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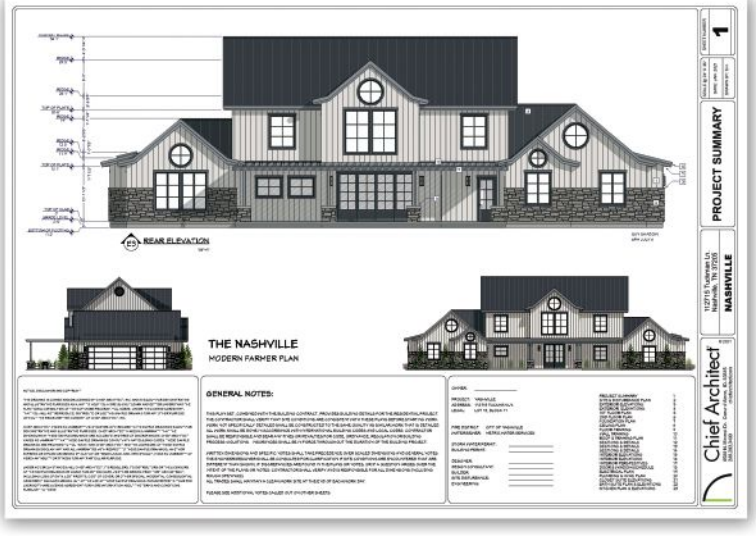

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On the cover: Kyle Garcia and Nickolas Lovejoy, of Kevin Lovejoy Building and Remodeling Inc., work the interior side of a 500-pound, high-performance window install in South Hero, Vt. Photo by Tim Healey. See the story on page 35.

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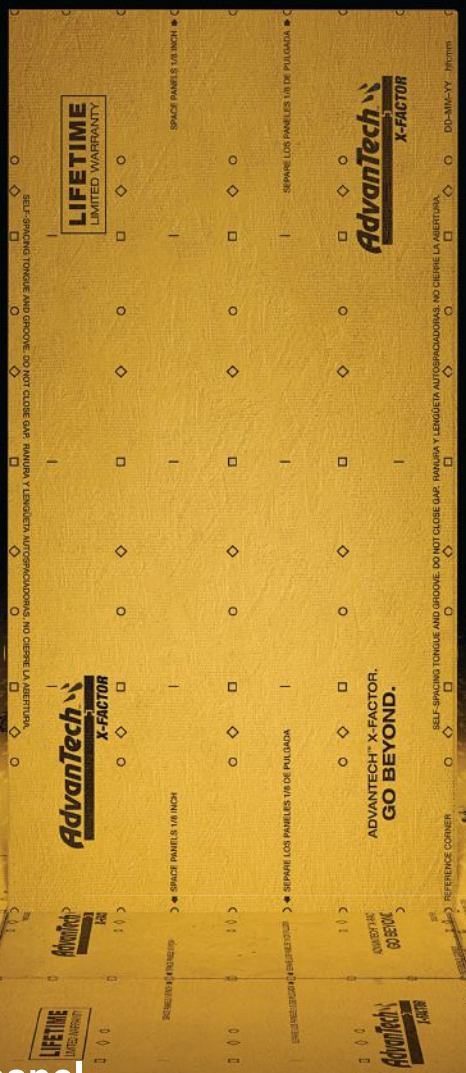

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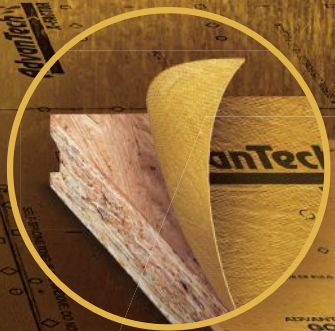

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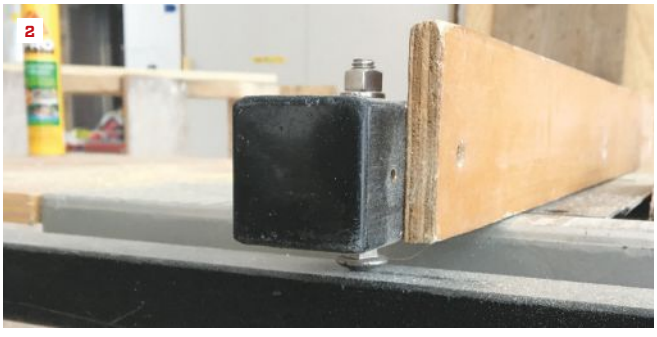
BY DAVE HOLBROOK

