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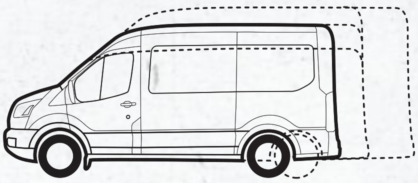

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On the cover: Kyle Davis of Pioneers Builders rips the backing angle on an LVL valley. Photo by Tim Uhler.

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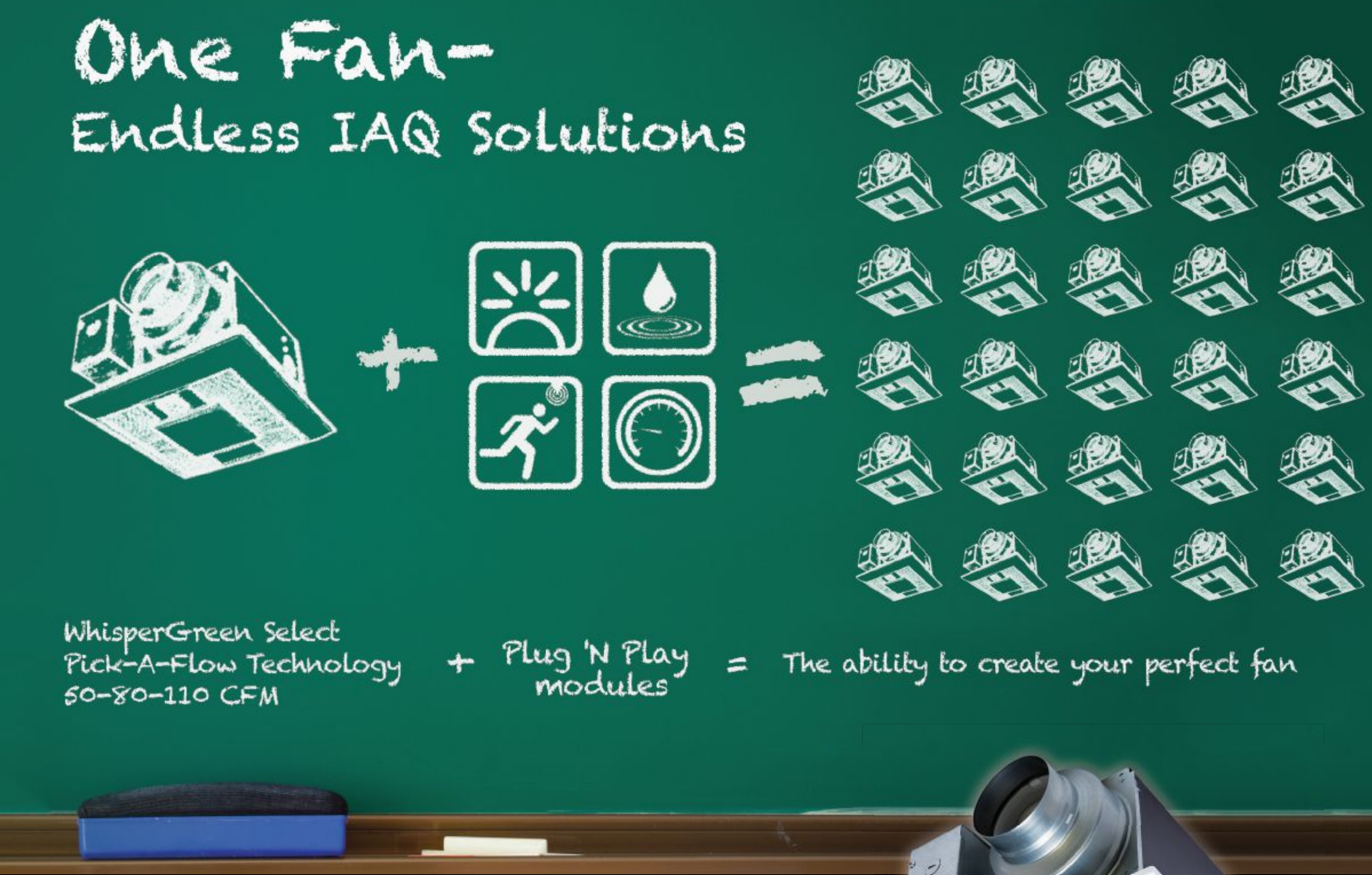

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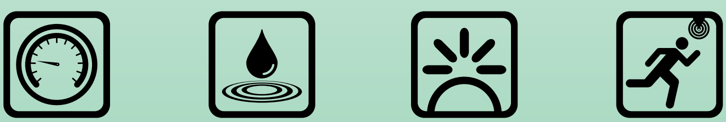

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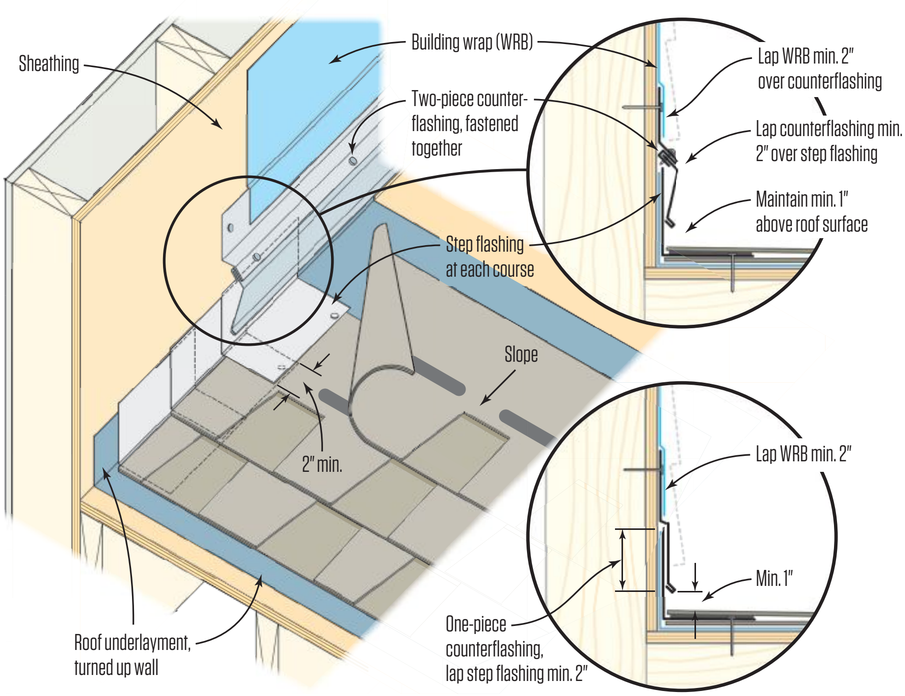
"SYNTHETIC STUCCO WITHOUT FAILURES," BY MARK PARLEE (DEC/14; LETTERS, JAN/15).

Chris Hoppe, P.E. (online, 2/21/15): Fastening step flashing on the vertical leg is not recommended by many asphalt-roofing manufacturers or the National Roofing Contractors Association (NRCA). See *The NRCA Roofing Manual: Steep-Slope Roof Systems—2013,* detail ASPH-12A. Fastening the vertical leg of the step flashing prevents one from removing it without removing the siding. Leaving the step flashing in place when reroofing does not allow one to inspect the underlayment at the roof-to-wall junction. It is my experience that most roof leaks occur at improperly installed penetrations and flashings.

Editor's note: The illustration below is adapted from Chapter 4 of *The NRCA Roofing Manual: Steep-slope Roof Systems—2013.* The bubble at lower right shows the detail in NRCA ASPH-12A, which uses a one-piece counterflashing. The bubble at upper right and the main drawing show the detail in NRCA ASPH-12, which uses a two-piece counterflashing.

Roof-to-Sidewall Flashing



"AIR-SEALING TECHNIQUES FROM A PASSIVE HOUSE PRO," BY INDIGO RUTH-DAVIS (MAR/15)

Rollie (online, 3/21/15): I didn't understand the I-joists on 36-inch centers: How does one sheathe with 4x8 panels efficiently?

Indigo Ruth-Davis responds: Using 36-inch centers for our I-joist insulation curtain wall was unique to this particular assembly. The inside finish material was 1x6 V-groove wood paneling that was attached to the timber frame and therefore didn't need a particular spacing. The outside of the wall had no dedicated plywood sheathing, as the timber-frame bracing had sufficient shear strength. In place of exterior sheathing, Solitex Mento+, a super-durable WRB, holds in the cellulose insulation. This was first strapped vertically along the TJIs with 2x3s. Horizontal purlins were then added, spaced for vertical siding nailers. This made for a nice vented rainscreen.

The wide TJI spacing and rainscreen was designed collaboratively by Chris Miksic, the builder; Greg Whitchurch, the designer/home owner; and me to both minimize framing and encourage drying to the exterior.

TRBuzz (online, 3/20/15): I got excited when my new issue of *JLC* had "Air-Sealing Techniques From a Passive House Pro" as the lead article, since [air-sealing] has been an obsession of mine for some time. Quite a letdown. There seems to be little connection between the drawings, photos, and text. The photos show the air barrier between the 16-inch-o.c. I-joist curtain wall and the structural wall. The article then states that with a superinsulated wall, the air barrier should be on the inside to prevent condensation. Huh? Maybe 16 inches of insulation isn't enough to keep the sheathing warm enough to prevent interior moisture from condensing on the sheathing. An additional airtight barrier on the inside can't hurt but would not seem to be a priority in this case.

Indigo Ruth-Davis responds: In our climate [Vermont; climate zone 6], an interior air barrier in deep walls is pretty important. All that insulation does make the exterior sheathing colder and therefore at *greater* risk for condensation from moist interior air making its way through the assembly.

Editor's note: In the presentation of this article, Indigo and the *JLC* editorial team were trying something a little different. As noted in the introduction (third paragraph), the photos show techniques that Indigo and company used in a recent

Passive House build. But how these techniques can be used in more conventional buildings is shown in the illustrations. We recognize that Passive House is not for everyone, but as a building standard that is pushing the envelope (no pun intended) on house energy performance, the materials and techniques adapted from Passive House projects can be applied to conventional projects. That's why the illustrations differ from the description and photos. Likely, we could have made that clearer, so thanks for the comments.

"Q&A: FINDING BURIED OUTLETS," BY SEAN KENNY (JUL/97)

Spencer Field (online, 3/17/15): I found a simpler method to try after chasing overzealous board hangers. If installed, remove the baseboards. Open a small hole at the base of the wall where you suspect the outlet to be. Insert your cellphone and snap a picture of the stud cavity. Didn't find it? Move over a bay.

"RAISING THE ROOF," BY LEE MCGINLEY (APR/14)

Lee05491 (online, 3/7/15): I wonder why this technique hasn't gained more popularity, particularly for multistory houses. I've fallen through rafters, only to be caught by my rib cage. Ouch! And years ago I was foolish enough to walk 2x4 top plates. Not anymore. As soon as I told my guys we were going to build the roof on the ground, there was an immediate sigh of relief. Much safer on the ground. Higher quality. Less expensive. You do, however, need an open space on the ground where the roof can be framed up.

"HOW TO DOUBLE R-VALUE WITHOUT ADDING INSULATION," (ONLINE, 3/5/15)

Paul Wahler (online, 3/5/15): So, I should tell my insulation subcontractor that if his crew puts the stuff in all full of lumps that he should expect a reduction of 25% in his payment.

LThomas (online, 3/15/15): It shouldn't take a math course to figure out that if you have hills and valleys [in attic insulation], then you have heat loss. Tell me what happened to common sense in building and repairs.

"SLIDESHOW: SEALING A SOUTH CAROLINA CRAWLSPACE," BY TED CUSHMAN (ONLINE, 3/9/15)

Mike O'Handley (online, 3/13/15): I'm bothered by the idea of applying poly-faced fiberglass to the face of those block walls in a known flood zone. Even if the crawlspace doesn't technically "flood," any moisture carried up through the footings to the foundation walls will normally evaporate into a crawlspace and dissipate via the vents. By placing that insulation over the face of the block, won't that moisture want to migrate through vapor diffusion outward to the crawl, at which point it will hit that poly, cool to dew point, and condense inside the insulation and turn it to a soppy mess?

We here in Washington state live in such a damp environment that despite having sufficient ventilation to meet code requirements, builders add vapor barriers to further limit exposure of crawlspaces to moisture. We keep the vents, though, and most of the time it works despite the fact that the vapor barriers and crawlspaces aren't "sealed."

I've seen sealed crawlspaces here too. In those cases, unfaced fiberglass was used on the foundation walls, over the top of a barrier that extended almost to the top of the foundation wall. The barrier prevents moisture from evaporating from the concrete into the crawl, and the insulation prevented temps in the crawl from getting so low that condensation became an issue. Most significantly, I've seen "sealed" crawlspaces where a barrier is installed against both the walls and the floors, and all overlaps were sealed, where this technique kept that space dry as a bone. In those cases, insulation had still been installed against the floor. The insulation kept the feet warm while allowing enough heat to migrate downward that the crawl stays warm enough to ensure any vapor in the air can't condense on any plumbing. Some of these houses dated from the 1970s and this seems to have worked really well.

Clint Allen, owner of Energy One America, responds: Thank you for your response and valid concerns regarding moisture in exterior walls of closed crawlspaces. According to IRC Table N1102.1 or IECC Table 402.1.1, sidewall insulation is a required element of a closed crawlspace assembly. We choose to use various methods of sidewall insulation in our crawlspaces, dependent on the site specifics. Each of these product choices is designed to provide insulation value as well as passive moisture resistance. Many times we will apply rigid board insulation, sometimes poly wrapped, and at other times (when not in high termite pressure zones), closed-cell insulation. Since this crawlspace was located in a high termite pressure zone, closed cell was not an option. It is our opinion that when installing closed crawlspaces in flood zones (where hydrostatically actuated vents are required), we should install the most sacrificial and least vapor-retardant materials possible so that in the event of a major water-intrusion event (requiring replacement of insulation regardless of type), we are able to replace them quickly and at the lowest possible cost.

As for the concern that passive moisture creates a dew point or excessive moisture concern during normal conditions, we simply have not seen this realized in the field. We overcome concerns over passive ground water by wrapping our primary liner system up a minimum of 18 inches from exterior grade and do not see excessive airborne humidity transferring through the higher block. Further, any moisture present in the block and traveling via capillary action would be removed to the inside of the crawlspace by the mechanical dehumidifier.

With thousands of completed installations in this climate zone, real-world experience has shown us that these sidewall assembly options are effective and without negative side effects.

Editor's note: An article by Ted Cushman that complements the online slideshow appears on page 25 of this issue.

"SLIDESHOW: RETROFITTING NEW WINDOWS – PART 1" (ONLINE, 2/26/15)

David Orona (online, 3/2/15): I thought current flashing width was 9 inches,

minimum? It doesn't look like the sides are getting that much. *The Installation Standards for New Construction Windows,* AAMA 2410-02 (5.5.3 Method A), states: "A strip of approved flashing material shall be at least 230 mm (9 in) wide. Flashing shall be applied in a weatherboard fashion around the full perimeter of the opening …"

Mike Guertin (online, 3/3/15): David, AAMA standards wouldn't kick in unless Manny was participating in AAMA's Installation Master Program. The building code (namely, the International Residential Code, or IRC) dictates window installation and flashing minimum practices. AAMA 2410 is not listed as a referenced standard in the IRC.

The window-flashing section of the 2009 IRC (the model code that's the basis for the Massachusetts residential code) just says that self-adhered flashing shall comply with AAMA 711, which addresses testing for various characteristics like bonding percentage, UV resistance, and water resistance. Nothing in it addresses flashing installation or size. The Vycor Pro that Manny used does conform to AAMA 711. The 2009 IRC goes on to say that window installation and flashing "shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage." The 2012 and 2015 IRC kick up the flashing section with more specific language—window installation and flashing must conform to the window manufacturer's installation instructions. And if there are no instructions, an installer must install a flashing pan that is sloped to the outside or sealed (I guess that may mean a "backdam"). The IRC goes on to say, "Openings using pan flashing shall also incorporate flashing or protection at the head and sides."

Editor's note: An article by Emanuel Silva that complements the online slideshows (Part 1 and Part 2) appears on page 47 of this issue.

