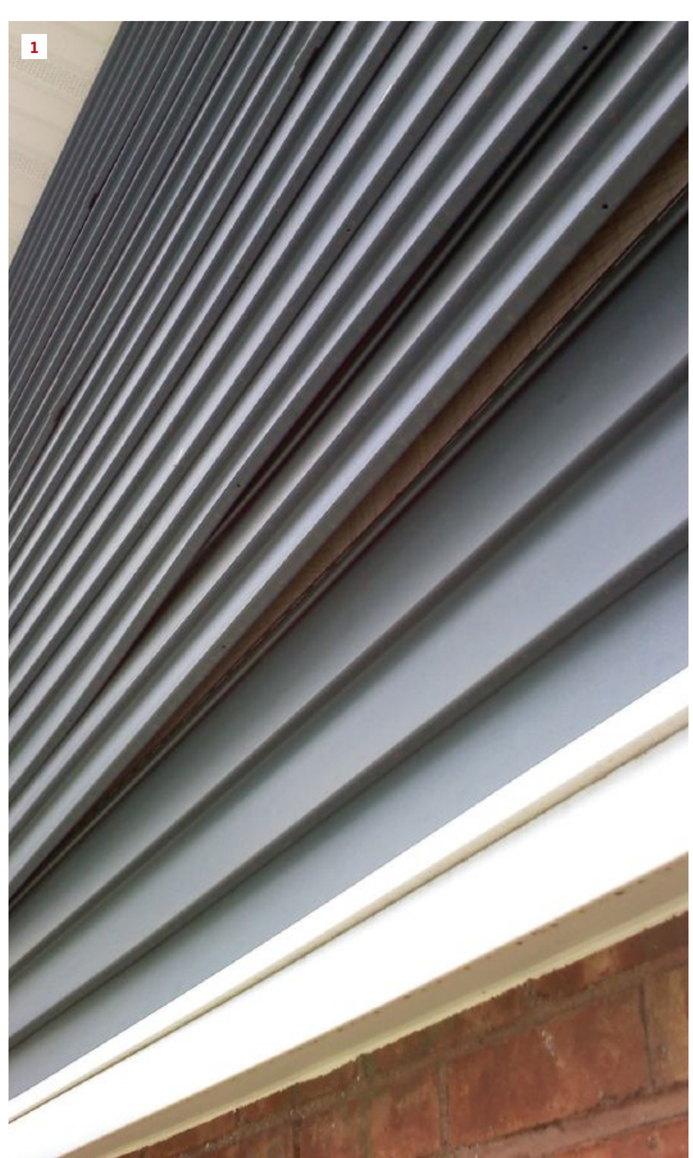
Now when I drive through those neighborhoods, I see many homes that still have their original cladding. And on just about every one that's more than a single story, there's at least one wall where the vinyl siding has unlocked somewhere between the first and second floors **(1)**. In other words, the joint that snaps the sections of siding together has become unsnapped. While I see this problem most often on the gable ends, it is not limited to that area.

RIM JOISTS TO BLAME?

So what's the culprit here? I can only speculate, but I'd put my money on shrinkage in the second-floor rim joist and wall plates. When this shrinking and settling occur, a siding panel attached to the second floor drops down, causing it to unlock from the panel below that's attached to the first floor. Another possible cause can be improperly stacking heavy building materials, such as drywall, during construction. Leaving all that material in one place can cause the plates to compress, which can result in the siding panels becoming unlocked.

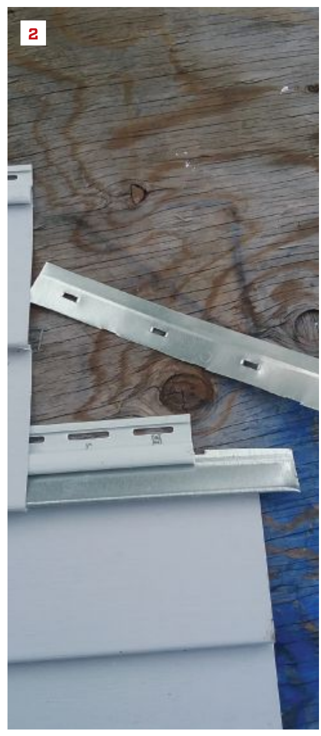
Regardless of how the panels become unlocked, the owners of these homes often call me to fix the problem. Some siding installers would recommend removing and reinstalling the siding from the problem area up, or even replacing all the siding, but neither option is cost effective.

Most of the vinyl siding installed on these homes is cheap, economy-grade material. After the siding has been exposed to sun and weather for 20 to 30 years, age-related issues such as brittleness make it very difficult to remove the siding without it breaking. And because the material has faded, finding siding with a color that matches is virtually impossible. In many cases, the homeowners are planning to add on to their home or are thinking about replacing the windows or siding in the foreseeable future. They don't want to



In older two-story homes with vinyl siding, it's common to see siding panels that have uncoupled between floors. Shrinkage in the structure behind the siding is most likely the cause.

Photos by Tom Struble



There are two different ways to reconnect separated panels. The first method is cutting a strip off a metal starter strip and inserting it into the lower locking strip **(2)**. The second method is cutting the face off J-channel and inserting that into the locking strip **(3)**. The unlocking tool then engages the top panel with the newly-added strips **(4, 5)**.

spend a lot of money on a repair to hold them over until they're ready for that big upgrade.

THE FIX

So I'm left with repairing the siding and trying to make it look good, while spending a minimum amount of time and materials on the repair. After I get the go-ahead to repair the uncoupled sections, I set up the wall with ladders, scaffolding, and whatever else I need to work safely and comfortably at that height. As far as tools go, I just need ordinary hand tools and what I call a "sideswiper," or unlocking tool, which is basically a flat hook with a handle that is used to lock panels together or unlock one panel from another. Unlocking tools are available at any siding distributor, and I've also seen them at big box stores.

Usually the gap between the panel locks is larger at the middle of the wall (as much as an inch), and then it tapers to a smaller gap near the sides of the building. The goal is to create a lower locking strip along the top of the lower panel so that it re-engages the lock strip on the bottom of the upper panel.

Instead of physically lowering the lower panel, I add what amounts to a secondary lock strip below the existing lock strip. If the gap is large—an inch or more—I cut a metal siding starter strip to the width I need **(2)**, which I determine simply by measuring the distance from the bottom of the upper panel to the bottom edge of the locking strip on the lower panel. When that width narrows from the middle of the wall to the edges, I taper the cut along the starter strip as needed.

If the unlocked panels are closer together and I need a narrower profile strip to engage the top panel, I cut the face off a length of vinyl J-channel and use that instead **(3)**. With either strategy, I insert the cut strip behind the lock on the lower panel, which holds it in place. Then I run my sideswiper tool down the locking strip of the top panel to lock it into the strip I've added **(4, 5)**. The lower course ends up slightly narrower than the rest when the new strip locks into the upper panel, but in most cases, the difference is barely noticeable from the ground.

Tom Struble is a siding contractor from West Milford, N.J.

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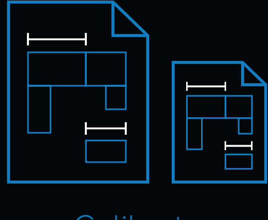

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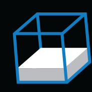

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BY CHRIS LAUMER-GIDDENS

An Insulated Slab for the Deep South

I'm an architect based in Atlanta. My wife, Jodi, and I moved to this area from Tampa, Fla., during the last recession (Jodi is also an architect and my business partner).

On the way to re-establishing our practice here, I developed a competency in building science and HVAC design. Recently, we also obtained our builder's license. Currently, our business model is based on a design-build approach, with a focus on what we call "high-performance" homes. Jodi runs the business and is the main architect and project manager, while I focus on building science, mechanical systems, and construction best practices and quality assurance on site.

For us, the term "high performance" is a way to connect with the priorities and values of our clients. They don't typically say "I want a LEED-certified house" or "I want a Passive House." Instead, they ask for a house that is comfortable and durable. But our prescription for that result involves creating an above-code building envelope that protects the home's structure from deterioration, by keeping the structure inside the building's various control layers for heat gain and loss, moisture penetration, and air infiltration.

The example I'm showing here, a project we call the "High-Performance Bungalow," follows that principle by including 2 inches of XPS foam insulation beneath the slab, and 1 inch of XPS on the outboard side of the wall and roof sheathing.

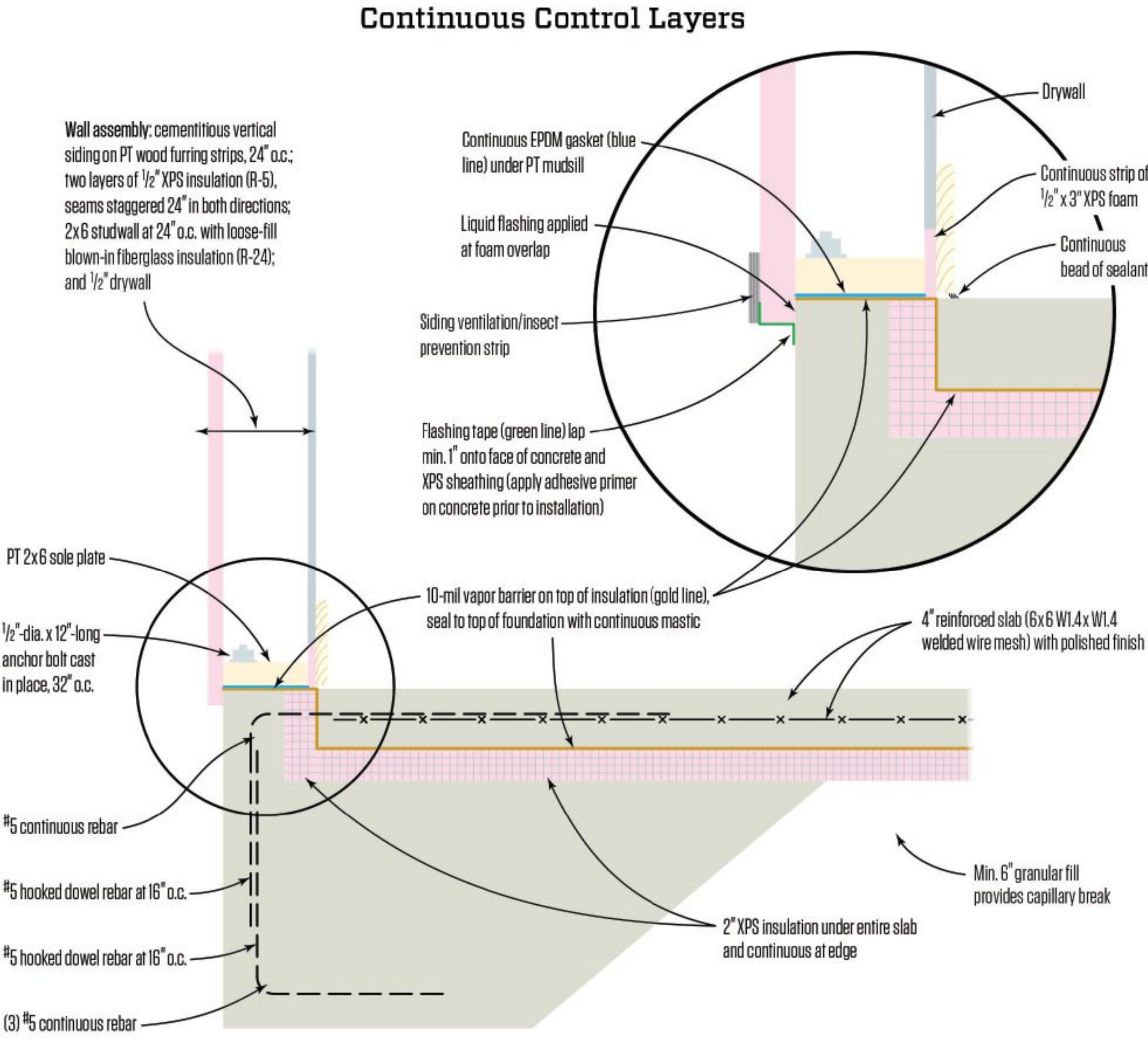
We built this house in northern Georgia. Interestingly, there's a widespread, mistaken belief that a house in our climate doesn't need much insulation—certainly not under the slab. That belief is supported by the attitude among some builders that building code requirements, which represent the bare minimum, are already too strict.