Jobsite Table Saw Basics

After four decades of carpentry, I'm a little vague on when I first used a table saw, a tool most builders now regard as indispensable on the jobsite. I currently use a six-year-old Makita suspended in a Rousseau stand, which provides a smooth-acting T-fence with a 26-inch rip capacity. The saw and stand were given to me, and I've made some tweaks to the setup, including a power switch convenient to my left hand **(1)**, and a support at the far end of the fence that makes it glide effortlessly on the rails **(2)**. Ease of use is vital to safe use, which is where I want to start this discussion.

Safety first. A portable saw is by definition lightweight, typically around 60 to 70 pounds. Unlike a heavier shop saw, it doesn't have the mass to remain stationary during use. Some portable saws come with integral, pop-up stands that provide the necessary stability. Other models require, at minimum, clamping or screwing to a solid, level, and immobile surface. Setup should be in a spot with ample room in front of and behind the saw for the longest pieces you'll be cutting. Keep the area around the saw free of cutoffs and other debris. Keep shirtsleeves, long hair, jewelry, and any other loose items away from the tool's reach. And, despite its name, try not to use the saw as a table for other tools, stock, cutoffs, and other items. The only thing that should remain in easy reach is a push stick **(3)**, used to guide the material past the blade.

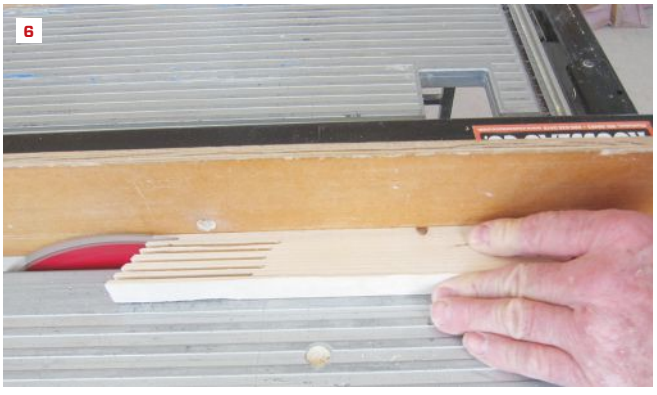
Manufacturers provide standard safety features with their saws, including lockout power switches and paddle cutoffs **(4)**, electronic blade brakes, blade guards, splitters or riving knives **(5)**, and anti-kickback pawls. These are all good, sensible features. However, not

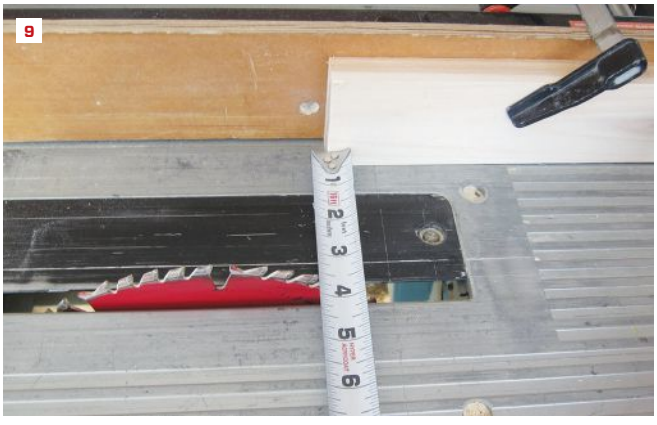


The right-handed author modified his saw, adding a left-hand cutoff switch to his saw as an ergonomic preference. The electronic blade brake, however, is integral to the factory switch **(1)**. A carriage bolt head added to the outbound end of the fence allows it to glide on the rail friction-free **(2)**. Commonly provided as standard safety equipment, a push stick is also easily custom-made and is an indispensable accessory to table saw use **(3)**.