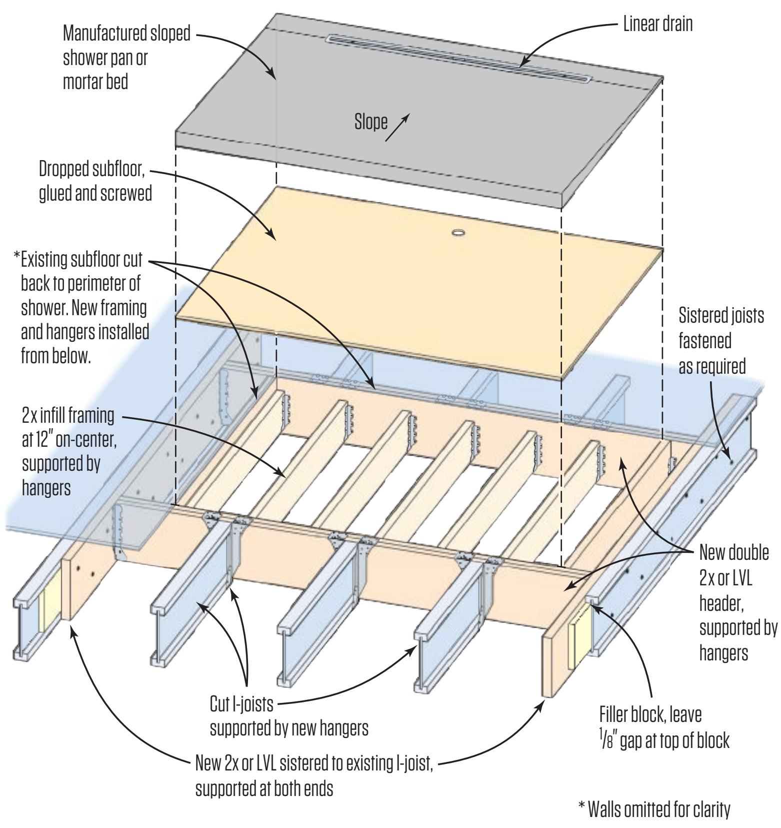
"ICE DAMS AND ROOF COLLAPSES PLAGUE WINTRY NEW ENGLAND," (ONLINE, 2/23/15)

Larry Glickfeld: According to the articles cited, it was mainly on decks, barns, and large, flat-roof commercial buildings where roofs failed. Although the former were not likely engineered for anywhere near the occurring snow loads, in the case of the commercial buildings, roof failure is often a result of clogged drains. Heat escaping the building tends to melt snow above, which then flows toward the drains. But if the drains are clogged, either significant ponding occurs or the melted snow freezes—either way creating heavy, concentrated roof loads in the area of the drains, thereby causing localized over-stress and partial roof failure. This was a common occurrence here in Washington state in the winter of 1996–97, where there were some 400 to 500 reported roof failures. But not one of them was a gable-roof, wood-framed residence (many were pre-fab steel buildings, mobile homes, and large flat-roofed warehouses and commercial buildings). It is critical that roof drains be cleaned on a regular basis.

Q I'm retrofitting a curbless shower with a linear drain in an existing home with an I-joist floor. What's the best way to drop the floor for the mortar bed?

A Michael Byrne, veteran tile installer and consultant, and moderator of *JLC*'s ceramic tile online forum, responds: Retrofitting the slope for a tile shower is a common problem for builders. Curbless showers, which have been growing in popularity, present an even greater challenge because of space limitations. A curb allows the slope to be added directly over existing subflooring. But while many people don't mind stepping over a curb to enter the shower, there seem to be just as many who object to stepping up and onto the floor of the shower.

Shower Pan for an I-Joist Floor



DRAIN AT SHOWER ENTRANCE

The first question to ask is where in the shower the linear drain will be placed. If it's located at the entrance to the shower, then no supplemental or retrofit construction is needed to provide slope for a curbless shower floor. In this configuration, readily available manufactured sloping panels can be literally dropped into place, or the slope can be added with a single-plane mortar bed.

Either way, sheet-membrane or liquid-applied waterproofing is required only on the surface. As I see it, the only two concerns for this installation strategy are the potential for waste water to run past the drain and out onto the bathroom floor (which should also be waterproofed regardless of the type of curb or drain) and the need to provide stability for a wheelchair that naturally wants to follow the slope and roll out of the shower.

DRAIN AT BACK OF SHOWER

Sloping the shower floor away from the entrance—from front to back—allows gravity to stabilize a wheelchair against the back wall, but it brings us back to structural issues with wood-framed floors. In these cases I recommend dropping the entire shower area and then using manufactured panels or a mortar bed for the slope.

Creating a dropped area in an I-joist floor means removing sections of I-joists and usually framing the dropped area with dimensional lumber or an LVL type of engineered lumber. The trick is to ensure that the dimensional lumber part of the equation—the part supporting the tile installation—ties into and is at least as strong as the surrounding I-joist floor. Also, the dimensional-lumber part of the floor must comply with the tile industry requirements for deflection: no more than 1/360 of the overall span (uniform load), and no more than 1/360 of the span between joist members (concentrated load).

As a caveat, the simplest way to drop a floor—regardless of the framing—is to have access to the framing from below. Because curbless showers are most often installed for accessibility, and because accessible bathrooms are usually on the first floor, let's assume that the shower you will be installing is on the first floor with an unfinished basement or crawlspace below. Let's also acknowledge that if this work is being done above a finished space, you most likely will need to remove a large part of the finished ceiling to gain access to both the framing and the plumbing.

I start by cutting out the subfloor in the shower area (see illustration, page 19). From below, add spacer blocks that fit between the flanges of the I-joists just outboard of the hole. These spacer blocks pad out the I-joist webs and need to be installed to manufacturer specs. Next, sister 2-bys or LVL material onto the joists that you padded out. These sistered members should extend back to some type of bearing, such as a carrying beam, post, or foundation wall. (If you're working in a crawlspace it may be possible to add footings and posts to support the framing). Attach the new framing to the padded I-joists with ½-inch bolts at least every 8 inches or so in a staggered pattern.

On both sides of the opening, temporarily support the I-joists that run through, and then cut them short enough to give you room to install headers across the opening with a pair of 2-bys or LVLs on each side. The headers will need to carry the cut I-joists on hangers after they're cut, so mount the I-joist hangers on the headers before slipping them into place, if necessary.

To fill in between the headers, start with a double joist on either side of the opening that consists of a full-height joist to catch the edge of the existing subfloor and a shallower joist at the height of the dropped shower floor. Then it's just a matter of filling in the joists at the dropped height. You may be able to get away with spacing the joists 16 inches on center, but 12-inch spacing will give you a stiffer floor. Finally, glue and screw down at least ⅝-inch-thick subflooring. Then you can add either a manufactured sloped shower pan or a sloped mortar bed with the appropriate waterproofing.

After you install the tile—and I assume the bathroom floor will also be tiled—lay out the tile so that a grout joint lands directly above the junction between the dropped area (where the shower floor begins to slope) and the original I-joist floor. Fill that transition joint with a resilient material such as a silicone or latex sealant.

Q I'm considering pervious concrete for the driveway on an upcoming project. What exactly is pervious concrete? Does it require extra maintenance to keep it functioning?

A Peter Zoni, sales manager at Cape Cod Ready Mix, in Orleans, Mass., responds: Pervious concrete is a mix of Portland cement, coarse aggregate, water, and admixtures. Because there is little or no sand in the mix, the concrete contains bigger voids than ordinary concrete. These voids let water and air pass through, allowing pervious concrete to drain huge amounts of runoff for long periods of time.

Pervious concrete is not a new product, but recently it's been gaining popularity because of its unique properties. First off, it's a great solution to many federal stormwater-management requirements regarding paved surfaces such as driveways. Because water percolates naturally through the material into the water table, using pervious concrete may eliminate the need for water-retention ponds and complex drainage systems, saving all the associated costs of engineering and installation.

Pervious concrete is also strong and durable. Our company has developed a pervious-concrete product, called Perk-Crete, that we recently installed on a 200-foot driveway that runs up a 15-degree slope to a horse farm. The driveway produces zero runoff and is strong enough for any traffic it will see.

Installation of pervious concrete must be done by trained and certified professionals following specific placement guidelines, including those for preparing the base to drain the water that passes through the concrete.

Because of its strength and durability, pervious concrete is resistant to damage from freezing and thawing. It's at risk for freeze-thaw damage only when the voids in the concrete become clogged and water no longer drains through. If this happens, pressure washing or vacuuming may be needed. But anecdotally, I've had a pervious-concrete driveway for years and have never pressure-washed or vacuumed it, and water still drains through it like the day it was installed.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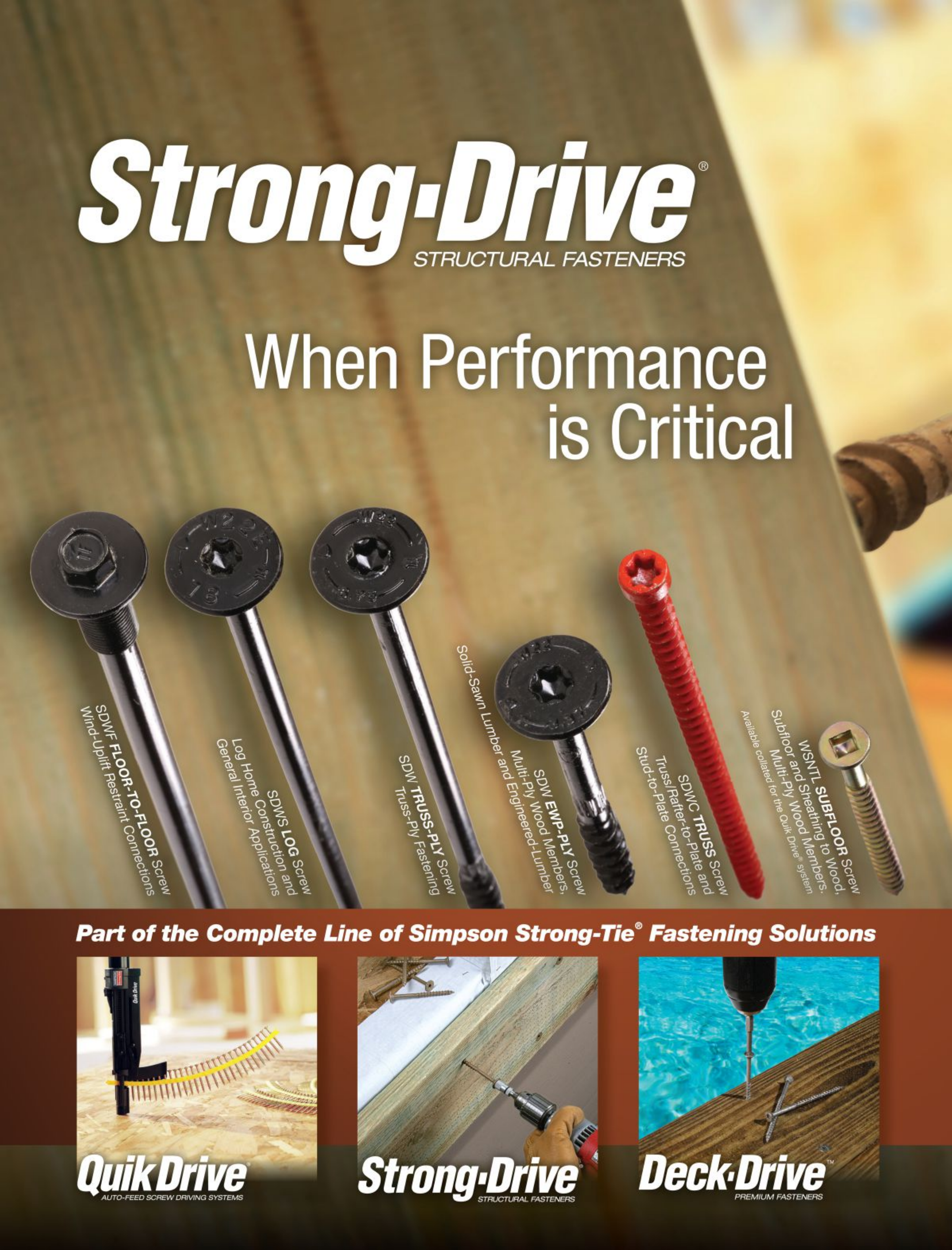
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BY TED CUSHMAN

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Sealing a Carolina Crawlspace

In the old days, building codes required crawlspaces to be vented to the outdoors. But in a hot, humid area such as coastal South Carolina, venting is more likely to make a crawlspace damp than to dry it out. So in recent years, codes in southern coastal states have changed to allow airtight, conditioned crawlspaces, with vapor barriers installed on the floor and insulation installed on the perimeter walls.

With the code change, companies that specialize in sealed crawls are doing a booming business in the region. This spring, *JLC* spent a few days on the job with Energy One America, based in Charleston and Hilton Head, S.C. Energy One America typically treats crawlspaces with a combination of poly vapor barriers on the ground and poly-faced fiberglass blankets or foil-faced rigid foam on the foundation walls.

The house we visited was located next to the Wando River in Charleston's Daniel Island neighborhood, in an area designated by FEMA as "Zone A"—with a risk of rising water, but not wave action. In this location, enclosed foundations are allowed, but vent openings near grade—to equalize pressure in case of flood—are required. Framing for the first occupied floor had to be one foot above the site's base flood elevation (BFE); in this case, that was almost 6 feet above grade, requiring eight or nine courses of masonry block in the foundation wall **(1)**. The masons left openings for flood vents in the third course.

To seal the crawlspace, the crew started with a ground cover, unrolling 12-foot-wide reinforced 10-mil poly sheets on the dirt floor **(2)** and lapping the poly up the block walls about a foot **(3)**. The crew fastened the poly to the block walls with hardened nails driven through metal disks using a Hilti GX 120 gas-actuated fastening tool. The tool has a lithium-ion battery and a

Photos: Ted Cushman

propane fuel canister, and the gun tip is magnetized to hold the steel disks **(4)**.

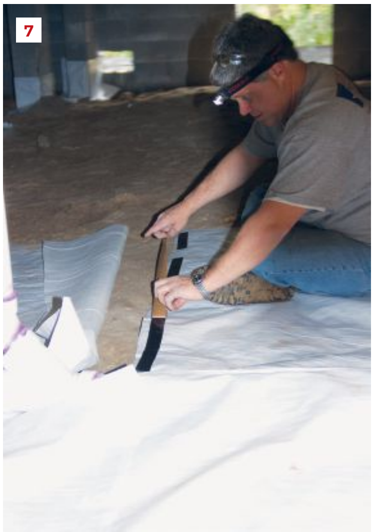
The plastic ground cover also had to lap up onto the block piers within the crawlspace that supported the carrying beams in the wood-framed floor system. The crew wrapped each pier with plastic, slitting the plastic to create flaps that extended outward along the ground. Then, the workers cut and fit the wide ground-cover pieces around the piers **(5)**.

The crew used two kinds of tape to fasten and seal plastic sheeting at joints around the piers. To position and hold the sheeting in place, they used a peel-and-stick butyl rubber tape with release tape on each of its two sticky sides. To make the connection, the worker peeled the release tape off one side of the butyl tape and stuck the tape onto the lower piece of plastic. Then he peeled the release tape off the other side **(6)** and pressed the upper piece of plastic into place. The same two-sided peel-and-stick tape was used at laps in the poly sheeting in the field **(7)**.

Penetrations in the floor covering required particular care. Where a main drain line passed into the ground, the crew had to carefully cut and fit the poly sheeting around the PVC drainpipe **(8)**. Once all the poly was in place, the crew sealed every lap and splice using vapor-barrier tape **(9)**.

The code-required flood vent openings complicated the installation of the vapor-barrier ground cover. Where the plastic lapping up the walls covered a flood vent, the crew had to fasten the plastic around the vent with four Hilti pins, then slit a hole in the plastic to match the opening **(10)**.

Interestingly, those code-required holes also demonstrated convincingly that venting a crawlspace will not remove moisture in the South Carolina climate—but in fact, will have the opposite effect. After all the poly was laid on the floor, the crew went home for the night. By morning, the ground cover was soaked with dew: The night air had brought moisture into the crawlspace, where it condensed on the relatively cold floor. On the second day, the crew had to wipe the poly dry with rags before taping seams. To completely dry out, this crawlspace has to be fully sealed and mechanically dehumidified.