That view is based on some misinformation about the climate in our area. Just to give you an idea: When Jodi and I returned from our Christmas vacation in Florida in 2016, it got down to 9°F at our home in Atlanta. Our design temperature for Manual J HVAC calculations here is in the range of 23°F to 26°F, depending on your choice of local weather station. Atlanta has between 3,000 and 3,500 heating degree days (HDD) each year. By comparison, Burlington, Vt., has between 7,200 and 7,400 HDD each year, with a design temperature of about -4°F, while Miami, Fla., has only about 200 HDD and has a winter design temperature of about 52°F.

Geographically, northern Georgia is not midway from Miami to Burlington. But in terms of climate, we're just about in the middle. Our climate here is not much different from that in Baltimore. Except for extreme cold and desert conditions, we see every condition that is found anywhere in the U.S. We have more heating days here than cooling days, and we spend more money on heating than on cooling. So for a net-zero house like this one, insulation against the cold is just as important as insulation against the heat.

Two inches of insulation at the slab edge and under the slab shaved 8,000 Btu/hour off the heating load of this Atlanta slab on grade.

Photos: Chris Laumer-Giddens



MAINTAINING CONTINUITY

To us, insulation around a house is comparable to a winter coat. You put it on the outside. And in the case of a house, the coat is like a "onesie"—ideally, it should be absolutely continuous. The fewer the interruptions (in the form of gaps, cracks, or holes), the warmer and cozier the home and homeowner are going to be inside that coat, and the longer the home is going to last, by being shielded from the elements.

For the "High-Performance Bungalow," we isolated the reinforced concrete slab from the earth and from the footing with 2 inches of XPS foam. We turned the foam up at the edge of the slab to break the slab thermally from the footing and the outdoors.

In our climate, the ground isn't cold enough to freeze. Year-round ground temperatures range between 55°F and 65°F. So the heat loss through the slab is never as extreme as it can be through the walls in winter. On the other hand, in a 2,400-square-foot home, the area of contact between the slab and the ground is large, so the total heat loss can add up.

Without the sub-slab insulation, I calculated the heat loss through the slab on the design day in winter at 11,000 Btu/hour. With the 2 inches of insulation, that number dropped to 3,000 Btu/hour. That's definitely worth the expense—especially when you consider that the entire heating load of the house on the design day is only 19,250 Btu/hour. (The cooling load is close: 15,000 Btu/hour.)

The foam has its greatest benefit at the slab edge, where conditions are most extreme. In winter, with the home heated to 70°F, the soil under the slab near the center of the floor is at about 55°F to 60°F—a temperature difference of only 10°F or 15°F. At the slab edge, close to the cold outdoor air, the temperature difference can be 44°F to 47°F.

So why bother insulating under the center of the slab? Well for one thing, the polished slab surface is the finished floor in this house. Keeping it even a few degrees warmer underfoot is a significant comfort issue. Also, keeping insulation continuous can be a surprisingly significant factor in limiting total heat loss. But in any case, there was little difference in material cost, while eliminating part of the insulation would have complicated the process, adding labor cost.

VAPOR CONTROL

As I mentioned, one of our design rules is to maintain continuity of the control layers around the entire house, including floors, walls, and roofs. That rule applies not just to the insulation (the thermal control layer), but also to the control layers for vapor, bulk water, and air infiltration.

The vapor control layer under the slab is a sheet of 10-mil polyethylene, with seams taped. It's important to locate this poly above the insulation, directly under the slab. Otherwise, you're likely to trap moisture between the vapor barrier and the slab, where it can degrade the insulation.

We taped the seams of this vapor barrier carefully and were also careful not to puncture it during construction. But making the sub-slab poly perfectly continuous isn't highly critical. There's no air pressure at this location to bring moisture through a pinhole leak, so a few punctures are not a big deal.

On the other hand, the insulation under the slab makes a significant contribution to moisture control. By putting the insulation between the slab and the cool thermal mass of the ground, we essentially keep the slab at the same temperature as the indoor air. That way, we stop the slab from being a cold condensation point for interior moisture in winter, and we also stop it from being a source of inward vapor drive in summer.

The insulation and the poly vapor control layer also contribute to the durability of the slab. By keeping the temperature and moisture content of the slab within a narrow range, we prevent the cycle of expansion and contraction or of condensation and evaporation that can, over many decades, cause deterioration.

The edge insulation around the slab perimeter is particularly important, because it isolates the concrete thermally from the wide swings of exterior temperature. That way, the slab doesn't experience differences in expansion and contraction that would stress the material.

Energy conservation, in other words, is not the only value served by this design: We are also achieving comfort and durability benefits that are aspects of the "high performance" label.

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SPACE CONDITIONING

As built, the floor, wall, and roof envelopes have proven to control both heat flow and moisture flow as we intended. Total heating and cooling load for this approximately 2,400-square-foot home, under design conditions, were about equal: 19,250 Btu/hour of heating on the coldest day of the year, and 15,000 Btu/hour of cooling on the hottest day of the year.

That's an appropriate load for a mini-split heat pump to handle. As for humidity, we installed a heat-pump water heater in the encapsulated attic space that serves as the mechanicals room. Those appliances help dehumidify ambient air as they heat water. We have a filtered intake for fresh air (not an ERV), and we rely on continuously-operating bath vents and owner-controlled kitchen vents for exhaust. We have instruments in the house to monitor temperature and humidity, and so far, the house over its first year of occupancy is performing just the way we had hoped it would.

But that's just the beginning of the HVAC side of this story. In spite of the very low loads in the house, just to make things interesting, our client requested a zoned system. She wanted to be able to independently control the temperature in different rooms—particularly in the bedroom.

In the old days, zoning was commonplace: Different parts of a typical house had widely varying, large loads, and typical equipment was sized to provide the many tons of cooling required to meet those loads.

It's a different situation for a bedroom that needs only 2,200 Btu/hour for heating and 3,000 Btu/hour for cooling—and that's on the design day. In mild weather, that room's requirements are even lower.

In any high-performance home, we're looking at mini-splits with variable refrigerant flow (VRF) technology, because they can dial themselves down to 3,300 Btu/hour, and some of them below that. In those units, the fan runs continuously, but the compressor adjusts the refrigerant flow depending on the air temperature flowing through, and it keeps the air within a degree or less of the set point.

You can zone those mini-splits by installing multiple heads in different rooms. And some appliances have indoor heads that can serve multiple rooms via ducted connections. But none of the models currently on the market have a central air handler that can be zoned by room.

But we were able to find a technology that consists of one air handler for the entire house, with five zones on it. The air handler has an attachment on it with five ports, and each port has a damper. Paired with a mini-split, the system opens and closes the dampers as the five zones call for heating or cooling. It's not perfect, because the compressor speed of the mini-split isn't matched precisely to the air handler's fan speeds. But so far, everything is working and our customer is happy.

Architect and builder Chris Laumer-Giddens is a principal in LG Squared, in Atlanta.

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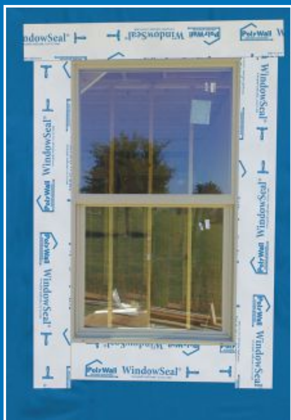

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Preventing Leaks in Tiled Showers

Detail the pan properly before any tile is installed

BY TOM MEEHAN

When I started tiling, we didn't do our own shower pans—that job fell to the plumbers. They put down a lead or copper liner in the framed shower, and then we put in the sloped mud base. When vinyl membranes came along, the plumbers could whip through the process quickly—too quickly, actually. As we put in the mud layer, we often felt chunks of debris under the membrane that would almost certainly wear through and cause leaks.

On one job, the shower developed a leak, and when I tore out the tile, I found that a roofing nail had been left under the membrane. The thin edge of the nail head had sliced through the membrane under the weight of the mud layer. Not wanting to get into a finger-pointing session with the plumber, I fixed the problem and ate the expenses. At that point, I decided to do my own shower pans—start to finish.

Taking over the whole process made sense. Leaks became all but nonexistent, which meant happy clients and fewer callbacks. But it also let us control every step of creating a tiled shower. A leakproof shower starts with the shower pan, but there are other critical steps, as well—most of which happen before any tile is installed.