Photos by Eve Aspinwall and Dave Holbrook

Power switches, shown here in a white circle, are deliberately configured to deter accidental activation while allowing quick, intuitive shutoff **(4)**. A riving knife, aligned in the path of cut, holds the saw kerf open beyond the blade, helping to prevent pinching and kickback **(5)**.





Feather boards are simple to make and provide a hands-free way to prevent stock from pulling away from the fence during rip-cutting **(6)**. Clamped to the table, this feather-board combo maintains constant pressure against the fence for safer and more accurate cuts **(7)**. When the saw is cross-cutting, the waste piece should be able to fall free of the blade **(8)**. Here, an offset block attached to the fence ensures the waste can fall free beyond the cut. The cut is measured between blade and block **(9)**.

The miter gauge must be calibrated exactly perpendicular to the fence and used to control all crosscutting **(10)**. The repeatable-dimensioned workpiece is safely removed without binding against the fence **(11)**. Here, the author attaches an auxiliary fence to the miter gauge. A backing piece of wood compensates for oversized screw holes through the gauge **(12)**. A precut kerf in the auxiliary fence provides a precise alignment reference for cuts of any angle. Clamping the workpiece to the gauge prevents it from slipping off the mark **(13)**.

all survive experienced users, me included, who clear the deck of blade guards and splitters, considering them obstacles, rather than aids, in use. There is a serious trade-off in safety versus functionality, while there are valid reasons for removing some of these features. However, there's no truly safe substitute; exercising constant caution and respect for this flesh-eater is the only safe mode of operating it.

Kickback. If you've used a circular saw, you've undoubtedly had it kick in your hand during a cut. In essence, a table saw is a circular saw turned upside down, and instead of feeding the blade into wood, you feed wood into the blade. Wet or crooked lumber, poor technique, or a dull blade can all contribute to kicking your workpiece back at you with dangerous force. Poor technique includes performing "freehand" cuts, where you dispense with the control provided by a fence or miter gauge.

A riving knife **(5)** consists of a metal "shark fin" positioned in the saw kerf, its top edge slightly lower than the teeth. This feature helps prevent the cut from closing up and pinching the blade. When ripping, never pull the workpiece backward (a pawl prevents this); always push the piece completely past the blade and switch the saw off.

Setup. A correctly set-up saw is going to provide the best performance and margin of safety. If you have to muscle stock through the blade, you and the material will suffer. Reduce friction and exposure by setting blade height no more than 1/8 inch greater than the material you're cutting. Always use a sharp blade and one specific to the task. For most cutting, I use a combination blade, which gives reasonably good results whether ripping or crosscutting. If I'm going to rip more than a board or two, I'll swap out the combo blade for a dedicated ripping blade. It provides noticeably easier cutting action and a better glue edge. Finish plywoods call for a blade designed to crosscut grain with minimal tear-out. These blades typically have 60 or more teeth, configured for extra-clean cutting. Note that if the wood comes out of the cut with burn marks, if smoke is pouring out of the cut, or if you find yourself pushing harder than when the blade was new, swap it out for a sharp one.

A fence that isn't perfectly parallel to the saw blade will either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A sacrificial fence face allows it to be set flush alongside the blade for close and narrow cutting. The author hooks two fingers over the fence as a safety control, a consideration in determining its height **(14)**. Material longer than about 3 feet calls for a stable outfeed support to resist gravity and loss of control over the feed **(15)**. A basic push stick should never be far from reach and should always be replaced when worn **(16)**. Because small and thin workpieces tend to ride up and chatter, a modified push stick with an extended hold-down surface is essential **(17)**.