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At the top edge of the ground cover, where the plastic lapped up onto the block-foundation perimeter wall, the crew sealed the plastic to the block with cans of foam sealant **(11)**. They also used this canned foam to seal the plastic to the block around the rough openings for the flood vents.

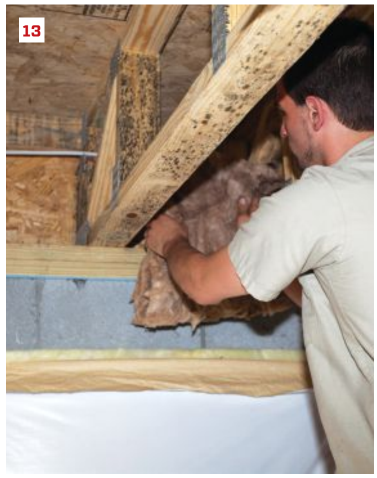
Once the ground cover was placed, sealed at the perimeter walls and block piers with foam sealant, and sealed at all seams and penetrations with vapor-barrier sealant tape, the crew moved on to the perimeter walls. Here they applied R-11 poly-faced fiberglass blankets, fastening them to the walls with the same type of Hilti fasteners used to attach the ground cover to the walls **(12)**.

The crew also installed unfaced fiberglass insulation in the band-joist area of the wood-framed floor **(13)**. But they left a gap between the top of the foundation insulation and the band-joist insulation, as required by code to allow inspection for termite infestation. This gap also allows any moisture that wicks up through the foundation to dry to the inside.

The last step in sealing the enclosure was to install the flood vents and crawlspace doors, using "Sealed Series" Flood Flaps vents (floodflaps.com). This type of vent maintains an airtight enclosure until there's a flood, but opens automatically under flood conditions to equalize water pressure **(14)**.

With the vapor barrier and insulation in place, the crawlspace was now isolated, but it still needed to be conditioned. Code allows two options: Connect the crawlspace to the main home's HVAC system, or provide independent dehumidification. Energy One prefers to install a dehumidifier in the crawlspace, with its own power supply and controls **(15)**—in this case, a Horizon Eclipse crawlspace dehumidifier with an integrated condensate pump and drain line (horizondehumidifiers.com). A humidity sensor in the crawlspace has a readout in an upstairs hallway; if humidity in the space ever rises above 50%, the sensor will alert the homeowners, and Energy One will return to troubleshoot.

Contributing editor Ted Cushman is based in Peaks Island, Maine. For more photos of this project, visit JLConline.com.



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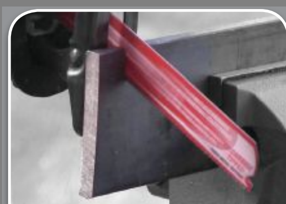

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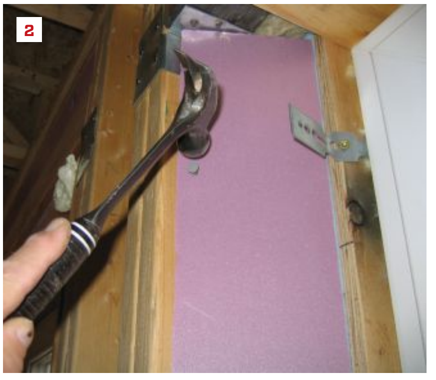

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Trimming Windows in a Deep Wall

BY LEE MCGINLEY

Carpenters are accustomed to installing American-made windows in new residential construction. They simply set the window plumb and level in its rough opening, nail off the window flange, then cover the flange with weather-sealing tape. On the inside, they squirt some foam between the framing and window, install an extension jamb and interior trim—done.

THE EURO DIFFERENCE

Installing European tilt-turn windows can be a bit more challenging, but there are good reasons for choosing them; high R-value, superior air-sealing, extraordinary ease of operation, and reduced thermal bridging are the reasons I opted for them. I chose Lithuanian-made triple-pane PVC Intus windows (intuswindows.com) for my own house, which I'll use as a case study to describe the process of trimming out these windows in a deep wall. My exterior walls are 10 ½ inches thick and use double-stud wall construction filled with Roxul insulation, (see "Working With Roxul Insulation," Mar/14).

I won't cover installation of the window units here. There are similarities among all Euro windows; the main difference is there is usually no nailing flange. Most Euro window manufacturers recommend metal mounting brackets or screws through the window frame to secure the units instead. This allows greater flexibility in where the window is located in a deep wall. The general procedure is well documented by *JLC* (see "Installing Windows in a Deep Wall," Nov/14), albeit with a different brand and at a different depth in the wall.

Passive House protocol calls for placing the glazing at the centerline of exterior wall insulation. That would have meant setting my windows back 4 ½ inches from the exterior—a detail that's vulnerable to water without a lot of fussy detailing. Plus, I wanted deep, flared interior window wells that could accommodate house plants and that would create a visual tunnel to distribute natural light inside the house.

FLARED WINDOW WELLS

To get the look I wanted, we secured the windows to

Photos: Lee McGinley

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¾-inch by 5-inch plywood bucks attached in the openings in the outer wythe. The window rough openings for the inner wythes were laid out 5 ½ inches wider (2 ¾ inches on each side) to accommodate a 30-degree flare (see Flared Window Well, right).

In order to separate the inner and outer wythes, I cut 5-inch by 10 ½-inch spreaders from ¾-inch plywood, and nailed them in the corner top and bottom between the wythes before attaching the bucks.

THERMAL BREAKS

The advantage of a double-stud wall is it reduces a lot of the thermal bridging found in standard stud construction, and I wanted to maintain that break as much as possible with the window detailing.

I first filled the space *between* the spreaders at the top and bottom of the windows with ¾-inch rigid insulation after the windows were set in place. I also placed 1 ½-by-2-inch rigid insulation to fill voids where the Roxul insulation had been held back **(1)**. Next, I cut and fit 1 ½-inch rigid insulation *on top of* the spreaders at the bottom of the windows. I held this back 2 inches from the inside edge. On each flared side, I angle-ripped ¾-inch rigid insulation and tacked it in place, keeping it back from the plywood bucks **(2)**.

I wanted a good nail base for the drywall, so I installed 1 ½-by-2-inch nailers to the front edge of the sill to provide a good screw base for the interior drywall **(3)**, and at the top of the window, stapled ⅝-inch CDX with the ends cut to the required 30-degree flare.

For the flared sides, I ripped ⅝-inch plywood with parallel 30-degree bevels along each long edge and stapled these off with a pneumatic stapler. I checked often to maintain a consistent reveal. Any plywood that protruded beyond the framing was hit with a power planer.

Before installing drywall, I air-sealed the windows by taping the corner between the window unit and the plywood surround using 3M's All Weather Flashing Tape. This tape is 2 inches wide with a slit paper backing that allowed me to tape one side of the intersection before peeling off the backing and taping the other side. A scrap block pushed the tape into the intersections and smoothed out possible wrinkles **(4)**. And before covering over everything with drywall, I squirted canned low-expanding foam (todol.com) into any voids.

READY FOR DRYWALL

Most of the interior of the house was hung with ⅝-inch drywall, so we had scrap material that could be used around the windows.

Using a straightedge and a drywall router, I ripped drywall 7 inches wide from 4-foot-wide drops. These pieces were angle-cut on the ends and screwed to the plywood at the top of the window.

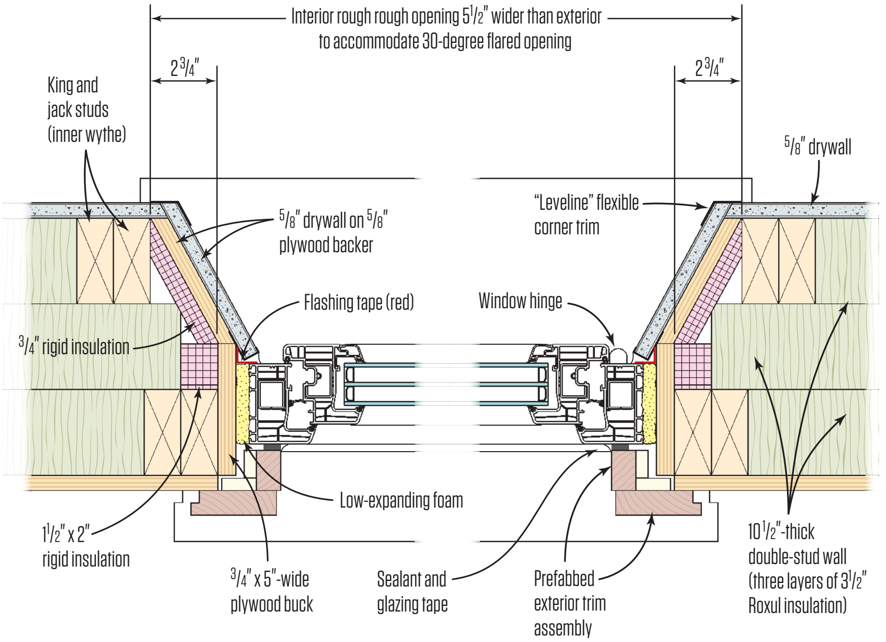
Using a sliding T-bevel at the bottom of the window, I checked the angle between the window frames and the side flares before making cuts. I wanted both sides to match. On a couple of windows they didn't, so I ripped shims to pad out the discrepancy.

For the side flares, I installed a diamond cutting blade in my portable table saw and ripped a 30-degree bevel on each long edge. Prior to making the cuts, I checked the width of the flares and discovered that there was a ¼-inch range in widths among the flared sides, so I ripped drywall to match each side. This extra step made installing and taping corner bead much easier.

Before measuring the height for the drywall on the flared sides, I placed a ¾-inch scrap on the rough sill next to the flare. This would leave a gap under the drywall flare for my finish sill. As I screwed the drywall in place, I held a level against the outside corner and shimmed low spots. Any rock hanging beyond an outside corner was trimmed with a Surform (see lead photo, page 30).

We finished the outside corner with Levelline (levelline.com) Drywall Corner Trim.

Flared Window Well

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This product has a tapered plastic core with paper edges. The plastic core provides a crisp corner without flexing.

DEEP SILLS

The finished window sills are 8 inches deep—wide enough for plants. To create a sturdy sill that would be resistant to warping, I used Baltic birch with a 1x2 brown maple nosing.

As with the side flares, there was some discrepancy in the width of the rough sills, so I cut them all to the width of the widest sill and trimmed them to fit each sill individually.

I expected some variation in length, too, so I made a template with 12-inch scraps for the left and right side of the sill that matched the flare angle. I laid these in place on the sill **(5)**, then measured the distance between them. To find the finish length of each sill, I transferred the angled scraps to a piece of Baltic birch, separated by the measured distance between them **(6)**.

After cutting the sills to length, I temporarily set the sill in place and measured what I'd need to rip it to be flush to the drywall.

The nosing overhangs the flared sides 1 ½ inches on each side. I cut the maple to length, then placed it against the Baltic birch, mindful to maintain the overhang, and drew registration marks that would allow me to align plate-joiner cuts **(7)**.

I used a standard plate joiner, which cuts wide slots for #0, #10, and #20 biscuits. But I decided to use Lamello #H9 biscuits, which are thinner, narrower, and shorter than the more typical #0. This afforded me a little extra wiggle room to help perfectly align the nosing to the top edge of the sill.

To cut slots for this biscuit size, I needed to adapt the fence to my plate joiner with a piece of ¼-inch plywood to get the depth of cut I needed **(8)**. I used five biscuits for each sill, clamping them to create finish sill assemblies. After the glue dried, I sanded them out and applied two coats of Minwax clear satin Fast-Drying Polyurethane.

SETTING THE SILLS

As I dry-fit the sills, I checked front-to-back and side-to-side for level, adjusting as needed with cedar shims. In a few instances I had to trim away drywall on the flared sides to raise the sill to level.

After dry-fitting them, I generously applied beads of foam-compatible construction adhesive to the rough sills and snugged the finish sills securely in place.

Lee McGinley designs and builds high-performance houses from his home base in Addison, Vt.


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BY GEORGE WEISSGERBER

Accurate Ballpark Budgeting

Discussing budgeting can be awkward for the contractor as well as for the client. Many of you probably put together a list of the prices of completed projects to share with clients to help establish a budget. However, I've been in this business for 40 years and have never built two totally identical projects. Many variations impact the eventual cost.

The square footage of a project seems to be the preferred basis for budgeting by contractors, architects, and clients alike. But quoting a single number—for example, $50 per square foot for a pressure-treated deck—can get you in big trouble. If you bid on a smaller job based solely on the square-footage cost of a larger deck you've built, you won't be charging enough. Conversely, if you bid a larger job based on the square-footage cost of a much smaller deck, your price won't be competitive, and you'll have priced yourself out of a job.

That's because there is an inherent "economy of scale" that should allow you to charge less per square foot for a 300-square-foot deck than for a 150-square-foot deck. Some of the items that cause this price variation include mobilization, material ordering and receiving, dust protection, trash hauling, inspections, project management, client management, daily cleanup, punch out, and final cleanup.

While you can surmise that your price per square foot needs to be adjusted up or down according to the project's size, you may not know how much to adjust it. By using the calculator I'll discuss here, you can instantly come up with a more accurate ballpark price to share with your clients.

UNDERSTANDING THE ECONOMY OF SCALE

I began to realize that fixed square-foot pricing was flawed years ago when I started doing estimates using the assembly, or template, methodology discussed in a previous column ("Building a Unit Price," Oct/13).

To gain a better understanding of why my assembly estimates did not have a similar cost per square foot, I used the same assembly to estimate prices for five decks where area (50, 100, 300, 600, and 1,000 square feet) and railing length were the main variables.

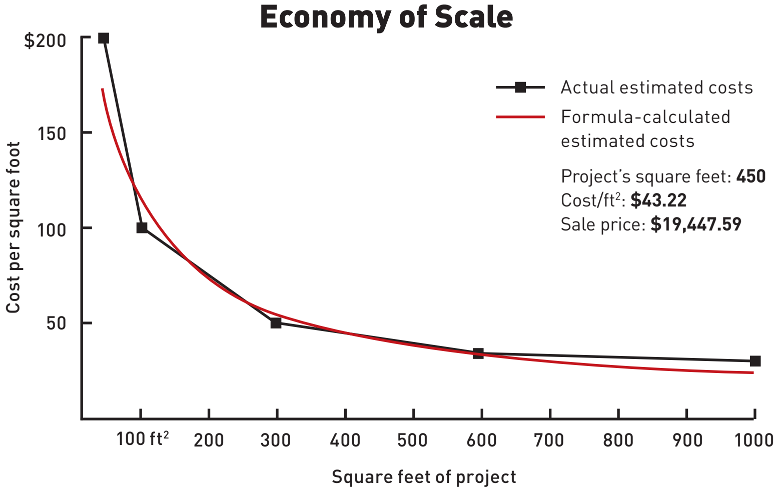
I divided each price by the square footage of the corresponding project to calculate a price per square foot, then plotted the results for all five on a simple size vs. price chart. I expected the line to descend, but the big surprise was that the plotted line was not a straight line; it was in fact a curve, as shown in the graph at left. (The two lines in the figure are slightly different; the formula creates a curve, whereas the straight lines connecting the plotted points are like steps that the curve smooths out.)

Research showed me that this curve effect, or so-called "efficiency curve," is common in many endeavors of a repetitive nature and is the driving force behind an economy of scale. This curve is the fundamental result of learning and repetition, where the time it takes to do a task falls off quickly at first but eventually levels off at the point where the task is being performed to its highest efficiency.

Not only are there efficiencies in labor, there can also be efficiencies in scope. For example, a three-sided, 100-square-foot, 10-by-10-foot addition requires 30 feet of exterior walls. However, quadrupling the size to a 400-square-foot, 20-by-20-foot addition only doubles the length of exterior wall to 60 feet.

I further reasoned that using this methodology would

Economy of Scale



If you plot the cost per square foot of similar projects (the graph above is based on a deck), you'll see that the cost per square foot decreases as the square footage of the project increases. The black lines and points in the graph above are actual estimated costs. The formula derived from those estimated costs creates a curved line. The points representing the actual estimates will almost always be lower than the formula-calculated cost per square foot in the curved line, but midpoints on the curve will usually be higher.

be an outstanding way to get a ballpark cost for a variety of remodeling projects.