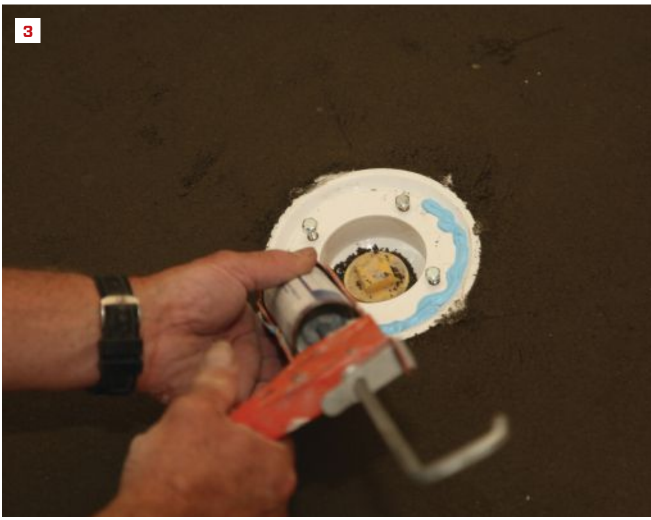
A strong floor under a shower pan is crucial, but less so than under a tiled floor. The 2 inches or so of mud base adds even more rigidity to the floor of a shower. In new construction, the floors almost always meet TCA guidelines for deflection; in remodels, I reinforce the floor framing from underneath the shower if I have any doubts.

I also make sure the wall framing is finished with adequate nailing for the membrane and the backerboard. The TCA suggests blocking around the bottom perimeter of the shower to back up the membrane as the mud layer goes in and to support the bottom edge of the backerboard. But when I use ½-inch Durock as backerboard, I find that this blocking isn't necessary on my installations.

Lastly, I make sure that the shower drain is permanently installed, and that all the parts are there. The last thing I need to find out when I start to install the pan and mud layer is that the plumber has to remove the drain for some reason, or that I'm missing a part.

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

Photos by Roe Osborn



Pre-pitch the Shower Floor

Tile is not a waterproof surface and neither is a mud base. Water will eventually make its way to the membrane, which must be pitched to the low point of the shower. This allows any moisture to exit through weep holes in the drain assembly instead of collecting and deteriorating the mud layer.

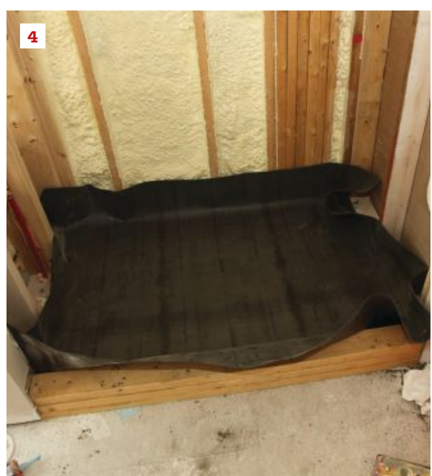
To add a slope to the floor under the membrane, first spread a layer of modified thinset on the subfloor to act as a bonding agent **(1)**. Then spread a layer of dry-pack mortar (four parts sand to one part Portland cement, and enough water so that it compacts in your hand), pitching it toward the drain at a slope of about 1/4 inch per foot **(2)**. Pack and screed the mortar to eliminate flat or hollow spots. Tapered foam panels (installed before the membrane) can also be purchased to provide the necessary pitch. The final step before cutting and fitting the membrane is applying an elastomeric sealant, such as NobleSealant 150, around the drain assembly **(3)**. This will create a seal between the membrane and the drain.

Measure, Cut, and Fit the Membrane

Use a waterproofing membrane specifically meant for shower floors. For this project, Chloraloy 240 CPE was used, with a nominal thickness of 40 mil. When measuring the membrane, be sure there's enough to go up the walls at least 2 inches above the threshold around the perimeter of the shower. There also needs to be enough material to wrap over the top and down the outside face of the threshold.

Place the membrane in the shower with the same overlap on all sides **(4)**. In the corners, neatly fold the membrane flat against the framing. Attach the membrane to the framing with nails, at least 2 inches above the top of the threshold **(5)**.

To connect the membrane to the drain, carefully cut the membrane from around the drain-assembly bolts, always cutting toward the middle of the drain **(6)**. Next, cut out the center of the membrane by letting the knife follow the inside ring of the drain. Press the membrane into the caulking that was spread earlier **(7)**. Slip the clamping ring into place and tighten the bolts incrementally, alternating sides until they are tight **(8)**.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Detail the Threshold

The membrane needs to be cut where it transitions from the vertical plane of the walls to the horizontal plane of the threshold. This area demands close attention to keep it waterproof.

The first step is to cut the membrane tight to where the top of the threshold meets the jamb framing, to allow the membrane to wrap over the top of the threshold **(9)**. Carefully fold the flap inside the shower and attach it to the framing with a nail 2 inches above the threshold. Nail the membrane to the outside of the threshold **(10)**, but do not fasten it to the top or inside of the threshold. Cut an overlapping corner piece of membrane for each side of the threshold **(11)**. Apply a generous bead of sealant to the joint underneath **(12)**, then apply sealant to the overlapping piece and press it into place to seal the corner.

Water-Test the Pan

When the membrane is installed and all the joints are appropriately sealed, insert an expansion plug into the drain and dump about 10 gallons of water into the shower pan **(13)**. Let the pan sit filled with water for three to four hours. Carefully inspect the drain and the floor below the shower for leaks before proceeding to the next step.

Metal Mesh Over the Threshold

Instead of using cement board on the threshold, pre-form a sleeve of galvanized expanded metal by bending it over 2x4s **(14)**. Hold the wire 1 1/2 inches off the bottom of the shower pan, with the factory edge (without sharp edges) on the inside of the pan **(15)**. After slipping the mesh into place, nail it from the outside only **(16)**, then coat it with thinset **(17)**.

Lay Down the Mud Base

To keep the weep holes in the drain clear, spread a small amount of pea stone around the base of the drain **(18)**. Dump several buckets of dry-pack mortar (the same mix that was used to create the sloped layer) onto the membrane **(19)**. Pack the mortar tight to the membrane, especially in the corners, along the perimeter of the shower, and around the drain. Smooth the mixture using a wood float and a steel floating trowel **(20)**. Be sure the corners of the steel trowel are rounded to keep them from damaging the membrane **(21)**. Screed the final surface perfectly flat with no voids. For this step, a level works well to make sure that the surface of the mud base is sloped at around 1/4 inch per foot toward the drain **(22)**.

Install the Backerboard

Many tile installers put the backerboard on before installing the mud base, which is acceptable if the board is kept off the surface of the pan—from which it could wick up moisture and cause discoloration of the tiles. But this method requires the installer to step on the membrane, potentially exposing it to damage.

Instead, wait until after the mud base is installed to install the backerboard, so that you never have to step on the membrane. With this method, the board can sit directly on top of the mud layer. Attach the board with 1 1/2-inch galvanized roofing nails, keeping all the nails at least 2 inches above the top of the threshold **(23)**. After the backerboard is nailed in, seal the corners with a bead of silicone caulk **(24)**. If there are areas where the tile will overlap onto a finished wall surface—like the sides of the shower entry on this project—brush on a liquid waterproofing membrane, such as Hydro Ban **(25)**. Apply heavy-duty mesh tape to the corners, as well as to the seams between the boards **(26)**, and spread a coat of thinset mortar over all the seams before the tile is installed **(27)**.

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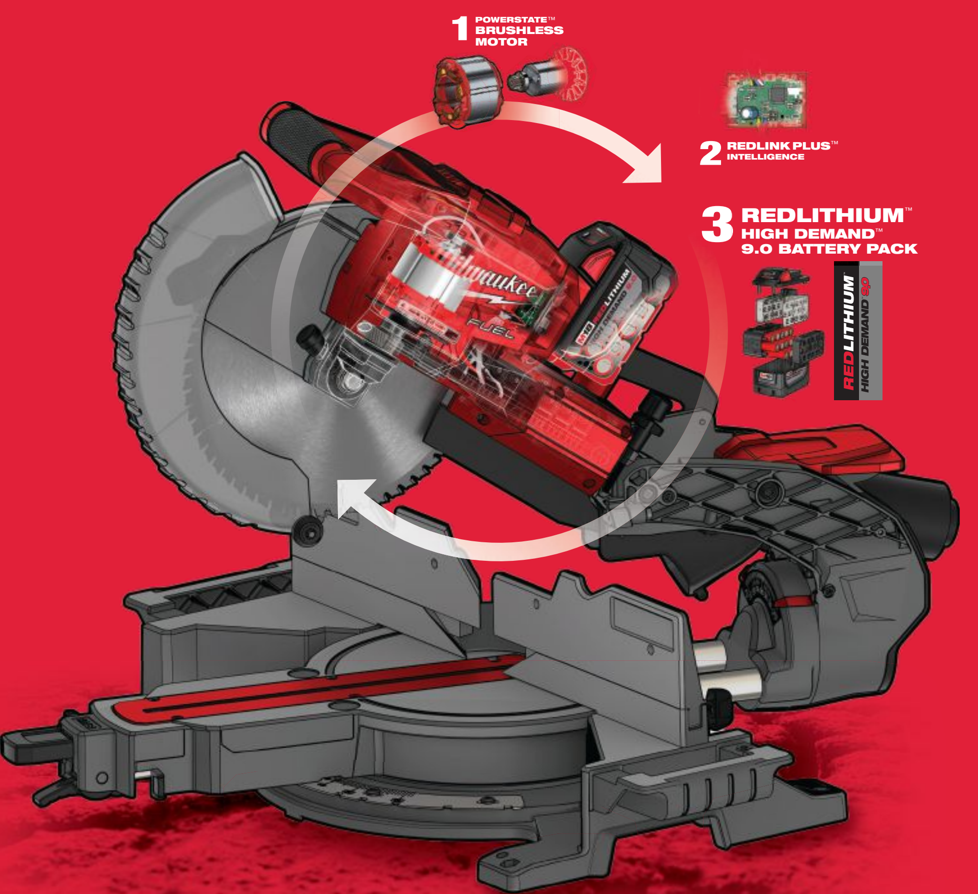

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High-Performance Insulated Wall Retrofits

Vapor-open assemblies correct durability and comfort problems while saving energy

BY TED CUSHMAN AND TIM HEALEY

Building and remodeling contractor Jim Bradley is doing a good business these days repairing and upgrading existing homes in northern Vermont. Bradley specializes in rehabilitation of underperforming homes with moisture problems, and in a recent conversation, he told *JLC* that he doesn't expect to run out of work anytime soon. As an energy auditor, he said, "we see failure day in and day out."

"I have to give the bad news to customers all the time," said Bradley. "Even good, fair-minded contractors who want to do the right thing, because of not understanding proper building science and wanting to hit the lowest price point, are still creating ticking time bombs."

Vermont's current energy code requires an R-25 wall, Bradley explained. Builders typically accomplish that with R-21 batt insulation in the 2x6 cavities and an inch of rigid foam insulation outboard of the stud wall's OSB sheathing. These walls are more energy-efficient and airtight than in the past, Bradley said—but he said many builders have not addressed the indoor humidity that comes along with the airtightness. The risk, Bradley argued, is mold and rot on the OSB sheathing, caused by condensation of indoor moisture during the long winter heating season and aggravated by the system's inability to dry out readily during the rest of the year.

But most of the problematic wall systems Bradley encounters aren't built to the latest code. Instead, they're an assortment of assemblies constructed under earlier versions of the code, or even in the years before the state enforced any residential energy code at all. Last year, Bradley described his crew's complete reconstruction of a double-stud wall that had experienced severe settling of its blown-in cellulose insulation (see: "Major Surgery for a Failing Fat Wall," Jul/15). For this story, we followed the action as Bradley's

Photos by Tim Healey

Bradley's crew removed the home's siding and sheathing from outside while the homeowners continued to live in the house **(1)**. They stripped out any poly vapor barrier they discovered, and air-sealed a few obvious leak points using gun foam **(2)**. Then they filled the stud cavities again with Roxul mineral-wool insulation **(3)**. Finally, the crew resheathed the walls using vapor-open materials: National Gypsum Gold Bond eXP gypsum board, and CDX plywood **(4)**.

carpenters rebuilt two conventionally-built single stud walls—one framed with 2x4s and one framed with 2x6s, but both insulated originally with fiberglass batts.

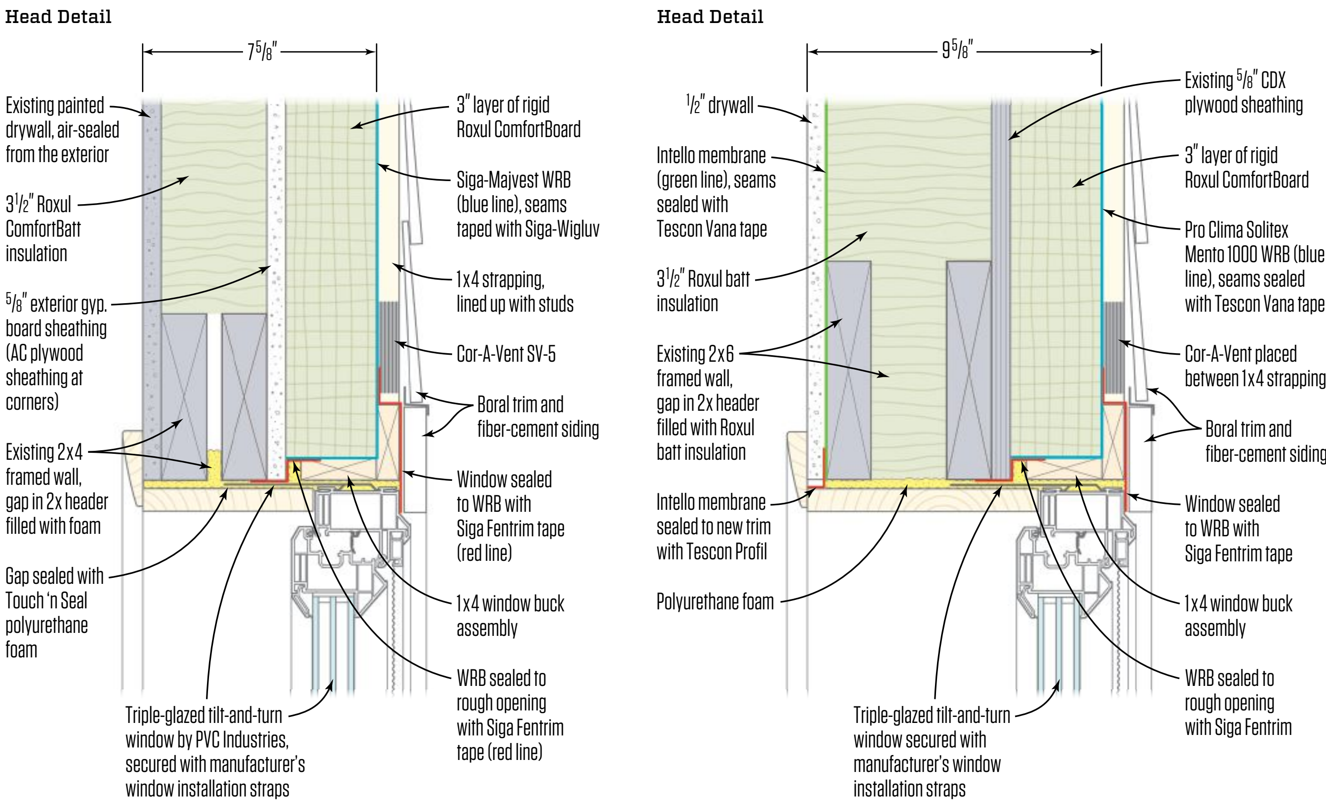
Compared with the earlier double-wall house, these two examples are much more typical of recent construction. And while they didn't show the catastrophic failure of last year's double-wall example, they did have significant issues, Bradley found. In reconstructing the walls, Bradley followed an approach similar to last year's example, using vapor-open gypsum board sheathing in the field, and plywood at the wall corners. But instead of blown cellulose insulation, he used Roxul mineral-wool insulation in the stud cavities, and he applied 3 more inches of Roxul over the structural sheathing—boosting the wall R-value while keeping the wall sheathing warm and still allowing vapor to escape to the outside.

STRIPPING AND REINSULATING

The first of our two cases is a modular house from the 1980s, factory-built with 2x4 walls, plywood sheathing, and fiberglass batt insulation in the stud bays. A few years earlier, Bradley's crew had installed new Intus high-performance windows in one wall of the house. At that time, Bradley added a built-up exterior insulated assembly to just that wall. The customers liked the results. "They noticed such a difference over the next winter, they decided they should do the same thing to the rest of the house," said Bradley.

Bradley decided to remove the home's siding and sheathing from the outside, pull out the cavity insulation, strip away any poly vapor barrier that he encountered, and reinsulate the wall cavities with Roxul mineral-wool batt insulation. Next he would

High-Performance Insulated Wall Retrofits



Bradley's two wall-reconstruction projects followed different pathways to a similar result. In the first case (above left), the crew removed the existing plywood sheathing from outside, reinsulated the cavities, then resheathed the wall with vapor-open material. In the second case (above right), they opened the 2x6 wall from the inside to reinsulate the cavities, but left the existing sheathing in place. In both cases, they insulated over the wall and constructed a vapor-open, watertight rainscreen.

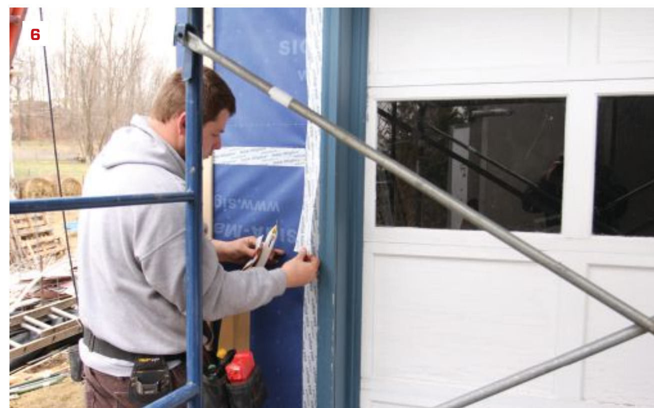
resheathe the building with vapor-open materials, then apply more Roxul to the wall over the new sheathing. Then he would install a new vapor-open weather-resistive barrier (WRB) membrane (in this case, Siga Majvest), strap over that drainage plane, and attach new HardiePlank fiber-cement siding over the strapping. The result would be a vapor-open, well-insulated wall that could dry in either direction.

Before reinsulating the stud bays, Bradley's crew did some point air-sealing of interior air leakage points such as drywall joints and electrical-box penetrations. "We didn't really need to do that," Bradley told *JLC,* "because when the wall was complete, this location would not communicate with the outdoors. "But we did it as an extra measure," he said, "just to make sure that we reduced the potential convective effect at those points. Whenever you get a convective flow, you diminish the R-value of the assembly."

After carefully reinsulating the stud cavities, Bradley's crew resheathed the wall—not with OSB, but with plywood at the corners and Gold Bond eXP gypsum board sheathing in the field. The plywood at the wall corners is for structural bracing of the walls, Bradley explained, while the eXP gypsum board is chosen primarily for its vapor-transmission characteristics. Panel joints are taped for airtightness, but this step also is not strictly necessary, Bradley said, because the Siga Majvest applied later as a drainage plane, and sealed with tape at the seams, is substantially airtight.

A WARM, DRY BLANKET

After reinsulating the stud cavities and resheathing the wall, Bradley's crew applied another insulation layer: 3 inches of Roxul



Bradley's crew attached 3-inch batts of Roxul ComfortBoard insulation over the new vapor-open wall sheathing **(5)**. This way, the sheathing would be kept warmer in winter, further reducing the risk of vapor condensation. The crew covered the insulation with Siga Majvest membrane, taping the membrane seams **(6)** to maintain airtight protection for the insulation, while still allowing vapor to escape. Next, the crew applied strapping over the sheathing **(7)** to create a rainscreen air space.

ComfortBoard. The crew fastened the ComfortBoard with long screws and washers, using just enough screws to hold the batts in place. Then they applied the Siga Majvest, taped the membrane's seams with Siga Wigluv tape, and strapped out the wall with 1x4 strapping. To fasten the strapping, the carpenters used screws long enough to go through 3 inches of Roxul and the ⅝-inch sheathing, and sink 2 inches into the wall framing.