I have since built a library of Microsoft Excel tools using actual estimates for projects like room additions, add-story additions, basements, and decks, where price depends heavily on size.

If you load a similar library into a laptop or tablet, you can use it with clients. Simply inputting the square footage of the project they are considering will give you a much more accurate ballpark estimate than a fixed square-foot quote. Of course, it is still important to make sure your clients understand that a ballpark estimate is just that and that the complexity of a particular design or custom features will affect costs.

SETTING UP YOUR BALLPARK CALCULATOR

To set up your own calculator, you need to know enough about Microsoft Excel to input data and formulas in a few fields in the program, but first you need to do the following:

1. Do five estimates, using your own tried and proven system, of various square-foot sizes of the same project type. I used a pressure-treated deck as an example here, but you can use any type of project you wish, as long as it's an area-dependent one—such as an addition or deck—and not a material-dependent project, like a kitchen or bath.

Your estimates should include the smallest and largest sizes that you would build and three intermediate sizes spaced out somewhat incrementally, as in my deck example.

When doing your estimates, keep the specifications the same. Adjust only the quantities of piers, beams, ledgers, joists, decking, railings, stairs, and the like, and the miscellaneous job costs, such as mobilization, protection, hauling debris, portable toilets, project management, and cleanup.

2. Divide your five estimated sale prices by the corresponding square footage to obtain a dollar-per-square-foot cost ($/sf) for each project.

3. Open a new MS Excel spreadsheet and set it up exactly like the one shown below, using the same cells and the same formulas that are listed under "Formulas entered into column 'B.'"

4. Once you have set up the spreadsheet, you can use it to accurately calculate your budgets for any size project by simply entering the square footage in yellow cell B11.

George Weissgerber, a senior vice president at Case Design/Remodeling in Bethesda, Md., developed the company's estimating system and handyman division. A working sample of his ballpark estimating spreadsheet will soon be available at JLConline.com.

Ballpark Estimate Worksheet

	A	B	C	D	E	F
1	**Project Type:**			**Pressure Treated Deck**		
2				Manually enter a simple description of the estimated project		
3						
4		**sf**	**$/sf**			
5	**Minimum**	50	200			
6	**Small**	100	100			
7	**Average**	300	50			
8	**Large**	600	34			
9	**Maximum**	1000	30			
10						
11		275				
12					Formulas entered into column "B"	
13		275	**Softens $/sf @ <Min & >Max**		=IF(B11<B5,(B5*0.8),IF(B11>B9,(B9*1.2),B11))	
14		$59.02	**Calculated cost/sf**		=EXP(INTERCEPT(LN(C5:C9),LN(B5:B9)))*B13^SLOPE(LN(C5:C9),LN(B5:B9))	
15		$16,232	**Calculated sale price**		=B11*B14	

If you have a working knowledge of Microsoft Excel, set up a spreadsheet as above. I've set up this sheet for a deck ballpark estimate. For your own ballpark calculator, enter the square footage of five projects in the green boxes and the cost per square foot in the blue boxes. Then, enter the formulas shown above into cells B13, B14, and B15. Essentially, the formula in B13 adjusts ("softens") the actual square footage if it is less than the minimum project size or greater than the maximum. When you enter a project size in the yellow box, the spreadsheet will calculate a square-foot price in B14 and a ballpark estimate in the orange box to share with your customer.

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/APPS THAT WORK/

Invoicing on the Fly

BY ROBERT POST

When I started my company 12 years ago, I wanted to have every edge possible over the competition. One area I focused on was producing estimates as quickly as possible. In my vehicle, I kept a laptop and printer on which I would produce and print an estimate for most jobs at the very first visit. This proved to be a valuable tactic, as it allowed me to close most jobs immediately.

Flash forward to post-recession 2015—I do the same thing, except with an app on my phone in a paperless fashion. I've been using Invoice2go, the third app I tried, for a few years now. It allows me to instantly email estimates, invoices, and work orders. And I no longer need to lug around a laptop.

For common projects like bathrooms or painting, I simply use templates that I tweak as needed. It takes only minutes to produce and send an estimate. Estimates for less-common projects take a little longer, but generally no more than 15 minutes. My sales schedule allows for time to send an estimate on the same day as the initial visit, though occasionally I need another day to get feedback from vendors or subs.

When building an estimate with Invoice2go, you can seamlessly select contacts from your phone. After you're finished entering items and costs, hit send, and your automatically addressed email opens up with the attached estimate and a predetermined, customized message for your client. I usually personalize it a bit, which takes seconds, not minutes. I always request a quick reply from clients confirming they received the estimate. This helps identify if it's been filtered out as spam and starts the conversation.

Some of the features Invoice2go offers include:

- Customizable forms and logo integration
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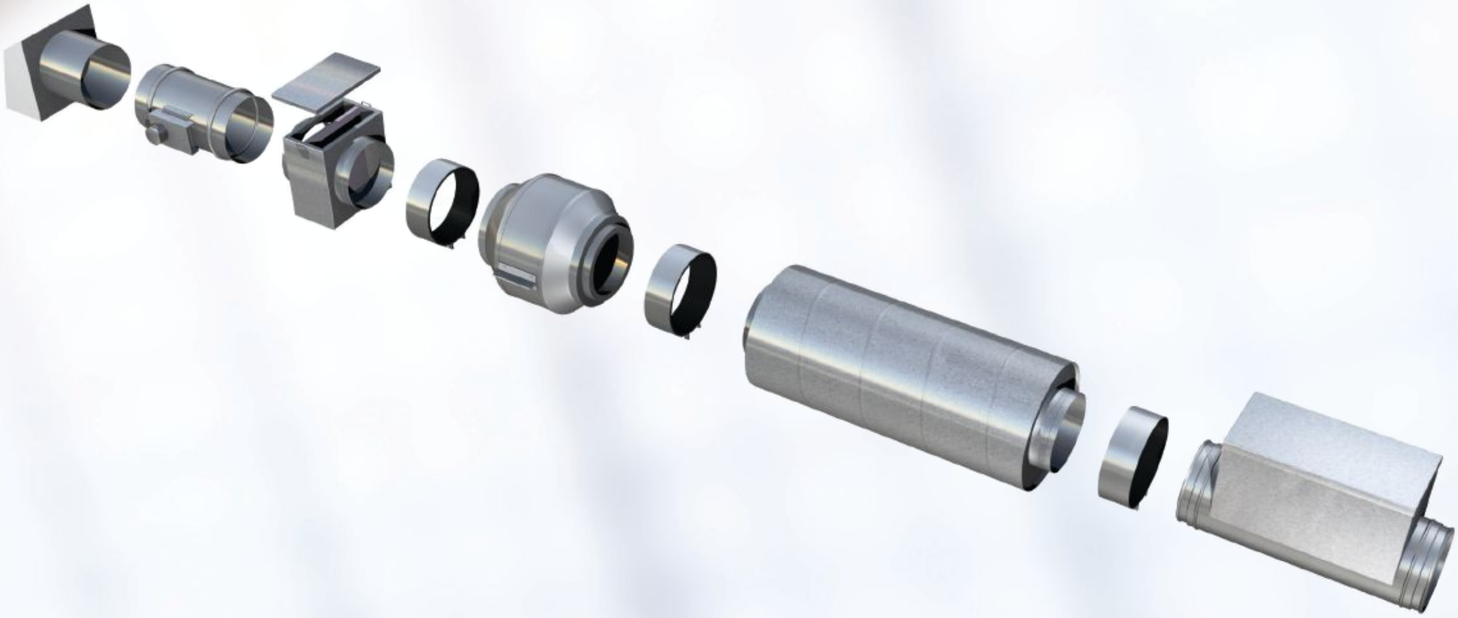
- Ability to produce estimates, invoices, purchase orders, and credit memos
- Reports including sales, payments, aging, expenses, profit and loss
- PayPal option for faster payments
- Cloud storage of company documents

Like most productivity apps, Invoice2go has a limited free plan for testing. Plans run from about $50 to $150 per year depending on the number of documents produced. Invoice2go has become another important tool in my app toolbox—that is, my smartphone.

Robert Post owns Post Remodeling & Handyman Services, in Oreland, Pa.



Framing a Supporting Valley

The trick is keeping clean ceiling lines above a vaulted space

BY TIM UHLER

On most of the homes we build, we stick-frame the roof. Often these homes have vaulted ceilings in the master bedroom under two intersecting roofs. The tricky part of this kind of roof is maintaining a vaulted ceiling under the intersecting roofs with clean drywall lines beneath the valleys and intersecting ridge.

In this article, I'll explain how we did this on a recent project using a double-LVL supporting valley rafter.

Photos: Tim Uhler

WHAT IS A SUPPORTING VALLEY?

A conventional valley typically joins at the ridge, where the intersecting roofs are the same height. A *supporting* valley is needed when you have two intersecting roofs with ridges at different heights and no place to post the lower intersecting ridge.

In this case, the main structural valley rafter intersects and is supported by the main ridge beam. This longer, supporting valley rafter carries the lower (minor) ridge and the intersecting (supported) valley **(1)**.

VALLEY GEOMETRY

On this project, we were fortunate that all the roof slopes were 6:12. This makes the geometry very easy. All cheek cuts on the

Full-Scale Layout on Deck

Calculating the Supporting Valley Length

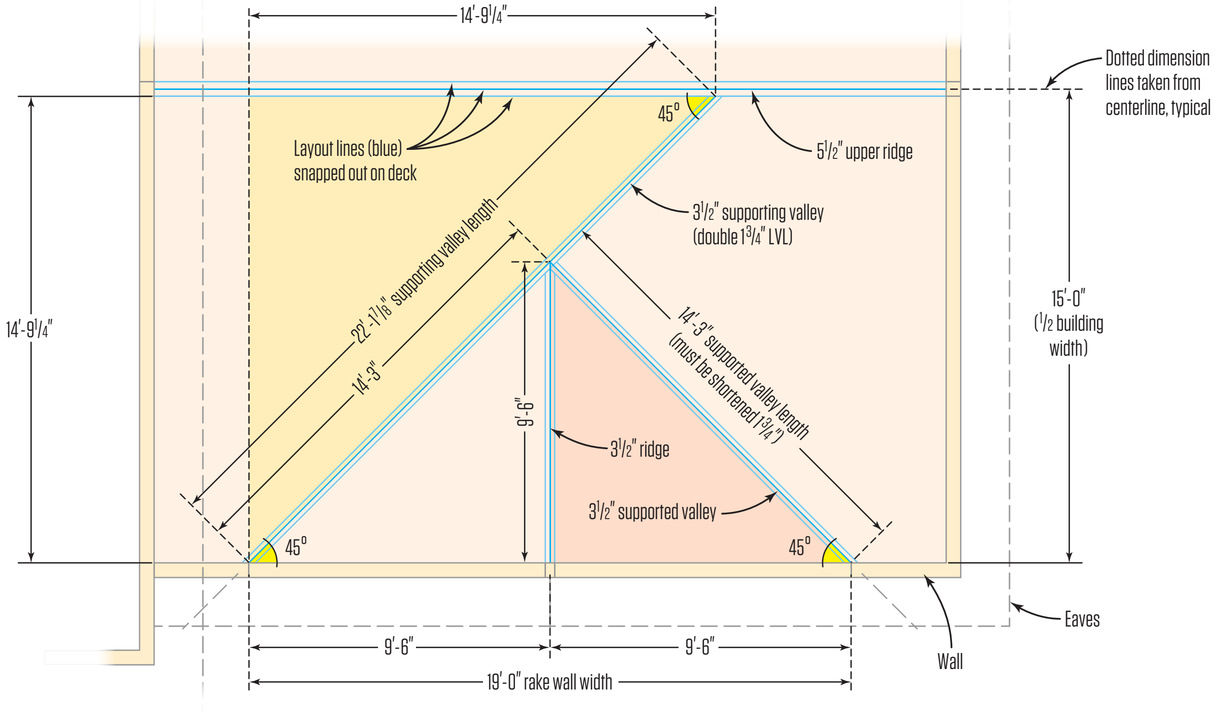
30′ (building width) – 5½″ (ridge width) ÷ 2 = 14′-9¼″ (effective run)

14 Foot 9¼ Inch Run 6 Inch Pitch Hip/V = 22′-1⅞″ (supporting valley length)

Calculating the Supported Valley Length

19′ (rake wall width) ÷ 2 = 9′-6″ (effective run)

9 Foot 6 Inch Run 6 Inch Pitch Hip/V = 14′-3″ (supported valley length)



main (supporting) valley rafter and on all the jacks are 45 degrees. The intersecting (supported) valley has a 0-degree (on the saw) cheek cut **(2)**.

Rake-wall support. We frame all our gable walls as rake walls on the deck and lift them (see "Rake Wall Framing," Nov/14). When we lay out the rake wall, we account for the "height above plate" for the rafters, so the top of the rake wall comes to the top of the rafters.

On a larger house, we would need to include posts in the rake wall to directly support the valley rafters. But on this project, the spans were relatively small, so we were able to save a lot of time by adding extra studs to the rake walls where the valleys intersected the wall to create full-height structural columns. We then fastened the valleys to the face of these columns using FastenMaster Timber-Lok screws **(3)**. The screws will be loaded in shear instead of having the valleys bear on posts in the rake wall.

Full-scale valley layout. We began the layout for the supporting valley from the inside of the wall. The simplest way to lay out the geometry is to snap out each framing member on the floor at the time the rest of the layout is snapped. This makes it easier to visualize and even calculate the valleys.

We first snapped out the center and outsides of the upper ridge that the supporting valley will connect to (see Full-Scale Layout on Deck, above).

Because the roof slopes are the same, the supporting valley intersects the main ridge and the gable-end wall at 45-degree angles. This valley will be a double 1 ¾-inch LVL. We snap parallel lines forming the outside edges of the valley, then snap out the lower ridge lines, and then the supported valley.

Once this is all done, it is very easy to visualize how to cut the valleys as well as figure the lengths of each member.

CALCULATING SUPPORTING VALLEY LENGTH

Because the supporting valley connects to the face of the ridge and the face of the gable-end wall, I can use room width (plate to plate), instead of building span, to calculate the length.

Calculate run. To find the run of the valley, I take the room width, subtract the full width of the ridge, and divide by two as shown in the illustration (above). The resulting number—14 feet 9 ¼ inches—is the effective "run" needed to figure the valley

1

2

3

length, as well as the common rafter length for this part of the roof.

Calculate valley length. I can use the effective run to calculate the ridge as follows:

14 FOOT 9 ¼ INCH RUN 6 INCH PITCH HIP/V = 22'1⅞"

This is the length along the center of the supporting valley.

CALCULATING SUPPORTED VALLEY LENGTH

To calculate the length of the supported valley, I again work from the full-scale layout as shown in the illustration.

Calculate run. I divide the width of the rake wall—19 feet—by two to get 9 feet 6 inches. This is the run to the center of the ridge for the lower, intersecting roof.

Calculate valley length. Using this run, I use the same calculation with the Construction Master:

9 FOOT 6 INCH RUN 6 INCH PITCH HIP/V= 14'3"

This is the length of the supported valley to the *center* of the supporting valley.

To get the actual length, however, I need to subtract some length so the supported valley butts to the outside face, not the center, of the supporting valley. This is an easy calculation because the smaller (supported) valley butts the longer (supporting) valley at 90 degrees. All I need to do is subtract one ply of the double LVL (1¾ inches) along the top edge, draw a plumb cut, and cut that line.

BACKING THE VALLEYS

To ensure that the sheathing on top and the drywall ceiling on the bottom would plane into the valleys correctly, we had to bevel the edges of the valley rafters and the intersecting ridge. To figure these backing bevels, I just take the arc tan (inverse of sine) of the valley angle. In this case, I can use my Construction Master Trig, as shown in "Backing the Valleys" on page 45, to get a backing angle of 18.4 degrees.

I need to figure out where I need to bevel the valleys using this angle. The configuration will be different in the valley area (below the intersection with the minor ridge) than it is above the intersection on the supporting valley where the valley just has to follow the pitch of the main roof.