The Roxul in the walls' 2x4 cavities is rated at R-15. The extra 3 inches of ComfortBoard, rated at R-4 per inch, boosts the wall's R-value by R-12, for a total of R-27. The exterior ComfortBoard blanket also keeps the wall's plywood and gypsum board sheathing warm, reducing or eliminating the risk of vapor condensation at the sheathing plane. And because the material is vapor-open, it allows moisture that passes through the plywood or gypsum board to continue outward and escape to the exterior. The watertight Siga Majvest membrane is also vapor-open: Rated at 68 perms, it is the most vapor-permeable material in the wall.

WINDOW BUCKS AND WINDOWS

With the basic wall build-out complete, Bradley's crew got ready to install windows. The first step was to wrap the Siga Majvest into the window openings and connect the membrane to the window's rough framing with Siga Fentrim vapor-open waterproof tape. Next, the carpenters assembled window bucks from 1x4 stock and strapping and set the bucks into the rough openings. Then they set the window units into the openings and sealed the windows to the drainage plane with Fentrim tape.

For this project, Bradley chose Revolution windows from PVC

The carpenters taped the Majvest membrane to the windows using vapor-open Siga Fentrim tape to make this juncture airtight and waterproof **(8)**. They assembled window framing bucks on a worktable next to the building **(9)**, then installed the bucks into the rough openings **(10)**. They installed the triple-glazed vinyl windows flush to the outside face of the wall **(11)**, and taped the window edges to the vapor barrier with Fentrim tape **(12)**.

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Industries, manufactured in Clifton Park, N.Y. With triple glazing, the vinyl windows achieve an R-7 center-of-glass rating. Revolution windows have the Euro-style tilt-and-turn action that's popular in the Passive House movement, but Bradley is able to order the units from PVC Industries with just a two-week or three-week lead time, not the months it can typically take to get high-performance European-made windows delivered to the United States. And Bradley said PVC Industries' customer service has been first-rate: In one case, he said, the company replaced and reinstalled two orders at no charge when dual-glazed units were mistakenly shipped instead of the triple-glazed units Bradley had ordered.

Price was also a factor, Bradley said. "I have priced out double-glazed Andersen windows against the PVC Industries triple-glazed windows," he explained, "and over a $25,000 project, the pricing between the two varied by only $300 in the total project cost."

For this project, Bradley chose to install the windows flush to the outside face of the building. "It gives the customer a bigger windowsill on the inside," he explained. "We have found that if we install the window more to the interior of the wall surface, and you have a bigger windowsill on the outside, it's a great place for animals to sit. But, it gets dirty too. The building-science side is, if your window is more to the middle, it's going to perform a little bit better. But that's a negligible difference."

AIR GAP, SIDING, AND TRIM

Over the strapping, Bradley's crew applied Boral trim and HardiePlank fiber-cement siding. But first, the carpenters installed Cora-Vent at the tops and bottoms of the walls and also above and below the windows.

Bradley explained: "If your siding is directly against your house, it's not going to allow for proper drying—whether water gets in from the outside, or vapor is coming out from the inside. It causes paint delamination and siding failure. So the rainscreen behind there is vitally

important, whether you do anything else for efficiency or not. Even if you are just replacing your siding, you need to put a rainscreen in there." Bradley recommends a minimum ¾-inch gap behind the siding to allow air convection. He installs the Cora-Vent to keep insects out, he explained: "It's honeycombed through the vertical section, providing some structure with breathing channels, and it has felt on one edge. You install it with the felt side down at the bottom, and with the felt side up at the top."

The HardiePlank is a prefinished, wide lap siding chosen by the customer, Bradley said. It's important to follow the manufacturer's instructions carefully when you install fiber cement, he noted: James Hardie's specifications include caulking the ends of boards where they butt into the corner-board trim, but leaving an uncaulked gap, backed by flashing, at joints in the field.

For trim at the wall bases and corners, Bradley installed Boral, a composite product that is 70% recycled fly ash (a coal-burning power-plant byproduct), bound together with fiberglass and polyurethane.

Bradley likes the Boral for its water resistance, durability, and stability. "You can submerge it under water indefinitely, take it out, and cut it, and it's still dry. It just does not absorb water. And it's stable—a 16-foot section will only change its length by 1⁄16 inch no matter the temperature change. By comparison, I have a 20-foot piece of plastic trim on my house that shrinks a half inch on either side in the winter months."

ANOTHER VERSION: INSIDE OUT

For a major remodel of another house, Bradley chose a different pathway: He gutted and reinsulated the walls from the inside out. The 2x6 wall had fiberglass in the cavities, building paper on the outside, and poly behind the drywall, Bradley reported, "and the area we opened up in the old section—and this was only 1989 construction—was full of black mold, and a lot of rodent activity as well."

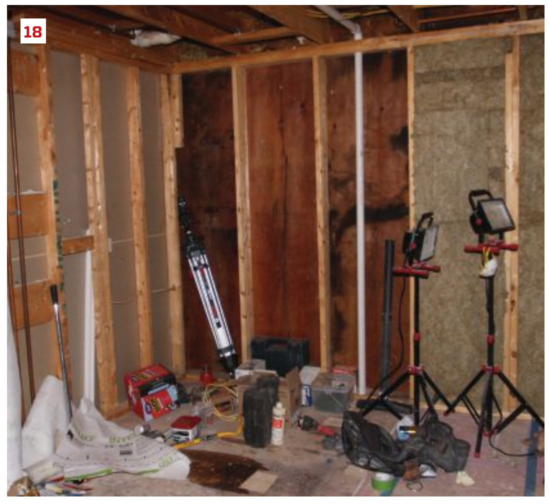
Bradley replaced only one section of plywood, which was badly damaged and behind a shower. The rest of the wall sheathing was cleaned and left in place. The cavities were reinsulated with Roxul. Then Bradley took advantage of the exposed interior to install Pro Clima Intello, a variable-permeability vapor-control membrane that adjusts to ambient conditions, keeping vapor out of the walls in winter but allowing vapor to escape into the house during summer.

On the outside of the building, Bradley attached a continuous 3-inch layer of Roxul ComfortBoard, then covered the insulation with Pro Clima Solitex Mento 1000, a vapor-open WRB. He strapped over the Mento 1000, and then applied siding over the strapping.

Ted Cushman and Tim Healey are senior editors at JLC.

The ¾-inch air gap behind the siding is open to air-flow at the top and bottom (facing page), but protected from insect intrusion with Cora-Vent **(13)**. Cora-Vent was also installed above and below the windows **(14)**. The crew installed Boral trim and HardiePlank siding over the strapping **(15, 16)**, caulking HardiePlank joints according to the manufacturer's instructions.

For a second, similar project, Bradley chose to demolish and rebuild the wall from the inside out. The wall sheathing was found to be blackened by mold in some areas **(18)**. The crew reinsulated the walls with Roxul **(19)**, then applied Intello smart vapor-barrier membrane to the walls **(20)**. They filled cracks around the newly installed windows with low-expansion gun foam **(21)**, then taped the Intello to the window edges using Pro Clima Tescon Profil tape **(22)**. The reconstructed interior air barrier **(23)** prevents outward vapor diffusion or air transport of moisture, but allows inward drying of the wall if the framing or sheathing do become damp for any reason.



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Photos by Gene Summy

Flashing Recessed Windows

Lessons in how to avoid costly mistakes when waterproofing complex window openings

BY GENE SUMMY

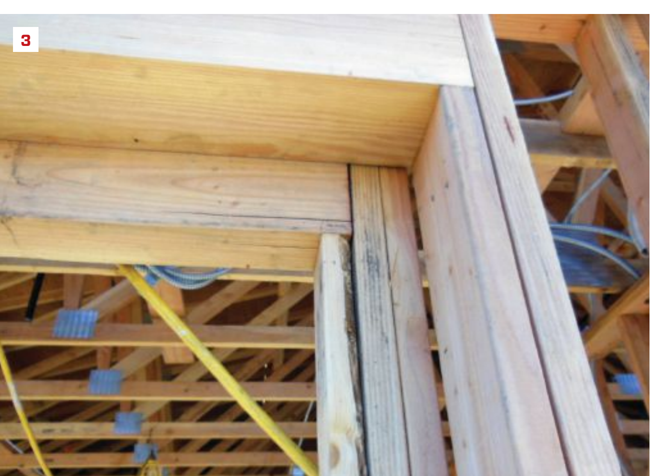
I have been researching, developing, and testing different flashing methods for recessed windows since 1999. I consider myself lucky to have been hired to investigate thousands of recessed-window leaks over the last 16 years, as it has afforded me unique opportunities to develop effective methods of detailing windows with the materials used commonly on jobsites.

We have a local affluent community here in Orange County called Newport Coast. Since 2000, this area has been a mecca for anyone with money. Most of the area sits on a hill overlooking the Pacific Ocean, and for most of these homes, it's perfect for good views.

For those of us in the water-management community, the beautiful views are not the first thing that comes to mind when we look at homes here; the storms are. They come in off the oceanfront, bringing plenty of driving rain and the need for effective waterproofing. Early in my testing career, I walked on "the Hill," as everyone calls it here, with architect Fernando Laullion through a vast neighborhood under construction. We noticed that 100% of the windows on the homes were recessed. The depth of the recesses varied from 3 to 12 inches. There were no flush-mount windows whatsoever. Recessed windows were written into the CCRs by the land developers.

And Fernando and I were astonished by what we saw. We observed 10 different teams of installers flashing the recessed window openings on 10 different homes, and we did not observe any of the teams following, or even attempting to follow, published guidelines. Why? Guidelines were simply not available.

We were fascinated to observe that a right-handed installer flashed the right side of the window differently than he flashed the left side of the same window. One side, usually the side of his dominant hand, was done better than the opposite side. In many



Recessed windows are used as step stools **(1)** and are also often damaged by tools and materials that are passed in and out of the opening during construction. For this reason, the author calls for installing an extra layer of black paper on the bottom area of the recess.

This window **(2)** was torn apart after the windows on a new home started leaking. Without a good flashing design provided on the plans, the installers simply applied peel-and-stick to the outside face, without bothering to first bend pieces into the corners or use pre-fit flashing corners.

The lumber used to pack out this recessed window opening **(3)** will be covered by the weather barrier and flashing tapes, and the trades that follow will have no way of knowing there's a major void in the backing due to wane along one edge. A lath or trim nail puncturing the flashing over this void would more than likely leak.

locations, the opposite side was a mess; it was hard to believe that the same person had done both sides.

We watched for a while, then we went and spoke with the installers. They told us that they had never been trained and had never been given step-by-step procedures to follow; they were simply trying to do their best. I believe they wanted to do the right thing but honestly didn't know how. That was the day I decided to tackle this problem.

In the coming years, I have been fortunate that my company has been the one that has responded to many of the rain-related leaks in this same area. We were able to see first-hand the effects of the poor installation practices on the very same recessed windows we'd seen installed. In most of the cases, we investigated by water-testing the windows that we knew leaked in natural rain events. This was a great learning opportunity, and we took advantage of it as best we could. We applied generally accepted methods of testing and isolation to precisely identify the sources of water intrusion. In many cases, fixing the leaks was also part of our scope of work, and the methods we devised are central to this article.

CAUSES OF LEAKS

The following are the basic categories of the leaks we observe frequently on jobsites:

Poor "origami." Leaks due to the complex cutting and folding of the waterproofing materials are common. Let's face it, cutting and folding sticky, thick material is no easy process. Even the most experienced guys will struggle. Towards the end of a day, the temptation to simply "karate chop" the materials into place often takes over.

Damage from trades. The recessed edges of the openings are vulnerable to abrasion from tool bags and heavy building materials being passed through. We've also observed trades using the lower edge of the windows as a step stool **(1)** and as a tool locker. The lower edge is often damaged by the heavy, steel-toed boots of

tradespeople climbing through the opening or reaching up onto the wall.

Poor design. Architectural plans are notorious for having sketchy details when it comes to recessed flashing. Often, the architect simply says something like "apply bituminous products to lower edge." He draws a side view that has dotted lines where he wants the waterproofing membrane to layer, with no mention of the corners and transitions. The result is that the installers will simply lap the outside face with peel-and-stick and not actually follow the contours of the corners **(2)**.

Incorrect or missing materials. We have discovered many openings where the window installer simply installed traditional window flashing around the window, assuming the next trade would waterproof the recessed opening. The window installer's logic was simple: "I flash the window; someone else waterproofs the wall system." The contracts often do not specify anything about the recessed windows.

In this article, I'll cover most of the details I've worked out over the years to prevent problems with recessed windows. If you do these things, you will sleep like a baby during the rainiest nights.

PREPARING THE OPENINGS

Sloped sill. Provide slope to the lower recessed edge of the window—the more slope, the better. I suggest at least 2 inches per foot to readily guide water down and out.

Solid backing. All areas within the recessed opening should have solid backing. Provide at least two trimmers on the sides of the window (for at least 3 inches of solid backing) and at least 4 inches above and below the window. This is important because you need room to work with the sticky material. If the area is too tight, the installer does not have the necessary room to correctly apply the materials. If you have any doubts about this, pick up some flashing tape and go flash some of these conditions yourself. You will quickly see what I mean.

No shiners, no wane. It is difficult for tradespeople to know where the backing is after the weather-resistive barrier (WRB) has been installed. If the home is fully sheathed, do not allow excessive gaps between the sheets. Gaps should be ⅛ inch wide, or the width of the shank on a 16d nail. Gaps larger than that not only leave a void behind any membrane applied over the gap, but are also a magnet for shiners, which are ready leaks waiting to happen. Make no mistake about it: Shiners usually leak.

Also, never allow waned lumber to be used as backing in the recessed opening **(3)**. Face all waned lumber to the inside, where it may give the drywall installers a headache, but won't create an expensive leak. When facing the outside, wane creates huge voids behind the flashing membrane. When subsequent trades—stucco lathers or the exterior-trim crew—come through, their nails will not self-heal against a void and will result in window leaks.

FULL DISCLOSURE

I recommend using a flashing system from a manufacturer that publishes guidelines on how to deal with recessed openings. This makes life easier for installers and contractors: You can largely stay out of legal hot water if you simply do what they tell you to do.

Two companies we have worked for that have thought out these issues are Fortifiber and DuPont. In the interest of full disclosure, I admit that I have worked for both. While I started out as a window contractor, I now run a company that trains window installers, mostly for large franchise builders. In the course of this work, we've helped test and advise on the development of the Fortifiber and DuPont guidelines. They both incorporate pre-formed flashing corners, and both offer in-field support. It's worth contacting the local rep, as he or she will usually visit your jobsite to train your employees.

GENERAL GUIDELINES

Regardless of the system you use, these guidelines will keep you out of trouble most of the time.

Work from bottom to top. This is obvious to a lot of folks but bears repeating. You have to work from bottom to top to make sure top layers lap over bottom layers.

Pre-formed flashing corners. Pre-formed corners are available from Fortifiber. They're sold as "Corner Flash A" (for the outer corners of the recess) and "Corner Flash B" (for inside corners). But you can also pre-form corners using DuPont FlexWrap or other flexible flashing material following the DuPont instructions.

Use flashing corners on all corners of the recessed opening, including the four outside edges of the outer face of the opening, as well as the four corners on the wall area in which the window is set. On the bottom of the opening, the corners on the outside edge are installed first, then the corners near the window unit. On the top of the opening, the inside corners near the window are installed first, then the corners on the outside edge. This will ensure that the layers are lapped correctly.

And don't forget the top corners. A lot of folks are so concerned about the lower sill area, they neglect the top corners of the opening. Those are just as susceptible to blowing rain and water dripping around the top edge and running into a tiny gap.

Protection layer. After the lower recessed edge is correctly flashed, apply a course of building paper to protect this important area from trade damage. Many times, recessed openings are used as tool-holders and stepping stools, which will damage your carefully applied and expensive flashing efforts. Adding a course of building paper or a sheet of nail-on flashing is a cheap insurance policy.

J-roller. The karate-chop method of pushing peel-and-stick into a corner is not enough. Alway use a J-roller to smooth the material flat and ensure complete adhesion. Wrinkles and poor adhesion will inevitably lead to leaks.

Little roofs. Think about the recessed areas as "little roofs." How much time and preparation do we give to our roofs? At least that much attention should be given to recessed windows. A little paranoia is a good thing.

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

Flashing a shallow recess. At the bottom of the window, first caulk the framing, then apply pre-fit corners to the outside edge of the recessed opening **(1)**. The inside flashing corners go on second. **(2)**. Next, apply sill flashing across the exterior face of the wall framing **(3)**. Make two slits at the edge of the opening, and fold the inner tongue of the flashing across the horizontal sill and up the inner face below the window opening, rolling it smooth with a J-roller **(4)**. Cut short pieces of flashing membrane to create end dams on both sides of the recessed opening **(5)**. The author recommends caulking the edges of the end dam and tooling out the sealant. Black paper is installed as a protective layer over the horizontal surface of the recess, and a final membrane "apron" to tie in with the WRB **(6)** is installed on the face of the framing.

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With the side flashings in place **(7)**, the window unit can be installed. (To meet the window manufacturer's requirements, the window flange must be installed in a bed of sealant; see "Installing Flanged Windows," Jan/16.)

Remember that the top corners, not just the bottom of the recessed opening, must also be flashed. Install flashing corners on the inner face near the top of the window first **(8)**, followed by the flashing corners on the outside face of the recessed opening **(9)**. A head flashing, which extends from one edge of the recess to the other **(10)**, is followed by a final membrane flashing applied to the outside face of the wall **(11)**.

The final membrane flashing is slit at the edges of the opening and folded inwards across the horizontal head and down over the window flange **(12)**, completing the flashing assembly **(13)**.

Flashing a deep window recess. Start by applying the sill apron across the outside face of the wall, and caulk the corner of the recess **(14)**. Flashing corners are applied to the outside edge **(15)** and folded over the apron. Strips of flashing are first folded along both sides of the recessed opening **(16)**, then slit so the outside edges can fold onto the exterior face of the wall. Next, the inner flashing corners are installed with caulk under them. At the front edge of the recess **(17)**, the author installs a "bridge flashing" spanning between the two flashing strips at the corners.

The end dam is installed next **(18)**, spanning the distance from the window opening to the outside face of the wall. The author always installs a protective layer of black paper **(19)** to ward off damage to the bottom of the recess during construction. A final sill membrane flashing is applied over the black paper below the window opening.

After side flashings are in place, the window unit is installed and flashing corners are installed above the window **(20)**. Next, the top corners of the recess are flashed, a head flashing is installed over the window flange **(21)**, and flashing corners **(22)** are installed at the outside of the recess. The final step is to apply a flashing membrane, which is slit at the edges of the opening and folded back over the top edge of the recess **(23)**.

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BY CHARLES WARDELL

1. Plug-and-Play LED Options
The expanded Loox LED lighting line from Häfele America Co. includes new fixtures, switching options, and peel-and-stick flexible light strips, or ribbons, that can be configured for nearly any application, such as under wall cabinets or inside a drawer. Components were designed for easy installation with color-coded, mated connectors, and with drivers that plug into a wall outlet. Prices vary by design and components; the installation shown here should go for around $230. hafele.com/us

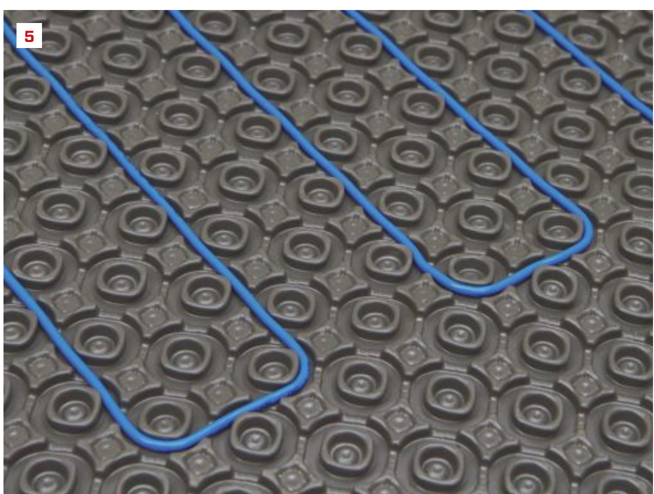
2. Fire-Resistant Foam
Lapolla's Foam-Lok FLX 500-EM Spray Foam just simplified the process of insulating attics and crawlspaces. That's because it has been certified by the International Code Council Evaluation Service for use in uninhabited spaces without an ignition barrier—in other words, it can be left uncovered without drywall. The testing criteria require that the foam withstand an open flame for a specific time without igniting. The closed-cell version has an installed cost of $1 to $1.25 per square foot for every inch of depth, while the open cell runs $0.50 to $0.75. lapolla.com