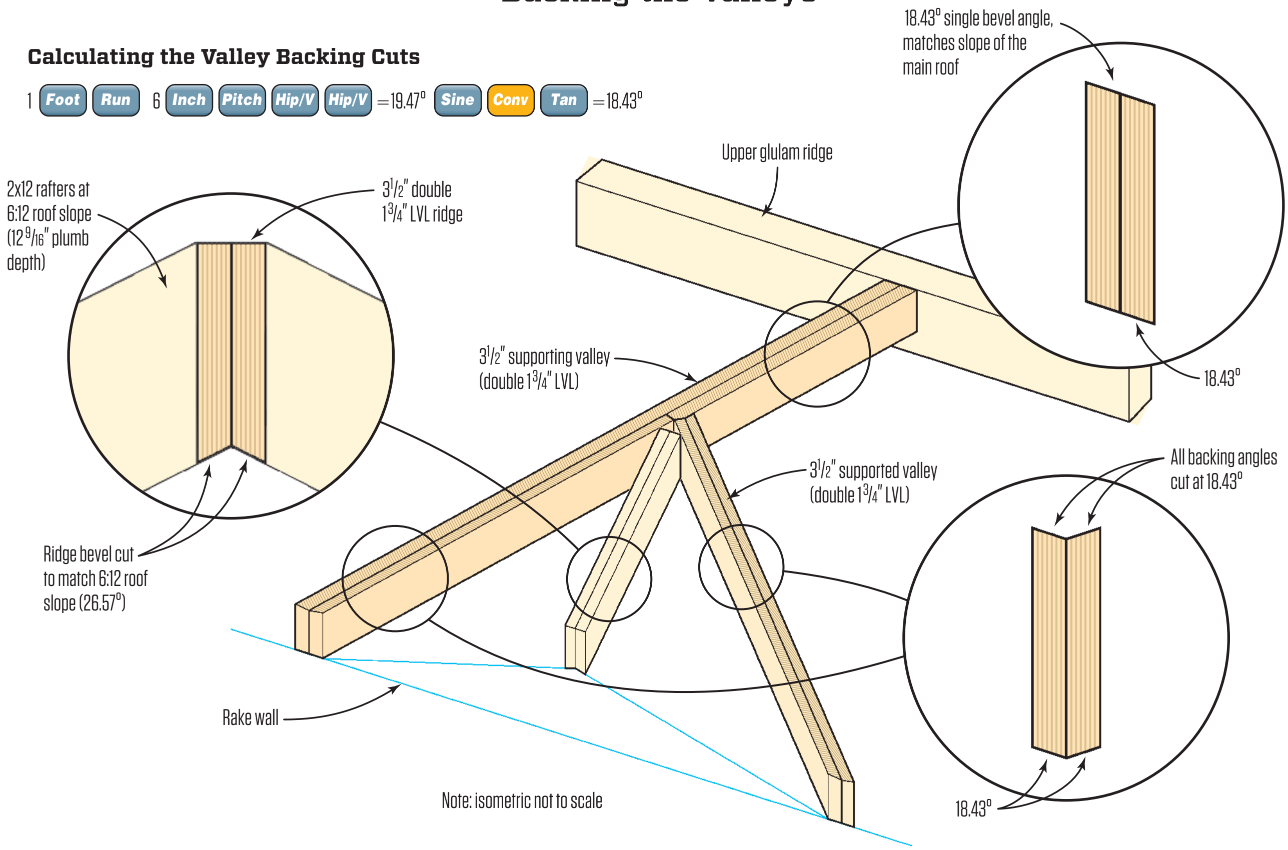
I have already calculated the length (14 feet 3 inches) to the intersection along the supporting valley, so I lay that out on the valley. Along this length (the portion of the *text continues on page 45*

APPS FOR CALCULATING ROOFS

The calculations I show in this article were done with a Construction Master Pro Trig from Calculated Industries. A great alternative is the BuildCalc app **(A)**, which sells for $10. I keep it on my Android phone, and it's also available for iPhones. I can enter the same information and it'll calculate all the angles.

On more complex roofs, especially for split-pitch and irregular-pitch roofs, I also use Sim Ayer's Rafter Tools app **(B)** (available for about $8 for both Android and iPhone).

Backing the Valleys



continued from page 43

valley below the intersection), the "sharp of the bevel" is along the outside of both valleys, sloping toward the centerline along the top edge, creating a "V" in section, as shown in the illustration above. Along the top edge, the "short point of the bevel" is on the outside edges, forming an inverted-V along the bottom (drywall) edge.

These bevels carry all the way to the main ridge on the outer ply of the double-LVL supporting valley ridge. For the inside ply of the supporting valley, there is a triangular "step" at the intersection where the bevel reverses direction **(4)**.

Because I want to bevel the bottom of the valley too, I need to know what width to rip it. I take a 6:12 angle on a 2x12, since we are using this size common rafter. This gives me about a 12 9⁄16-inch plumb depth on a 2x12 rafter. I just measure 12 9⁄16 inches along the plumb cut of the valley to make the valley the same depth as the common rafters.

For this roof, we chose to drop the intersecting (minor) ridge **(5)**, and bevel the bottom edge to allow for a nice clean drywall line **(6)**. This bevel is a simple 6:12 angle (26.57 degrees).

STACKING THE ROOF

The order we assemble this roof is: 1) main ridge, 2) supporting valley, 3) supported valley, 4) minor ridge, 5) infill jacks.

Depending on the design approved by the engineer, fastening the valleys and lower ridge can be a hassle. As mentioned, we used TimberLok screws to secure the valleys to the face of the main ridge and to column studs in the rake walls. At the intersection of the valleys and the minor ridge, we ran 5⁄8-inch threaded rod and used bearing plates to spread the load over 6-by blocks cut at 45 degrees **(7)**.

At times, the valley members for the supporting valley might need three LVL plies. What I like to do is ask the engineer to design it for two-ply and if the depth needs to be deeper than the cut depth of the rafter material, we skip beveling the bottom of the valley and deliberately make sure that the valley hangs below the ceiling lines. We then install blocks between jacks ripped to the valley backing bevel to provide drywall backing. Sometimes we'll add a 2x4 to the bottom of the valley to make it easier on the drywall crew and provide a nice crisp line.

Tim Uhler is lead framer for Pioneer Builders, in Port Orchard, Wash.

Retrofitting New Windows

Strategies for fast and professional installation—on a budget

BY EMANUEL SILVA

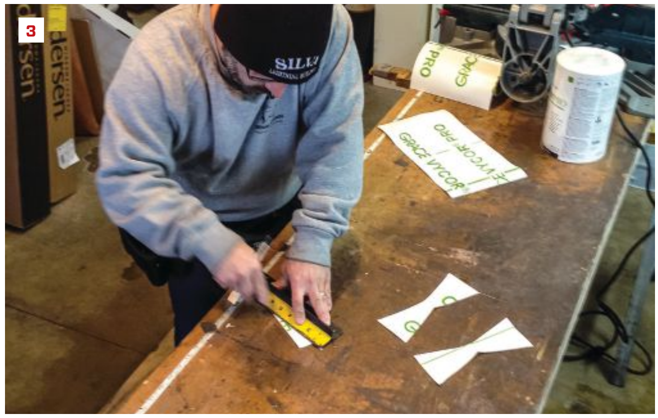
Over the past 18 years, my company has installed so many windows that I've lost count. During that time we've learned how to work very efficiently, performing all the steps necessary to achieve long-lasting results in the shortest period of time. But more importantly, we do our best to please our clients so that they're happy to refer us to future customers.

We were recently contacted to replace eight windows on the front of a client's home. I submitted the bid and received the go-ahead. But with our busy calendar, we had to schedule the job for mid-winter. On the day we signed the contract, I spent a few hours making an accurate list of window measurements as well as a stock list for all the parts we'd need to complete the job. The windows were two different sizes; I temporarily removed the interior trim from one of each size so that I could take all the measurements I needed.

Once I'd measured the existing rough openings, I chose stock-size windows that were close to the originals. Using stock windows significantly helped keep the price down for the clients. Not only were the window units less expensive, but also I was able to streamline the installation by preassembling interior and exterior trim kits and by precutting all the flashings, as well as the filler pieces that would be needed to pad the openings for the new windows.

When winter arrived, it brought with it the coldest and snowiest

Photos: John Simmons



weather in this area's history. So being able to do the prep work in the relatively warm confines of my garage shop meant that the work on site would move along at a faster pace, and we could minimize the amount of time the interior of the house—as well as the crew—would be exposed to the elements.

PRECUTTING LENGTHS OF FLASHING TAPE

The large work table in my shop was great for doing the prep work. First, I tackled precutting the flashing tape. For this project, we had chosen a recently introduced Grace product, Vycor Pro, which was compatible with all the surfaces we were working with and was rated for application in below-freezing temperatures (24 degrees). Vycor Pro comes in rolls of various widths; for the flashing around these windows, we opted for the 9-inch width.

Using the list I had made on site, I cut two sets of tape to install around each window. The first set would seal the edges of the rough opening, and the second set would seal the window flanges to the wall of the house after the windows were installed.

For each window, I began by cutting the pieces for the sills and the heads. These would all be the same length. I unrolled the flashing to the measurement needed and used the hook of my tape to mark the appropriate length. To keep the cuts straight and square, I placed one side of the tape along the edge of the work table and lined up my layout square with the hook mark to guide the cut **(1)**. Then I labeled all the cut pieces and put them aside **(2)**.

I planned to flash each side of the windows in two pieces to prevent the tape from sticking to itself as it slipped behind the siding. So for two layers of flashing on both sides of each window, I cut a total of eight lengths. I labeled these pieces, as well.

The last pieces to cut were the "bow ties" that I use to seal the corners where the sill flashing and jamb flashing meet. Vycor Pro is reported to be a "highly-conforming, non-asphaltic, butyl-modified flashing tape." And while the material will stretch a little, these small bow-tie-shaped pieces ensure a good seal at the two lower outside corners of the window opening, the places most vulnerable to moisture intrusion. I needed sixteen of these pieces, and started by cutting 3-inch strips. To make the bow-tie shape, I folded each strip in half and measured in 1 inch from both sides along the fold. From those marks, I cut to the opposite ends, creating the angular shape I needed for bending around the corners **(3)**.

While in the shop, I also cut the pieces of wood I'd need to build-in the existing openings to the rough-opening size for the new stock-size windows. After removing the interior trim on an earlier visit, I determined that the wall thickness was 4½ inches overall. I ripped two 2x6s to raise the sill to the proper height and ripped lengths of ¾-inch plywood to build-in the sides. I also ripped lengths of primed cedar clapboard to create a sloped drainage plane for the sills. Finally I prefabricated the exterior trim for each window, a process I'll describe later in the article.

GETTING READY FOR THE NEW WINDOW

After arriving at the jobsite, I worked one window at a time. I began by removing the old exterior trim, then I slowly started to pry back the siding. Immediately, I discovered that removing the siding would be a bigger challenge than I'd originally thought. The installers had attached it with 3-inch galvanized finish nails driven into the house framing instead of the usual box nails.

When I tried to loosen the first row of clapboards, the finish nails stayed put, pulling through the back of the clapboard and cracking it in the process. So instead of prying, I slipped the blade of my reciprocating saw behind the siding and clipped the nails. With the nails cut, the pieces of clapboard came out easily **(4)**. Next, I lifted the felt paper and tacked it out of the way while I prepped and installed the new window **(5)**.

When I retrofit a window, I typically peel back the siding along both sides of opening to simplify installation and flashing of the new window. But because of budget constraints, I used a different strategy: I kept the siding in place along the sides of the window and pried it away from the wall to create enough space for the flashing tape to slide behind **(6)**. With the clapboards slightly lifted away from the wall, I slid my pry bar behind the siding as a gauge to find the nail that was closest to the opening, which gave me the maximum width for the flashing along the sides of the opening.

CREATING A NEW ROUGH OPENING

To create the rough openings for the new windows, I installed the fillers that I'd cut earlier in my shop. I started with the two sill pieces, then I screwed a ¾-inch plywood strip to each side. The last piece to go in was the length of clapboard with a tapered shape that would act as a drainage board **(7)**.

Cutting and installing these fillers took about a half-hour per window. The cost of my time and the few materials for the fillers worked out to be a lot cheaper than what the upcharge would have been for ordering custom-size windows to fit the original rough openings.

FLASHING THE OPENING

To insure a watertight installation, the opening must be properly flashed and integrated with the existing weather barrier; in this case, felt paper. Pulling the siding slightly away from the wall yielded enough room for the flashing to extend 4 inches onto the wall—2 inches on the sheathing and 2 inches on the felt paper to create a tight seal around the opening.

To make sure the flashing pieces fit properly and easily, I made a control line to help align the pieces as they were applied. I first marked the centerline of the opening (measured left to right) on the sill. I found the center of the sill flashing tape by folding it in half. By lining up the fold with my centerline, I then was able to accurately mark where the flashing tape met the side jambs, which was also where I needed to cut the flashing tape to fit around the sill. I made the cut so that the remaining flap of flashing tape would extend up the outside wall and behind the siding.

To apply the sill flashing, I peeled back the release paper on half of the sheet and lined up the center marks. I applied pressure outward from the center in both directions to help secure the flashing tape to the drainage board. To secure the outside of the sill flashing, again I worked from the center out, sealing the bottom flap first. Where the ends of the flashing tape met the siding, I used a narrow shim to guide the flashing into place **(8)**.

Next I installed the bow ties—the most crucial part of the flashing installation **(9)**. Starting on the wall of the house, I applied the bow tie at an angle to the lower corner of the sill. I pulled the bow tie over the corner, letting it bridge between the sill and the side jamb. The side-jamb tape would then extend down over the bow tie and the sill to make a weather-tight corner.

Applying each side's flashing tape in two pieces made the process much easier. This time I made my alignment marks for the top edges of the tape, and again I prefit the pieces and located my cuts accurately before peeling off the protective backing.

After aligning the flashing with the mark, I worked down the

jamb until I reached the inner corner, using my layout square to press the flashing tight to the corner. I smoothed the outer face with my hand and again slid the flashing behind the siding and pressed it into place with a shim shingle **(10)**.

To complete the side-jamb flashing, I installed the top pieces as I had the lower ones, except the extra flap extended up the wall for 3 or 4 inches. The last piece to be applied was the head flashing. Again I marked the centerlines and installed the flashing tape working from the center outward, one side at a time. I installed the head flashing with the bottom edge flush with the opening instead of tucked inside **(11)**. The rough opening was now ready for the window.

SETTING AND FLASHING THE WINDOW

Before sealing and fastening the new window, I set it into the opening to establish exactly where it would sit. With the existing siding still in place, I left equal space on both sides so that the trim kit would fit with only minor alterations. I made a reference mark on the head flashing above the opening and on the top window flange. I then popped the window back out and applied a generous bead of OSI Quad (a low-temperature sealant) to the back of the flange, making sure to cover the nail holes **(12)**. The bottom flange was left without sealant to allow water or moisture to drain away easily.

I tilted the window into place, using my reference lines to help position it correctly. I set my long level on top of the window while a helper on the inside shimmed the bottom of the window until it was perfectly level **(13)**. At that point I temporarily tacked both bottom corners using 2-inch galvanized roofing nails.

Next, I made diagonal measurements in both directions to square up the window **(14)**. When both measurements were the same, I nailed the top corners **(15)** and finished driving the nails on the lower corners. Before I nailed through the remaining holes, I ran my level along the top, bottom, and sides of the window to make sure they were still true and there was no distortion of the flanges. Once I finished nailing off the flange, I wiped off any excess sealant that might prevent the outer flashing from lying flat against the wall.

To make the window watertight and to seal the flange to the flashing I had applied earlier, I installed outer strips of flashing tape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17


18

along both sides. Before I applied the flashing, I scribed a pencil line along the top and sides of the window about 3/8 inch from the flange, using my finger as a guide. This line helped me place the flashing tape during the installation, and having the tape lap slightly onto the side of the window provided a better seal along the edges of the window frame to prevent moisture from entering.

Again I used two pieces of tape along the sides to make installation easier. Starting from the bottom, I overlapped the bottom corner flange of the window and the side flashing around the rough opening. As I applied the side flashing, I sealed it to the window flange and worked under the edge of the siding **(16)**. I let the top of the side flashing extend past the top of the window by about 4 inches.