3. A Better Recip Blade
Milwaukee says that with optimized 5-tpi tooth geometry, its new The Ax Sawzall blade will cut twice as fast as other carbide blades and allow for faster plunge cuts, without worry about bouncing on the work surface. The teeth resist fracturing from hitting nails, and according to Milwaukee, The Ax blades will last 30 times longer than bi-metal blades. They come in 6-, 9-, and 12-inch lengths with costs of $8, $11, and $14. milwaukeetool.com

4. ICC-Compliant Zip Panels
Huber has added an R-9 thickness to its Zip System R-sheathing, a line of panels with a layer of polyisocyanurate foam. The new thickness lets builders satisfy the 2015 International Energy Conservation Code's continuous-foam-insulation requirements in areas where Huber's existing R-3 and R-6 panels aren't thick enough, and where the builder doesn't want to use the R-12 version. Material costs range from a few dollars more to twice that of a wall assembly with OSB, housewrap, and rigid foam, but installation is faster. Huber Engineered Woods, huberwood.com

5. Customizable Floor Heat

When radiant-heating cables are installed below the floor surface, SunTouch's new HeatMatrix uncoupling membrane provides the ability to vary wire spacing. This lets customers fine-tune heat output for a room's heating needs. And by uncoupling the floor tile from the subfloor, the membrane also reduces the chance that differential movement will crack the tile. It's installed using a modified thinset. List price is $2.40 per square foot and it comes in a 161-square-foot roll. The manufacturer also sells heating wire with a diameter made specifically for the HeatMatrix. suntouch.com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6. Tough New Surface Material

Neolith is one of a new class of "Sintered" materials made by placing the ingredients of glass, porcelain, and quartz under extremely high heat and pressure (2,200°F and 5,900 psi). The result is a uniform, stone-like slab with excellent scratch, chemical, and heat resistance. It's sold to licensed fabricators in three thicknesses: 3mm (for furniture and walls), 6mm (flooring), and 12mm (countertops). The 12mm (1/2 inch) material weighs 8 pounds per square foot. The manufacturer says the cost should be comparable to quartz. neolithcountertops.com

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7. Faster Subfloor Screw

Simpson's new Strong-Drive WSV subfloor screw can be driven faster and with less force, while delivering more holding power than a standard subfloor screw. Its tip and thread pattern provide up to 25% less torque than standard screws, and a deep-recessed, six-lobed ribbed head delivers cleaner countersinking and more secure bit retention for fewer cam-outs. The screw was developed for use with the company's Quik Drive system. A box of 2,000 collated screws costs $85. strongtie.com/wsv

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8. High-Performance Window Buck

ThermalBuck is a window buck made from expanded polystyrene insulation wrapped in a polyurethane shell. Meant for installing windows in walls with rigid exterior foam, it comes in 8-foot lengths that are cut on site to fit, and held in place with adhesive and screws. The manufacturer, Brinc Building Products, says that unlike wood, this material won't warp, shrink, or expand. And because it protrudes out from the framing to support the weight of the window, it will transfer wind loads from the window to the structure. It comes in four thicknesses, from 1 to 2.5 inches, with prices from $2.50 to $2.75 per foot. thermalbuck.com

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Our CableRail stainless steel cables are a great choice for your customers who are looking for a view-friendly railing infill option that's attractive, durable, and ultra-low maintenance, while our packaged cable assemblies and automatic-locking Quick-Connect® fittings make installations a breeze.
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Photo courtesy of Decks by Kiefer

9. Easy Accent Wall
With modern design all the rage these days, the Endura line of 3D decorative wall panels from Ekena Millwork provides an affordable way to add a modernistic, textured accent wall to any room. The PVC plastic panels measure 12 inches square, can be used inside or outside, and are paintable. The panels are glued in place. (The manufacturer recommends using Loctite Power Grab adhesive.) The line includes dozens of patterns; with a retail price of just over $9 per panel, an 8-foot-by-12-foot wall would cost around $360. ekenamillwork.com

10. Polymer Cedar Roofing
PlyGem's new Engineered Cedar roof shingles are crafted to mimic the look of milled cedar shingles, and come with a gray hue similar to that of weathered wood. The shingles are made from the same polymer formulation as the company's Engineered Slate roofing, with nearly 100% recycled resins. They can be cut and scored with a utility knife and fastened in place with roofing nails fired from a standard nail gun. Pricing should be on a par with premium asphalt shingles. plygemroofing.com

11. Prefab Shower Base
Schluter's Kerdi-Shower-ST prefabricated shower base is part of the company's series of new shower components that are designed to speed the process of waterproofing a shower prior to tile installation. The sloped base is made from expanded polystyrene foam that can be cut with a utility knife and installed with thinset. It's available in six sizes, from 38 by 38 inches to 72 by 72 inches, with prices from $65 to $200. Each base has a drain hole sized to accept the company's shower-drain product. schluter.com

12. New Poly-ash Beadboards
Boral has added three new profiles to its line of Boral TruExterior Beadboard: a 4-inch, a double-4, and a double-6. The new profiles (which join an existing 6-inch beadboard) are made with poly-ash material, a blend of polymers and fly ash that is dimensionally stable and resistant to moisture, cracking, splitting, and termite damage. The profiles are 5/8 inch thick and come in 16-foot lengths. The material can be installed 24 inches on-center with no support backing. Price to the contractor runs about $5 per square foot. boraltruexterior.com

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Work-Worthy Soft-Toe Wedge Boot

BY CHRIS ERMIDES

Wedge boots are popular with ironworkers because they have no heels or outsole lugs to get hung up on something and cause the wearer to trip—a reasonable feature to want when there's a web of steel between you and the ground. As a carpenter, I appreciate wedge boots because they don't mar wood floors or tile, and I can kick the dirt out of them easily before walking indoors.

I started wearing this style boot about 10 years ago. My first pair were Red Wings, in the 8-inch Classic Moc style 877. Unfortunately, just when they were getting really comfortable, the outsoles wore down and I couldn't find a cobbler to replace them. I was disappointed, especially because they were incredibly expensive ($290).

I moved on to a pair of Danner 6-inch Bull Run Cristy boots—cheaper by comparison at $210. I liked the look of these boots better than my Red Wings (and, incidentally, better than the Keen Glendales in this review). The Danners wore nicely, and quickly developed that glove-like feel you want from boots. But they dig into my ankle when I'm working low to the ground or floor, which we do all the time in this industry. So they aren't my favorite on days like that. And unless I wrap the laces around my ankle, they often untie themselves from the speed hooks.

So, when I tried out Keen's Glendale WP soft toe, I was hoping for more support than the Danners and more comfort on the days I'm wearing knee pads for extended periods. After wearing them on and off for the past six months, here are some things I really like about them, and some things I don't.

THE CONSTRUCTION

The first thing I noticed when I took them from the box was their weight. Out of curiosity, I put them on a scale: an ounce shy of 2 pounds each. Then I weighed my Danners, which I used to think were heavy. The Danners were 4 ounces lighter—so not significantly less, but noticeable enough when they're on my feet.

The padded leather upper was a nice change from the leather-only uppers I was used to. And I noticed more room in the front part of my foot and around the toes than in boots I've worn previously. This, I later learned at a Keen Utility media event, is due to the type of "last" (the form that boot companies use to build around—sort of like a model foot) they use. Keen Utility's last is larger in the toe area than other companies'.

I also noticed that these boots were incredibly stiff when first out of the box. They're not so stiff that they don't eventually break in—they have. The upper is made of thick leather; the rubber outsole is wide, which feels stable and solid underfoot. And while I can't quantify this, the rubber outsole feels stronger than other Vibram outsoles I've worn; I never stepped on a nail, but the boot meets or exceeds ASTM F2892-11 EH Standard, which includes puncture resistance of 270 pounds. (Other boots meet this standard, as well.) The rubber outsole also doesn't wear as readily as other boots I've worn. Like the Red Wing and Danner boots, the Glendales feature a welted outsole, which means that the outsole is stitched to the welt around the perimeter of the shoe. While this style makes for a stiffer, more expensive boot, it's also very durable and the sole is replaceable.

When I was installing baseboard and tile, I appreciated the added protection offered by the rubber toe cap. The toe hardly seemed to wear at all, certainly compared with the leather boots I've owned. And although the boot doesn't include a steel toe (there is a steel-toe version, though), the rubber caps do offer more protection than boots that don't have them.

THE BOTTOM LINE

The Glendale WPs are super-comfortable, but they're heavy. And while you wouldn't want to wade into deep water with them on, they are waterproof; they feature Keen.Dry, Keen's proprietary breathable, waterproof membrane. I can wear them all day, even in the swampy New York summer heat, and have reasonably dry socks at the end of it; my feet don't sweat nearly as much in these as in the other boots I've worn. If you're looking for comfortable wedge boots that will last and are breathable and waterproof—and you don't mind the weight—these are worth a shot. I typically wear a size 11, which was true for these as well. At $170, they won't break the bank.

Chris Ermides is the editor of Tools of the Trade.

A Close Look at Two Chalk Lines

BY TIM UHLER

In 2013, I wrote an article in *Tools of the Trade* magazine called "Framers Everyday Carry" about what I carry in my tool bags every day. In that article, I wrote about the Tajima chalk line, stating that "in my opinion, no other chalk line is worth having." I stand by that statement, but recently Milwaukee released a couple of well-thought-out chalk boxes that made me wonder if maybe Tajima had some real competition.

These two Milwaukee chalk boxes—the Bold Line and the Precision Line—are very similar. They both feature a "strip guard" clutch, planetary gear system, and a 6-to-1 ratio (making them faster to wind). Milwaukee claims that this gearing system will prolong the life of the box by distributing forces evenly over three gears. The "strip guard" protects the gears when the line is snagged—if you are like me, you just wind harder.

The Bold Line has a 1.5mm braided line, while the Precision Line has a .9mm "tightly braided" line that makes narrower marks. This box also is designed to spill less chalk. The Bold Line chalk box has a rubber overmold, which offers better gripping, while the Precision Line does not. Oddly, even without this overmold, the Precision weighs slightly more than the Bold.

THE GOOD AND NOT-SO-GOOD

What we like about these lines is that you can push the handle to release the line as you pull, whereas the Tajima has a lock. These lines also have stout gearing, which is obvious during use; you can feel when winding that the gears have no play and are very strong. I think Milwaukee's claims that these will last a long time are accurate. I don't see myself replacing either of these boxes anytime soon.

We love the Tajima boxes but don't use them if we are going to get the line wet. When moisture gets into the Tajima box, the chalk consolidates; then, when we wind the line up, the gears break. This isn't a problem at all with the Milwaukee lines.

What we didn't like about the Milwaukee boxes is the line itself. You can't stretch the line at all. I love being able stretch the Tajima line into a corner to snap a line. I found with the Milwaukee that I had to have the right amount of line out to get into the corner.

My recommendation is to buy the Milwaukee lines—Bold for framing, and Precision for everything else. What I plan to do is replace the line in the Milwaukee with the Tajima line and I think I'll have the perfect chalk box: a durable Milwaukee box and a Tajima line that is crisp and long-lasting. The Bold Line sells for $9, the Precision Line for $12, and the Tajima for $17.

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

Bold for framing. The Bold Line (far left) features an overmold, which improves the grip. Its cotton line does not stretch, however, so it isn't possible to pull into a corner unless you have the right amount of line already paid out.

Precision for everything else. The Precision Line (near left) leaves a small, crisp line compared with the Bold Line. It too has a cotton line that doesn't stretch enough to pull into corners.

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Compact Cordless Drill/Driver

BY BRUCE GREENLAW

Compact 18-volt lithium-ion drill/drivers first hit the market a decade ago. I've always viewed them as a good choice for woodworkers and serious do-it-yourselfers, but the ones I've tried in the past lacked the portability of the 12-volt subcompacts, and the muscle, speed, and runtime that builders often draw from their larger, 18-volt heavyweights.

When DeWalt sent us its latest 20V MAX XR compact drill/driver (model DCD791) earlier this year, I was mostly interested in checking out its unique new three-mode, base-mounted LED headlight. And hey, it's great. It can project a low or medium beam with a 20-second afterglow, or a much brighter 60-lumen spotlight that stays lit for around 18 minutes after you squeeze and release the trigger, then flashes twice and dims to signal that it will shut itself off in two minutes. This welcome feature essentially adds a standard jobsite flashlight to the tool.

After drilling and driving with the DCD791, though, I'm surprised. Thanks to the latest generation of brushless motors and lithium-ion batteries, 18-volt compacts are clearly evolving into a practical category for builders and remodelers.

The DCD791 is 6⅞ inches long, and it weighs 3.4 pounds when equipped with a 2-Ah battery from the kit I tested. That's an inch shorter and 1.6 pounds lighter than DeWalt's new full-size 20V MAX XR model DCD991 equipped with its 5-amp-hour battery and side handle. And although the DCD791 weighs .5 to 1.4 pounds more than current 12-volt subcompacts, it's actually shorter than some models. The upshot? The DCD791 hangs easily from belts and pockets, can tuck into my tool pouch, and can navigate tight spaces.

But the compact build is just part of the story. According to the specs, the DCD791 is 27% more powerful than its compact predecessor and almost as powerful as the full-size 20V MAX DeWalt from five years ago. It also delivers a top speed of 2,000 rpm, which is significantly faster than any subcompact.

To put the rubber to the road, I ran the new compact through my usual trials. With a 1-inch spade bit, it consistently powered through 2-by Douglas fir in about 5 seconds; with a 1½-inch spade bit, about 10 seconds. It also easily bored through the material with a 1-inch and 1¼-inch Irwin solid-center auger bit, a 2⅛-inch self-feed bit, and a 3-inch hole saw. Raising the bar, I tried a 1½-inch solid-center auger bit and a 4-inch hole saw. There seemed to be ample power, but compact drill/drivers don't have side handles, and I couldn't prevent snags and kickbacks. DeWalt says the tool can power a 2 9⁄16-inch self-feed bit through 2-by SPF in a pinch, but I didn't try that. Like all the full-size 18-volt drill/drivers I've tested, the DCD791 could sink Simpson Strong-Tie's .22-inch by 10-inch Strong-Drive SDWS structural wood screws into an LVL-LSL-PSL sandwich without pilot holes, though it felt like a bit of a stretch.

To put this performance into perspective, it was helpful that I recently tested the latest full-size Milwaukee M18 Fuel hammer drill for the July issue, and in fact, often ran that tool and the new DeWalt compact head-to-head. Although they both have a top speed of 2,000 rpm, the Milwaukee's higher torque often translated to significantly faster drilling speeds. For instance, it drilled spade-bit holes up to 70% faster than the compact DeWalt. And the Milwaukee's side handle was indispensable when drilling big holes. For the most demanding tasks, you'll definitely want to switch to a full-size model.

As for runtime, equipped with an Irwin 1-inch solid-center auger bit, the DCD791 drilled an average of 115 holes per charge though 2-by Douglas fir when I tested it with each of the included 2-Ah batteries. It took 57 minutes to recharge a depleted battery with the kit's charger.

THE BOTTOM LINE

A 12-volt subcompact drill/driver and a full-size 18-volt hammer drill can team up to handle most drilling jobs I encounter. If I were upgrading my tools right now, though, I'd consider substituting a brushless compact 18-volt drill/driver for the 12-volt subcompact. So far, I like everything about DeWalt's compact DCD791, from its surprising power and runtime to its bright LED spotlight and metal-sleeved ratcheting chuck. I'm guessing it could handle at least 90% of my drilling chores, leaving the rest for my heavy-duty 18-volt hammer drill.

Bruce Greenlaw is a contributing editor to JLC *and* Tools of the Trade.

DCD791D2 Specs
Tool weight: 3.43 pounds
Length: 6⅞ inches
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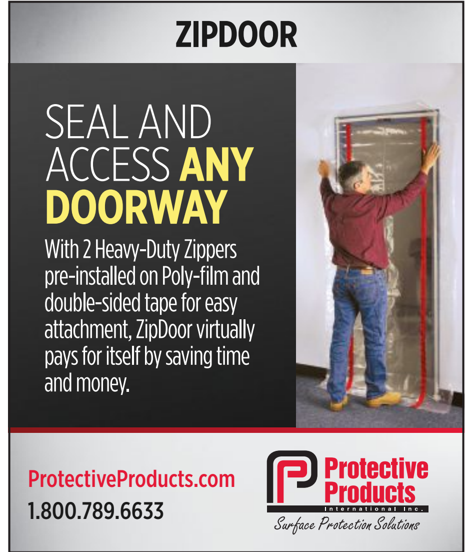

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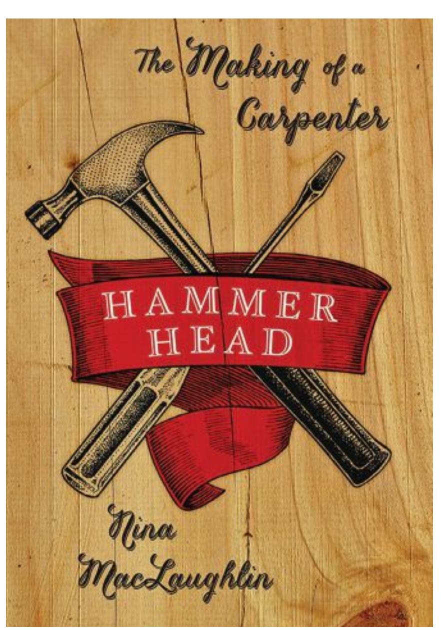
BY CLAYTON DEKORNE

What Are You Doing With Your Life?

In her recent book, *Hammer Head: The Making of a Carpenter* (W.W. Norton, 2015), Nina MacLaughlin brings the reader into the intimate details of her decision to change careers, leaving behind life as a newspaper journalist and embracing a profession in the building trades. It's a book that certainly should be handed to every aspiring carpenter. But veterans won't be disappointed.

I dove into the book with wary curiosity, half expecting an account tinged with irony, something like the *Nanny Diaries* or *Turning Tables*—two popular books that take the reader on a woman's venture into temporary work, written by educated twenty-somethings who acknowledge their dip in social status on entering a service job. Instead, I encountered in *Hammer Head* a sincere and respectful account that evokes the author's genuine awe in learning to build.



> " ... we bounced to the next job and the next. Each one, over some months, aided in lifting the curtain that had obscured the physical world closest to me. Now, there were doorways, shelves and walls. Wood, glass, plaster, paint. The awareness, this new noticing had an intense effect on my sense of my own body and place in the world. I wasn't just my own human sack of flesh, inhabiting mental space. There were walls around me, and thresholds. There were windows that let in light and sound ... I knew how many pieces of wood framed those windows and doorways, how they were put together ... "

This new-found understanding, which lets her see beyond the surface of things and understand how the world is put together, seeps into the reader, bringing confirmation for those already working here, and inspiration for anyone aspiring to live life fully. MacLaughlin makes it clear she's in the trade for keeps (as much as any of us can say that at any particular turn of life) and her growing awareness is no passing fancy. It's this open look—her ability to invoke the beginner's mind—that makes this a valuable read even for crusty old veterans who have chosen to, but might not remember why they do, work with hands and heart.

The book is organized around sections, each named for a tool and appropriately starting with Tape Measure, then followed by Hammer, Screwdriver, Clamp, Saw, and Level. Yet there is no rote discourse on how to use each tool. Each section is an essay that tracks MacLaughlin's evolution from helper to carpenter with riffs on a theme, such as the distance by which one measures not only boards but also one's progress, or the pressure you put on yourself when the work suddenly dries up, and you are faced with examining what you are doing with your life.

MacLaughlin is not afraid of challenging us, as when she tackles screwing up—the inevitable blunders on the job that may occur more frequently for the novice, but that we must all learn to recover from throughout our careers. Surprisingly, she also is not afraid to be provocative, as when she invokes, in the same section, screwing as it relates to sex.

It's a riff that brings in the glaring issue of gender differences on the job, as she grapples with how her choice to embrace a "dirty job," so to speak, challenges her experience of being and wanting to be an attractive female. This is perhaps the bravest part of her book. It's a candid accounting that few may want to acknowledge, yet she addresses the issue gracefully. It's hard not to feel humbled by her honesty, and immediately we feel more comfortable for her having aired the issue, whether we are prone to be sensitive to it on the job or not. Refreshingly, though, gender is not a theme that dominates the book. Respect for the work, and acquiring skill, even finesse and fluidity, in the work, and bringing a house to life, are all more prominent themes.

When I caught up with MacLaughlin on the phone, she acknowledged that, while she expected feedback on her book to come mostly from women entering the trades, the majority of responses have actually come from seasoned tradesmen thanking her for bringing them back in time to their own experience of starting out in the trades, and reminding them why they chose this life path.

Clayton DeKorne is editor of JLC.

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