For the head flashing, I used two pieces of 5-inch-wide tape. Starting from one side, I applied the top edge first and worked it down toward the window **(17)**. Using a small flat bar, I smoothed the tape into the corner of the flange. The ends of the head flashing completely covered the tops of the side pieces and extended slightly under the siding.

The window manufacturer's instructions called for a metal drip cap along the top of the window, so I cut a piece of aluminum drip-cap flashing to length and sealed it in place with flashing tape **(18)**.

PREASSEMBLE THE WINDOW TRIM

To match the existing trim on the house, we used brick mold around the windows. I opted to use PVC trim instead of wood; PVC is more durable and would require less maintenance. I also used a PVC sill to match the original.

As mentioned earlier, I prefabricated the trim kits for each window in my shop before the installation. To make the trim kits, I first took measurements directly from the window. I made sure to leave the required space between the window and exterior trim as specified in the instructions. I then returned the windows to their boxes to protect them until they were installed.

With the measurements done, I started by cutting the sills to the proper length. This was also the length of the top casing. I cut both ends of the top casing at 45 degrees, measuring between the long points for my length. For the side trim, I cut one end of both sides at 45 degrees. Before cutting the other ends of the side pieces, I needed


19


20


21

to know the angle of the sill where the sides would attach. To copy the angle, I laid the sill on its back and placed a scrap piece of casing against it. I traced the angle and then took the scrap to my miter saw and lined it up with the blade to set the angle of the cut.

With the saw blade properly set, I cut the side-trim pieces to length. To make the two sides exactly the same length, I measured and marked one side. Then I lined up the long points on both pieces and set them against the fence on the miter saw. Cutting both pieces together and face up produced the two opposite sides that were exactly the same length.

The large, flat area of my work table made building the trim kits fast and easy. To assemble them, I started with the mitered corners. I applied PVC cement to one side of the corner and mated both pieces together. I predrilled and drove coated trim-head GRK screws to secure the joint. I repeated the same procedure for the other mitered corner. For the sill, again I predrilled and drove the screws, this time through the bottom of the sill. Assembling the trim kit was just a matter of applying glue to the sill and screwing into the bottoms of the side casings.

To speed up installation and to minimize the time we would need to spend outside, I predrilled and set all the fasteners that would secure the trim kit to the wall of the house. Knowing that brick mold is not as wide as traditional casing, I made sure that I set the screws along the outer edge of the brick mold so that they wouldn't penetrate the window flange. I spaced the screws about 12 inches apart wherever possible, which provided plenty of holding power.

INSTALLING THE WINDOW TRIM

To install the trim kit, I set two spacers on the top of the window to create the gap required (and the gap I'd planned for). I also checked the gaps along the sides to see if any adjustment was necessary. Once the trim kit was in its correct location, I used the edge to scribe a line along one side indicating where the ends of the clapboards needed to be trimmed **(19)**. To avoid cutting through the siding and into the flashing tape, I slid a thin strip of wood behind the ends of the clapboards that I would be trimming back. An oscillating multi-tool made quick and clean cuts along the scribed line **(20)**.

Before installing the trim kit, I primed all the bare edges of the

wood with quick-drying primer. Raw wood, like the cut ends of clapboards, is vulnerable to absorbing moisture, which can cause paint to fail prematurely (or worse, can lead to rot).

I applied a bead of low-temperature sealant to the back of the trim kit on all sides and then placed it around the window. I set a level on top of the trim and made some minor adjustments to make sure it was perfect. Then I drove in all the preset screws **(21)**.

I like my trim kits to lie perfectly flat against the wall. But if the screws are simply driven in as tight as possible—as they usually are—any waves or unevenness in the wall will telegraph through the casing, especially with the more flexible PVC material. To prevent that, I used a straightedge and fine-tuned each screw to let the casing lie flat without mirroring the wall's imperfections.

For this project, I used the Cortex concealed-fastener system to hide the screw holes. Cortex provides plugs made from the same PVC material as the trim; after the screws were driven to their proper depth, I inserted the plugs into the holes and drove them flush. Because I had adjusted the depth of the screws, some of the plugs sat proud and could not be driven flush, so I simply shaved them with my knife as needed.

BUTTON UP THE SIDING

Before replacing any clapboards, I installed a second drip cap on the top of the trim kit, as specified by the window manufacturer **(22)**, and sealed it in place with flashing tape **(23)**. I then let the felt paper (that I'd tacked out of the way earlier) come back down to cover the whole assembly, sealing the vertical edges with strips of flashing tape.

I installed the new pieces of clapboard above the window, leaving a 3/8-inch gap between the siding and the window trim. After being predrilled, the siding was fastened with stainless steel nails **(24)**. Where the boards butted, I slipped a strip of felt paper behind them and caulked the joint to help prevent water from entering.

To seal between the window and the trim kit, I inserted foam backer rod and then applied a bead of low-temperature sealant. I sealed all four sides of the window, using my finger and mineral spirits to tool the caulking smooth **(25)**. I also caulked the edges of the casing adjacent to the clapboards.

A frequent contributor to JLC, *Emanuel Silva owns Silva Lightning Builders in North Andover, Mass. For more photos of this project, visit JLConline.com.*

May 6–7, 2015
The Renaissance
Arlington Capital View

FEATURED SESSIONS

Keynote Presentations by:

Mike Holmes
"America's Most Trusted Contractor" and host of Holmes Makes It Right on HGTV.

Matt Ehrlichman
CEO, Porch.com, a service specific to the home improvement industry. Named by USA Today as Entrepreneur of the Year for 2014.

WEDNESDAY, MAY 6, 2015

12:00 pm
Registration Opens

1:00 pm–1:15 pm
Conference Welcome

1:15 pm–2:15 pm
Regulatory Update: Top Official From OSHA
Few government agencies matter more to remodelers than OSHA. In this session, a top official will reveal what new rules and enforcement priorities you can expect.

2:40 pm–3:40 pm
The Big Picture: Kermit Baker, Joint Center for Housing Studies at Harvard
Nobody in academia tracks remodeling numbers like the Joint Center for Housing Studies of Harvard University. You'll hear a customized, up-to-the-moment report on what's happening in our industry.

4:00 pm–5:00 pm
Technology & You: Matt Ehrlichman, Porch.com CEO
Few innovations have shaken up the remodeling industry in recent years like social media. Among social media's most significant new operators is Porch.com. What does Ehrlichman have in store for you? Don't miss this opportunity.

5:00 pm–6:00 pm
Welcome Reception

6:00 pm–8:00 pm
Networking Dinner

THURSDAY, MAY 7, 2015

7:00 am
Registration Opens

7:00 am–8:00 am
Breakfast

8:00 am–9:15 am
Keynote: Mike Holmes, "America's Most Trusted Contractor"
Build It Right: Mike Holmes shares his inspirational and motivating story, as it took him from caring contractor to popular television host, helping educate consumers and influence builders around the world. Mike will also share his insight and trade secrets on building it right and selecting the right products.

9:40 am–10:40 am
Meaningful Benchmarks: Victoria Downing, Remodelers Advantage
Work less and earn more: that's why people join Remodelers Advantage. Its leader, Victoria Downing, brings together several top remodelers whose work habits and philosophies could be role models for your operation.

11:00 am–12:00 pm
What's In A Word? A Potential Sale: Sam Rashkin
You could be missing out on upsales opportunities simply because the words you're using are turning off customers. Sam Rashkin, one of America's foremost promoters of high-quality construction practices, has created a new vocabulary of terms that can help you make sales.

12:00 pm–1:00 pm
Lunch

1:00 pm–2:00 pm
It's All About The Sales Pipeline: Panel Discussion
No. 1's: What do some of America's best remodeling sales reps know that you don't? We convene a panel of top salespeople from operations across the country so they can tell you how they do it.

2:30 pm–3:15 pm
Workshop 1
Prestigious industry partner organizations—Certified Contractors Network, Guild Quality, and Remodelers Advantage—share their insights and expertise in winning business strategies.

3:30 pm–4:15 pm
Workshop 2
Prestigious industry partner organizations—Certified Contractors Network, Guild Quality, and Remodelers Advantage—share their insights and expertise in winning business strategies.

4:30 pm–5:00 pm
Air To The Throne: Larry Zarker, Building Performance Institute
Air to the Throne? When the green movement began the focus was on saving energy, but lately its turned to air quality. Zarker reveals the challenges of maintaining air quality in today's homes and the opportunities for remodelers to capitalize on this growing concern.

6:30 pm–9:30 pm
Big50 Reception and Dinner
Join your colleagues as REMODELING honors the 2015 Big50 winners with a reception and awards dinner. The Gala is a great networking opportunity for attendees—join us and salute the industry's best.

Event Sponsors:

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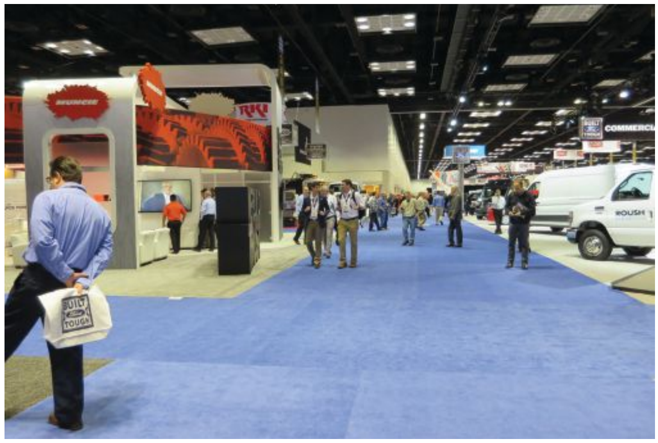


Trick Out Your Truck

Cool new gear from the Work Truck Show

BY DAVID FRANE

The Work Truck Show features the latest and greatest equipment and technology for work trucks and vans—including these items from this year's show.

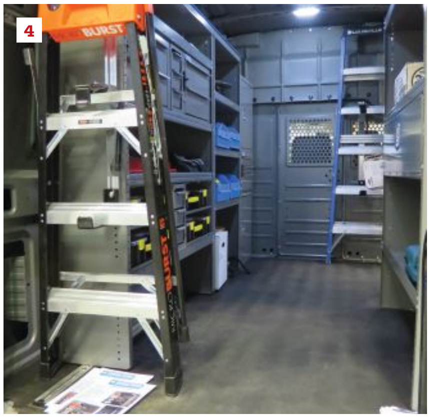
The show is held each March in Indianapolis, and it's the premier event for work trucks and related accessories. Sponsored by the National Association for the Work Truck Industry (NTEA), it's where truck owners and people in the industry go to meet with suppliers and see the latest products. This was my first time attending the show, although I definitely plan to go again.

While there, I saw everything from caps, service bodies, and storage systems to high-tech gizmos for converting vehicles to electric, CNG, or hybrid operation. It's a great show; the only downside is I can no longer drive down the highway without checking out every work truck and van I see.

The photos here contain a small portion of the equipment seen by the more than 11,000 attendees at this year's show. Next year's event runs from March 2 to March 4, at the Indiana Convention Center in Indianapolis. Check out NTEA's website, ntea.com, in the coming months for a schedule of events for the 2016 show.

David Frane is the editor of Tools of the Trade *(toolsofthetrade.net), where a version of this article first appeared.*

Photos: David Frane



1. BrandFX makes composite truck bodies and the BFX Easy Lift, a tonneau cover that pivots up on a pair of arms with gas cylinder assists. When open, it provides shade; when closed, it provides security. If you need to haul a load that won't fit under it when closed, you can drive up to 75 mph with it open. The cover weighs about 180 pounds and sells for about $2,600. (brandfxbody.com)

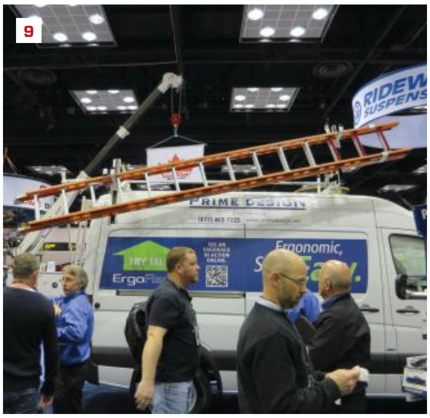
2. Weightlifter makes lifts for trucks and vans, and its newest van model is called the Slide Lifter. Powered by electricity and hydraulics, it's capable of lifting more than 1,000 pounds. (weightliftertruck.com)

3. The Decked Truck Bed Storage System fits in the bed of a pickup. Made from high-density polyethylene (HDPE), the unit can support 2,000 pounds on the deck. Available for 5-foot-6-inch and 6-foot-6-inch beds, it has two 4-foot drawers—each rated to carry 200 pounds—that ride on rollers and are secured by heavy spring-loaded latches. If your tailgate doesn't lock, there's the option to equip the drawers with keyed cylinders. The 12-inch-tall unit is held in place using existing hold-downs; there's no need to drill holes in the bed. (decked.com)

4. Adrian Steel makes this General Service Interior for the Chevrolet City Express, a cargo van about the size of a long wheelbase Ford Transit Connect (there's a package for that vehicle, too). It includes a steel partition, shelving, drawers, removable bins, hanging hooks, a locking door kit, and a ladder rack for the top of the van. (adriansteel.com)

5. Western Mule is one of a number of companies that make cranes that fold into the bumper when not in use. Shown is the A-Series crane. Models are available to lift between 750 and 2,500 pounds. (westernmule.com)

6. ARE's 3DL Series fiberglass tonneau cover provides three points of access and 4 inches of storage above the bedrail. The bed can be accessed by lifting the cover from



the rear or opening doors on either side of the lid. The unit can be painted to match the vehicle. Options include LED strip lighting and remote keyless entry to control the doors of the truck and the locks on the bed cover. (4are.com)

7. Cummins (the diesel folks) owns Crosspoint Kinetics, the company that makes the Kinetics Hybrid PM Motor. It installs behind an existing transmission and functions as a regenerative braking assist, in a manner similar to that of a hybrid car's motor—but with a couple of major differences. The electricity generated by braking is stored in a large capacitor pack instead of in a multitude of batteries. And the unit doesn't completely power the vehicle; it aids during acceleration from 0 to about 30 MPH (speeds where traditional engines are least efficient). The unit fits class 3-7 trucks and buses and is currently aimed at fleets. (crosspointkinetics.com)

8. Here, a Ford Transit is upfitted with a MasterRack shelving system geared toward HVAC work. The bins with chains across the front, on the left, are for holding Freon or other gas tanks. (masterack.com) The white "box" on the bottom right is a Fleet Gold AC power inverter that lets you run computers, power tools, cellphones, and more. (fleetelectric.com)

9. A variety of ErgoRack ladder racks were shown on vans. This one is on a very tall Sprinter. The rear end of the ladder swings farther down and can be brought lower still by pulling on a slide mechanism. The ladder can be lifted off the rear bracket and then off the front. (primedesign.net)

10. The cylinders on either side of this custom Freightliner chassis may look like torpedoes, but they're actually compressed natural gas (CNG) tanks. There were many CNG-powered vehicles at the show because CNG is cheaper than diesel—and fuel is a major expense for companies that run fleets. (freightlinertrucks.com)

11. The TruckOffice replaces the console and jump seats found in extended cab trucks. The console replacement is a lidded box with places for office supplies and files. The storage area behind the seats is made from blow-molded plastic and has hinged lid compartments. A second, mostly-metal version is an enclosed platform where tools and other supplies can be stored securely. Both versions can be outfitted with 120V receptacles and an inverter. (truckoffice.com)

12. Knapheide exhibited service bodies, vans, and this cap outfitted with Sortimo modular storage boxes that are secured by clips on the shelf. If the boxes look familiar it's because Sortimo makes Bosch L-Boxxes. These Sortimo L-Boxxes can be used interchangeably with those from Bosch. (knapheide.com/sortimo)

13. Most service bodies are made from steel, aluminum, or fiberglass. Stahl's Razorback service body is made from high impact polypropylene—a first for the industry. Lighter than a steel body, it allows for better fuel economy and larger payloads. Supposedly, you could hit the thing with a hammer without leaving a dent. (stahltruck bodies.com/razorback)

14. Maxilift's Ant M50 is a crane small enough to be mounted inside a van—though it can also be mounted on the bed of a truck. It can lift 1,100 pounds with the boom retracted to 3 feet 3 inches and 440 pounds when fully extended to 8 feet 1 inch. It's available in several configurations; the simplest model uses a hydraulic hand pump for lifting. (maxiliftcrane.com)

15. This particular Sprinter has 7 feet of headroom in back, which, according to Mercedes, is more than can be found in any other van. (mbsprinterusa.com)

16. Via Motors turns new trucks and vans into plug-in hybrids. The vehicle is powered by an electric motor connected to batteries, which can be charged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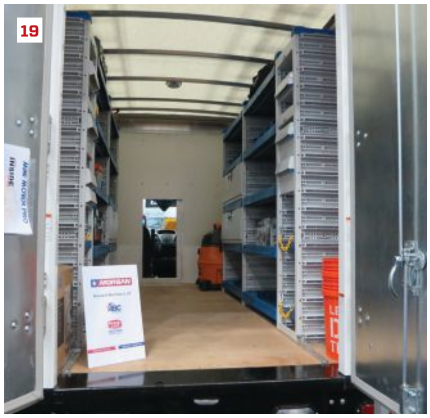
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with household current or the engine. The batteries are installed under the bed; the transmission is removed because it isn't needed. Under battery power alone, the truck has a range of 40 miles. When the batteries get low, a small 2.0- to 2.4-liter engine kicks on to drive the generator used to recharge them. The motor is not connected to the drivetrain; it only powers the generator. Total range (electric + gas) is said to be 350 miles. Price: about $90K. (viamotors.com)

17. Switch-N-Go makes detachable work truck bodies that are hoisted onto the vehicle the way dumpsters are hoisted onto their trucks. With this system, a single truck can be used to haul multiple bodies, including storage boxes, flatbed/equipment bodies, stake beds, and of course, dumpster boxes. (switchngo.com)

18. SpaceKap makes fiberglass service bodies. Built on the same principle as slide-in camper bodies, one of these service bodies can be quickly removed from a truck and transferred to another without being unloaded. Or it can be dropped at the jobsite and left on four jacks (only one shown here). (spacekap.com)

19. You're looking at MasteRack SmartSpace configurable van shelving (masterack.com) installed in a Morgan Mini-Mover Pro box (morgancorp.com). The shelving is made from structural foam and aluminum and is up to 33% lighter than comparable steel interiors. The units are modular, so they can be quickly reconfigured.

20. This Ford Transit 250 is equipped with a Reading Classic Service Van Body. Made from welded aluminum, it is said to be half the weight of a steel body—which results in greater fuel economy, payload, and life (it won't rust like steel). Inside the roll-up rear door, you can see the translucent roof panels. (readingbody.com)

BY CLAYTON DEKORNE

Lessons in Building Science

Not long ago I was sitting in an educational session for builders in upstate New York. The speaker was a retired code official turned building inspector, addressing the audience on recent changes to the energy code, also known as Chapter 11 of the Residential Code of New York State. Recent in this case meant the 2010 edition, because the state hasn't yet settled on adoption of the 2012 IECC. (Rumor has it that the new air-sealing standard that lowers the tested air-leakage rate from 7 ACH50 to 3 ACH50 is one of the primary sticking points.)

The speaker had a PowerPoint slide showing an exterior wall section that looked like an illustration out of an old *Audel's Carpenters and Builders Guide,* and he had just finished explaining the "new" insulation requirements for climate zones 5 and 6, and the differences between cavity insulation and continuous insulation. He then pointed to the interior face of the wall and said, "In climate zones 5 and 6, a vapor barrier is required on the inside face of the wall. Code allows either poly or Kraft-faced batts, nothing else. And you have to seal this vapor barrier tightly around penetrations, like the electrical outlets, otherwise hot, humid air will come whistling through there and condense on the back side of the cold sheathing in winter."

I started to cringe because not only are there other vapor-retarder materials allowed, but the speaker was beginning to confuse diffusion with pressurized air leakage. It got worse: "See, moisture moves from wet to dry," the inspector continued. "If the air is humid from occupants breathing and cooking and taking showers, this air is going to rush out all those holes around the outlets and the base of the wall to the drier outdoor air, unless you have a good vapor barrier." Ugh. I raised my hand and asked if we shouldn't be slowing things down to explain the difference between a vapor barrier and an air barrier.

In most homes, air leakage is the biggest driver of moist air into wall cavities. But in the case of a thin wall without a vapor retarder in a cold climate, high indoor humidity can diffuse through the interior finish and condense on the cold surface of the exterior sheathing.

Photos: Steve Easley

UNPACKING DIFFUSION

Back in August 1993, *JLC* published what we then titled "The Last Word (We Hope) on Vapor Barriers." It was hardly the last word, but we (mostly) got it right. I was working on the article under the sage guidance of Steve Bliss, and for me it was the first time I was clear on the difference between an air barrier and a vapor barrier. Since then I feel like I've had to relearn it at least a half a dozen times. So I was sympathetic to the blank stares from the attendees sitting in the room, and decided then to write about it here. Of course, I imagine at least half of you reading this now will think this too pedestrian, and the other half won't be interested. Either way, I hope you'll freely comment online, and push the discussion forward. The half or so that understand the difference between diffusion and pressurized air leakage are probably building high-performance homes or fixing failed ones, and the other half are running the risk of creating building failures.

Diffusion is moisture-vapor movement through building materials. The driver of diffusion is vapor pressure, which can be understood loosely as the weight of the moisture in air. Humid air has a high vapor pressure and wants to move from the humid side of a material to the drier side. Like any pressure, vapor pressure wants to equalize; the drier air in the wall cavity is pulling the more humid air to it. (Or is it the wetter air is pushing out?) I think of the air in a room in winter laden with water. Forgetting about air movement in the room for a moment, think about the moisture as uniformly distributed through the air in the room and "soaking," so to speak, into the drywall. As if pulled by the drier air, it moves through the microscopic interstices of the wall materials into the wall cavity, floats through all the air pockets in the cavity insulation and, if the back side of the exterior sheathing is below the dew point, will condense on that surface. This can lead to the mold seen in the photo on page 65. Of course, you need to have really high humidity in the room and dry, cold air outside for this to be a significant problem.

Diffusion is not a big deal unless you have humid conditions and a big difference in temperature. We've all seen these conditions: tiny houses with three teenagers taking two showers a day. Hundreds of house plants. Cords of firewood drying in the basement. Indoor pools. Nate Adams' "Petri Dish House" (Dec/14) is a great example of conditions that are ripe for significant diffusion problems. But in truth, most of the time diffusion is not a big a deal, except when you use super-low-perm materials like poly and foil.

THE VAPOR DRIVE CHANGE-UP

The problem with vapor pressure is that the vapor drive can change direction with climate conditions. While hot humid indoor air is likely to move outward in winter, it can change-up on you. Even in climate zones 5 and 6, you can have wet, warm conditions outside when the outdoor humidity is high and the vapor pressure wants to equalize to the inside. What happens when this humidity hits the back side of that poly you have on the interior walls? It condenses. Better hope that it doesn't last long and the inside of the wall dries out, or you will get black slime on all the poly.

Instead of using poly, which can trap moisture in a wall, use paper-face batts. Kraft paper is considered a "smart vapor retarder," so-called because the permeability increases as the relative humidity increases. Or, you can use those other, more-forgiving vapor retarders allowed under the energy code that the good inspector did not mention; latex paint is enough to slow the diffusion of moisture vapor and is allowed under the 2010 IECC, as well as the 2012 and 2015 versions (even the current NYS energy code) when used in a wall with vented siding or continuous exterior insulation.

Kraft paper is the better choice, by far, for a vapor retarder in a cold climate, because no cold climate is always cold. The permeabilty of the paper facing increases as the indoor relativity increases, so when the vapor drive reverses, the wall will dry out, rather than trapping moisture from outdoors in the wall cavity.

Of course in a hot, humid climate, moisture vapor migrating from outside is a really big deal. It will hit the back side of the interior drywall, which is cool from indoor air conditioning, and the moisture will condense on this surface, turning the back side of the drywall black. These days, vapor barriers are not typically used at all in southern climates (that's part of what we didn't get quite right in the "Last Word" article). Sometimes they are mistakenly used, though. Vinyl wallpaper is a classic problem wall finish in hot, humid climates. Everyone knows that, right?

IT'S ALL ABOUT AIR LEAKAGE

While I've talked a lot about diffusion, I hope the lesson is clear that vapor diffusion plays second fiddle to pressurized air leakage. Any air-pressure difference—indoor mechanicals, stack effect, and wind are the big ones—will push or pull large volumes of air through the tiniest of holes.

Diffusion is slow and plodding. It is a function of area, so even a ripped-up, poorly installed vapor barrier that covers only 80% of a wall will still be 80% effective. Air pressure, on the other hand, is fast and dangerous. If the air-pressure difference is great enough, a tiny hole can allow an enormous amount of air to escape or enter a building. All this moving air can carry moisture and the same thing can happen: It can condense on any surface below the dew point.

Clayton DeKorne is editor of JLC.

1. Rainscreen Cedar Shingles

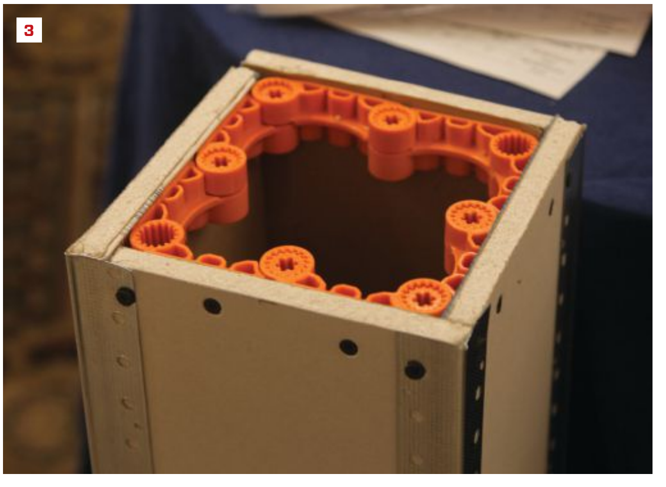
Ecoshel's Smart-Shingle System Panels take most of the guesswork from installing western red cedar sidewall or roof shingles, while providing a built-in rainscreen. Guides printed on the panel fronts insure that shingle joints are offset from those on the two courses below. On the panel backs, thick vertical beads of hot-melt glue hold the panels off the courses underneath, allowing water to drain and the shingles to dry from both sides. Made in Maine from Premium #1 grade, vertical-grain western red cedar, the panels cost about $400 a square. ecoshel.com

2. Multi-point Security

Endura's Trilennium multi-point door-locking system is made in the U.S., has three deadbolts, and uses a solid, one-piece I-beam along its entire length to improve security and even increase door-stile stability. Unlike some multi-point locks that require individual releasing, the Trilennium deadbolts all release with the turn of a single handle. Available in a variety of handle styles and metal finishes, the Trilennium costs approximately $300 for a single door and $500 for a double-door setup. trilenniumlocks.com

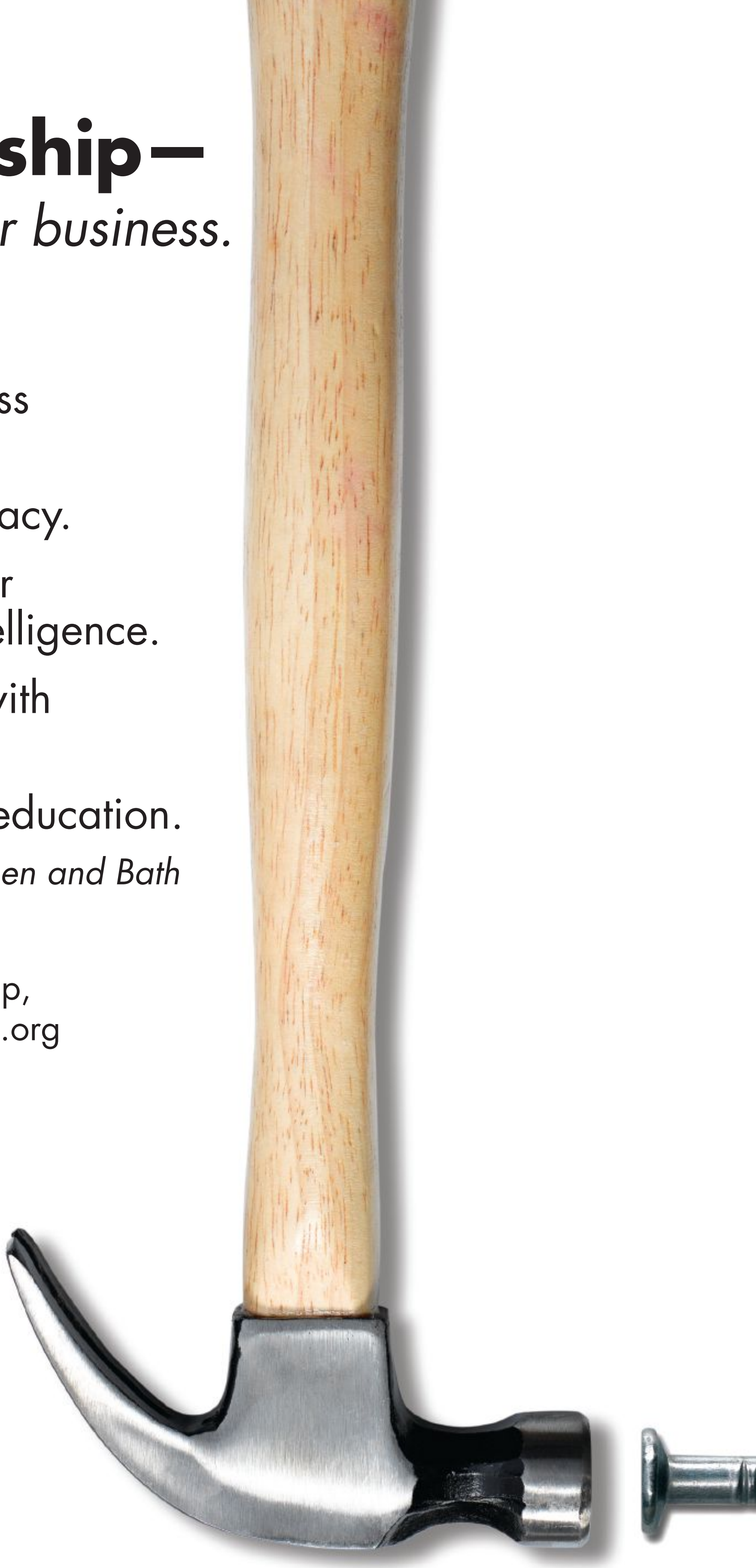
3. Quick Way to Box Columns

The Simpliframe modular fastening system is sold in kits containing small plastic parts that snap together into rectangular frames, which in turn provide the skeleton for a mechanical chase or box-in for a Lally column. Much faster than messing around with lumber or strapping—and resulting in a smaller profile—these will yield big savings in labor. The basic kit with enough parts for several frames large enough to box a basement column sells for around $25. simpliframe.com



4. Carpenter's Pencil Reloaded

The ever-inventive Bob Cummins, maker of the Prazi beam cutter, introduced a new product at JLC Live that might be a must-have in every carpenter's nail bags: the SharpDraw carpenter's pencil. It has the same sort of click mechanism used to advance snap-off blades on some box cutters. Instead of a blade, though, it has a flat #2 HB carbon-fiber "lead" that is sharpened each time the tip gets drawn along a straightedge. Prazi USA can private-label the wood grip with any name or logo. Cost: $5.95 each. praziusa.com



5. Algae-Resistant Shingles

Atlas Pinnacle Pristine Shingles use a high concentration of copper-fortified granules and 3M Scotchgard to protect roofs from streaking. As rain washes down the roof, some of the copper in the granules dissolves and kills moss, algae, and molds. When the entire roof system (underlayment, starter strip, ridge caps, and Pinnacle Pristine shingles) is from the Atlas Signature Select family, the roof is covered by a fully transferable, non-prorated 15-year warranty on labor and materials. atlasroofing.com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6. Laminated Framing Lumber

Quebec-based Lamco Forest Products has introduced LFL—an engineered lumber made from short lengths of slow-growing black spruce. The short culls are bound together with double tongue-and-groove edge joints and structural finger joints. Milled in sizes to match dimensional framing lumber (1 1/2 inches thick, depths from 2 1/2 to 16 inches), the material is reportedly as strong as LVL, but cuts and nails like dimensional lumber and can be notched for rafter birdsmouths or stair stringers. It's reportedly lighter than LVL, but has a superior fire rating. lamcoewp.com


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7. Fast Footings

EZ Tube stackable concrete footings are made from a round base section with a 22-inch diameter, and 11-inch-wide by 12-inch-tall cylinders. Installation is quick: After digging a footing hole, install a galvanized guide rod through the base, then lower the base into the hole. Run a bead of sealant caulk on top of the base, then lower a cylinder into place. Add cylinders until you reach the desired height, then attach a post base, and you're finished. The cost of one base section, galvanized rod, and four cylinders is approximately $160. Installation time: about 30 minutes, not including digging. e-zcrete.com


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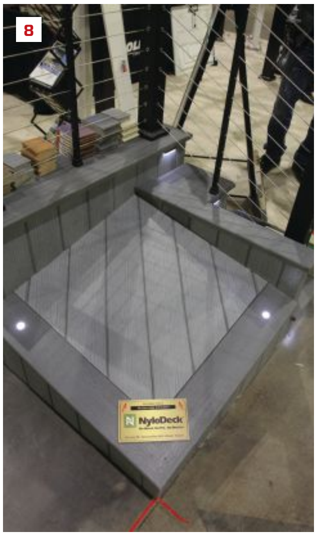
8. Durable Decking

NyloBoard's NyloDeck decking, rated to span 24 inches o.c., and NyloPorch beaded porch flooring are both made from 100% recycled carpet. The strong, lightweight composite material is reportedly impervious to moisture, mold, mildew, and insects. The maker also claims it's one of the most dimensionally stable boards available, having passed thermocycling tests that show less than 1/8-inch movement in a 20-foot board over a 100°F temperature swing. The company also makes NyloSheet—a panel of the same material that can be used in wet-location or heavy-exposure applications. nyloboard.com



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9. Sensible Staging

Invented by Colchester, Vt., contractor Eric Kurtz, Smart Bracket Staging brackets are designed to hang over the top plates of a framed wall and support standard aluminum staging planks (wood ones can be used as well). Each pair of brackets is rated at 1,000 pounds, so only two brackets are needed to span up to 24 feet (the longest aluminum plank available). The end brackets ($299 each) include a rail post with a pocket to hold a 2x4 guardrail. Accessory Smart Rails ($159 each) provide interim guardrail support. smartbracketstaging.com

10. Sturdy Screen Door

PCA Screen Doors are made from heavy-duty aluminum and come stock with continuous hinges, integral kick plate, and corner keys that stiffen the aluminum frame. Most ingenious is an angled screen locking system that works kind of like a Chinese finger puzzle. The result is the screen can't pushed out. It comes prescreened for about $200. So far, storm panels are not available, but we hope they're coming soon. Doors are available wherever Brosco hardware is distributed. pcaproducts.com

11. Single-Room HRV

Vents-US, the North American arm of Ukraine-based Vents, a European fan maker, is selling a couple of interesting single-room heat-recovery ventilation units. The Micra 60 (shown) hangs on an exterior wall with filtered, through-wall intake and exhaust vents high and low. The heat recovery core is a counter-flow aluminum plate, which is reportedly 79% efficient. The vents are thermostatically heated to prevent condensation. Cost: around $1,200. Also available is the TwinFresh, which looks identical to the Lunos (available from 475.com), for a similar price of $1,000 a pair. vents-us.com

12. Post-Tensioned Hold-down

Quick Tie Products makes a post-tensioned cable system, which serves as a hold-down to resist shear and uplift in framed walls. A similar cable hold-down for block walls was also introduced at JLC Live. Each Quick Tie consists of a galvanized wire-rope cable with a threaded stud swedged to each end and a plate washer and nut on the upper end. Preordered custom-length cables are installed to run from a building's uppermost top plate down to the foundation, where the cable end is epoxied into a hole in the concrete; after the epoxy has cured, the cable is tightened by wrenching down on the nut. Price varies by length. quicktiesystems.com

Power Up: 10 ¼-Inch Wormdrive

BY SIM AYERS

One way to cut 4-by lumber is to make two passes from opposite sides of the stock with a 7 ¼-inch circular saw. The extra labor is okay in a pinch, but it's unacceptable for production framing. In California, besides the usual 4-by posts, beams, and headers, we often have to install lots of 4x4 hold-down posts to meet the seismic requirements of the California building code.

Many framing contractors avoid making dual cuts by using a 10 ¼-inch Big Foot Tools wormdrive saw, which has a maximum cutting capacity of about 3 ⅞ inches. It's actually a 7 ¼-inch Skilsaw wormdrive fitted with oversize upper and lower blade guards and a compatible baseplate. The saw is also used for cutting doubled 2-bys, cutting thicker beams with two opposing cuts, and gang-cutting thick stacks of plywood.

We bought our first Big Foot in 2002 and have used one almost daily ever since. But these are demanding cuts, and we've had to transfer our Big Foot guards and baseplates to new 7 ¼-inch Skilsaws several times after burning out the motors. When *JLC* asked if we'd like to try the new 10 ¼-inch Skilsaw Sawsquatch wormdrive (skilsaw.com), we jumped on it. After using it for two months, we think it's definitely an upgrade.

POWER BOOST

If you look past the imposing blade guards and baseplate and the reversible side handle, the new Sawsquatch resembles the other premium Skilsaw wormdrives. It has the same levers, a legible bevel scale that's divided into degrees, an accurately calibrated depth bracket for quickly setting the desired cutting depth, a folding rafter hook, and a blade wrench that stows on the baseplate. The versatile wrench can also pry the diamond knockout from a new blade, loosen an overtightened bevel or depth lever, and remove or install the oil plug and brush caps. The saw has the same brawny wormdrive gearing as the smaller models and, like all Skilsaw wormdrives manufactured over the past several decades, is powered by a "Dual-Field" motor that runs cooler than competing ones for improved durability. But the Sawsquatch motor has more steel laminations in the field and armature than the other Skilsaw Dual-Field motors, which adds length and weight but generates more torque.

The gear housing, blade guards, and baseplate are made of magnesium. The motor housing is made of aluminum.

ON THE JOB

Out of the box, the Sawsquatch we tested made a perfectly square crosscut through a 4-by at the 0-degree bevel setting, but you can quickly fine-tune this setting if necessary by turning a screw on the baseplate. The saw bevels to 51 degrees and has a positive stop at 45. On our saw, however, this stop set the bevel to 44.1 degrees, forcing us to pull on the stop spring to adjust to 45 degrees. We rarely make bevel cuts with our 10 ¼-inch saws, though, so this is a minor nuisance. Also, the rafter hook was slightly bent, preventing us from hanging the saw from a 2-by. I have no idea if it arrived that way or if we accidentally whacked it hard in our truck box right after we received the saw, but I think it would take a pretty big blow to bend it. The hook looks just like the ones on our other Skilsaws and we've never had a problem, so that was probably just a fluke.

To gauge whether the Sawsquatch was indeed more powerful than the Big Foot, we used both saws interchangeably while framing a 3,100-square-foot residential addition. The Big Foot was powered by a Skilsaw SHD77 and equipped with the same general-purpose 40-tooth Diablo thin-kerf blade that's included with the Sawsquatch. In all, we crosscut about 90 4x4 posts along with 65 4-by girders and headers. We also ripped some 3-by and 4-by for various reasons, which we routinely do. All of this lumber was Douglas fir. Unlike the Big Foot, which occasionally bogged down when ripping green lumber, the Sawsquatch powered right through every cut.

The 18 ½-pound Sawsquatch also seems

to have the perfect power-to-weight ratio and is beautifully balanced. In fact, we like it so much that I even cut some single 2x4s with it, which I never do with our Big Foots. We also noticed that you can easily check or change the brushes on the Sawsquatch. You have to disassemble the Big Foot saw to access both brush caps.

I wish I could report that we love the Diablo blade that comes with the saw, but we don't. After making about 40 crosscuts with both saws, the blades wouldn't make a perfectly square cut. The blades are super thin, which might be the problem. The 36-tooth blades included with our Big Foot saws have also warped, but not as quickly. Unfortunately, those are the only two 10¼-inch diamond-knockout blades I've seen, so our choices are limited. We would really appreciate a stiffer blade.

THE BOTTOM LINE

The new 10¼-inch Skilsaw Sawsquatch felt great in the hand and didn't struggle with any of our crosscuts or rips in 4-by Douglas fir—and it costs about the same as a 10¼-inch Big Foot saw. We already own two Big Foots, and they have served us well. But if we were starting from scratch, we'd definitely buy the Sawsquatch for its more powerful motor and better ergonomics. A warp-resistant blade would make it even better.

The model SPT70WM-22 that we tried has a three-prong plug, while the model SPT70WM-72 has a twist-lock plug. The rip fence is sold separately. By the way, the Sawsquatch comes with a reassuring 180-day money-back guarantee.

SPT70WM-22 Specs

Blade diameter: 10 1/4 inches
Weight (with blade, wrench, and cord): 18.5 pounds
Amps: 15
RPM: 4,600
Cutting depth at 0º: 3 11/16 inches
Cutting depth at 45º: 2 3/4 inches
Cutting depth at 51º: 2 1/2 inches
Price: $450
Included with saw: multifunction blade wrench, Diablo blade
Warranty: 1 year, 180-day money-back guarantee

Sim Ayers owns SBE Builders, in Discovery Bay, Calif.

1. Like the latest 7 1/4-inch Skilsaw wormdrives, the Sawsquatch carries a multifunction wrench in the base and has a rafter hook. But the Sawsquatch has a longer motor that generates more torque.

2, 3. On site, the Sawsquatch easily crosscut 4-by framing and ripped 3-bys and 4-bys without bogging down.

QUICK-CHANGE NAILER HOOK

We reviewed the Pneuhook universal quick-change hang hook for pneumatic framing and roofing nailers back in the June 2014 issue. It's equipped with a coupler and a male plug so you can connect the Pneuhook to the nailer's male plug and the air hose to the Pneuhook. Swapping the hook between multiple nailers is a breeze.

At the time of the review, the hook was made of powder-coated steel and cost $30 or $40 depending on the coupler and plug type. Pneuhook inventor and veteran carpenter Scott Jacobson reports that the hook is now made of stainless steel for lifetime resistance to corrosion, but the price remains the same. You can order one at pneuhook.com. *—B.G.*

Photos: 2 & 3, Sim Ayers

April Advertising Index

Simple and Compact Bluetooth Laser Distance Meter

BY BRUCE GREENLAW

After testing 17 laser distance meters in the past few years, I think there's no such thing as a universal laser distance meter for residential and light-commercial work.

If you want extreme versatility, for instance, you can buy the Bosch GLM 100 C. Costing $300, it can measure distances with a simple point and click, as well as measure indirectly around obstacles, read angles, and clamp into an optional rail to become a 2-foot electronic spirit level—and it's an exceptional estimator, too. A built-in Bluetooth module allows you to pair it with an iOS or Android device and use a free app to store, manage, and share measurements.

Then again, you can choose an uncomplicated compact like the two-button Spectra Precision QM75, which is strictly designed for installation work. Costing around $125, it can measure distances or take a continuous reading when moving toward or away from a target, period.

For me though, the new Bluetooth-enabled Leica Disto E7100i (leica-geosystems.us), which costs $150, might be the sweet spot. I just put one through a quick scrimmage, and it's unique.

FEATURES

The E7100i is one of the tiniest and simplest models I've seen. It weighs just $3\frac{1}{4}$ ounces, is as slender as my utility knife, is dust and water resistant, and has been drop-tested onto a hard surface from one meter. It can measure distances up to 200 feet, take continuous readings, calculate areas, and display your last two values until turned off. It's accurate to $\frac{1}{16}$ inch and shows fractions down to $\frac{1}{32}$ inch. The display is backlit for an easy read.

The setup isn't entirely intuitive. The E7100i can beep to confirm operations, or be muted to measure quietly. But you need to press the middle buttons simultaneously for two seconds to turn the beep on or off. Also, you must press the area button for two seconds to switch between fractional inches, feet and inches, decimal feet, and meters.

The E7100i also has a Bluetooth Smart module that allows you to pair it with compatible computers and iOS or Android devices at the push of a button, which opens the door for designers and estimators. For starters, you can scan a QR code on the package to download the free "Disto sketch" app, which I did with my iPhone 6. That allowed me to snap photos with the phone, draw dimension lines on them with a finger, and then take the measurements with the E7100i and easily drop them next to the appropriate dimension lines. You can also sketch simple drawings with a finger and insert measurements in the same way. It's easy to add labels and comments to the photos and drawings, and even easier to email the visuals as PDF files. This isn't a powerful app, but it might come in handy for quickly sharing dimensions of existing spaces and details.

Better yet, Bluetooth-enabled Leicas, including the E7100i, are the only models that can be used with Chief Architect design software, including "Premier" and "Interiors" for PCs and "Room Planner" for iOS devices. I downloaded the free Room Planner app with an iPhone 6 and gave it a try. The app allows you to create floor plans and 3D models and to insert everything from doors and siding to furniture and cars. Once I added the app's Dimension Bundle, which cost $1.99, I could use the E7100i to push field measurements of existing spaces directly into Room Planner drawings, which is a time-saver for remodeling. You can email the drawings, attach them to a text message, or share them in other ways. Other E7100i-compatible third-party apps are also available.

THUMBS UP

As a basic standalone laser distance meter, the Leica Disto E7100i is hard to beat. It's simple, precise, and rugged, and fits into a narrow toolbelt pocket. And the Bluetooth Smart module works with compatible mobile devices and computers, which is a bonus for remodeling contractors.

Disto E7100i Specs

Power: two AAA batteries
Range: 6 inches to 200 feet
Accuracy: ± $\frac{1}{16}$ inch
Smallest fraction: $\frac{1}{32}$ inch
Price: $150
Included in kit: two AAA batteries, removable pocket clip, belt pouch
Warranty: lifetime

Bruce Greenlaw is a contributing editor to JLC.

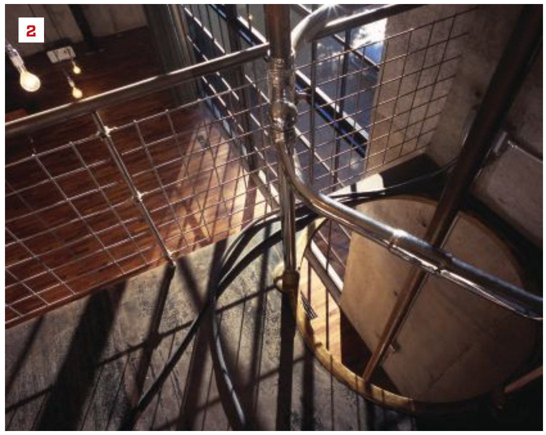
BY JON VARA

1. McIntire's entry-level Model 19 uses a latching safety gate to prevent the unwary from falling through the floor opening. The company's more advanced poles include self-opening trap doors—activated by the user's weight—to provide separation between upper and lower levels.

2, 3. This refurbished pole—which predates the steel-mesh safety gate—provides the owner of this artist's studio with a direct route downstairs, not to mention on-the-fly access to the uppermost bookshelves.

1

2



3

The Fun Way Down

The McIntire Brass Works in Somerville, Mass., is the nation's only manufacturer of fireman's poles, and as you would expect, most of its products land in fire stations.

But according to owner Arthur Anthony, the company also sells several poles a month to residential customers who prefer a thrilling slide down a pole to trudging down one or more flights of stairs.

For some buyers—including the man who installed a $30,000 state-of-the-art system to provide quick access to his garage, midway between his two Ferraris—money is no object.

Being a frugal Yankee, however, Anthony does his best to steer most residential customers toward company-refurbished poles, which can sometimes be had for as little as $2,000.

"I advise people not to put a pole in a tree house," he says. "They're not designed for outdoor use, and the kids will get tired of it in a year or two, anyway."

He also suggests a cheap and practical solution for those who want a pole to slide down from the upper level of a set of bunk beds.

"I tell them to go to a dance-supply place and buy a stripper pole," he says. "It works really well for that."

JLC *contributing editor Jon Vara lives in Cabot, Vt.*

Photos: 1, McIntire Brass Works; 2, Marco Prozzo; 3, Benjamin Benschneider