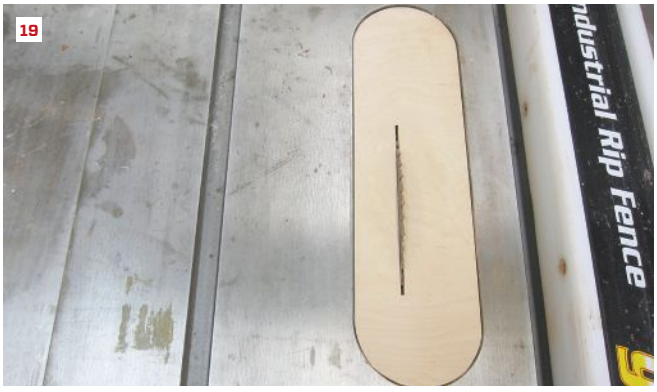
force the stock against the face of the blade, binding and burning it, or pull it away from the fence, ruining accuracy. Usually, the fix is a simple matter of adjusting the fence to lock down dead parallel with the miter grooves. Occasionally, the saw arbor itself is out of alignment with the table. In either case, consult your owner's manual for how to correct it.

Feather boards. Using a feather board, simple to make and use, improves precision when you're ripping **(6, 7)**. Feather boards hold the stock firmly against the fence while preventing kickback.

Crosscuts. I typically use a miter saw for crosscuts. On the table saw, use the miter gauge to guide the stock through the blade, letting the cutoff fall free on the far side of the blade **(8)**. Because of the high risk of kickback, never crosscut material directly against the fence. However, the fence can still be used as a stop for repeat crosscuts to a fixed dimension. First clamp or screw a straight piece of 1-by lumber to your fence, with its far end at the start of the cut **(9)**. Measure your crosscut dimension between this board and the blade and lock the fence down. Use your miter gauge to push the material through the cut, held against the auxiliary board. The workpiece will fall free of the fence once cut **(10, 11)**. Attaching an auxiliary fence to the miter gauge **(12)** allows you to make a reference kerf to align your cut against, useful for precise cuts at any angle **(13)**.

Push stick. When pushing near the fence, I keep a couple of fingers hooked over the fence and push with my thumb, forefinger, and middle finger **(14)**. For this reason, I don't like fences that are more than 3 inches high. When cutting long stock, use a stable outfeed support **(15)** to prevent the piece from dropping out of control. To complete the cut, grab your push stick and move the material beyond the blade. Push sticks come in all kinds of shapes, based somewhat on preference but also application. For larger stock and wider cuts, a simple stick with a notched end to engage the workpiece fits the bill **(16)**.

When you're cutting small pieces, several considerations come



The wide gap in the throat plate allows the blade to tilt but leaves short, narrow workpieces without essential support **(18)**. A zero-clearance throat plate is a common proprietary accessory—and is also easy to make—to provide solid support for narrow cuts **(19)**. For bevel cuts, determine the entry point by moving the workpiece against the blade and measuring against a sawtooth flush with its surface **(20)**. Bevel rips are best controlled by a feather board, as the angled cut tends to pull the material away from the blade, affecting accuracy **(21)**. Uniform edge beveling can be performed by embedding the angled blade into the face of a sacrificial fence to the left of the blade, no feather board needed. Use a test piece to adjust the exposure **(22)**.

into play. First, there's a tendency for the piece to ride up on the blade at the start, rather than parting around it, and to chatter once entered. In this case, I use a pusher made from 1/4-inch plywood **(17)**. Its long edge holds the piece down against riding and chatter, with a shallow leg at the rear to hook the piece. Keeping it thin helps keep the pusher out of the blade.

Another issue when cutting small or narrow pieces is the lack of support under the piece because of the gap between the throat plate and the blade **(18)**. On my saw, the gap is wide, and the design doesn't allow readily swapping in a custom zero-clearance plate **(19)**. One option is to make narrow cuts in material that's longer, then crosscut the piece free using the miter gauge. Alternatively, you can feed the piece partway through its length, then flip it end for end to complete the cut. This provides constant support at the infeed end.

Bevel rips. Every portable saw I've owned has tilted to the left, away from the fence. Bevel cuts aren't much different from square cuts to make. First, raise and set the blade angle. To set the fence to dimension, place the material to be cut alongside the blade and measure from the fence to a sawtooth nearest the surface **(20)**. Set the blade slightly higher than the material. Bevel cutting can tend to pull the stock away from the fence, so use a feather board to hold the line **(21)**. Start the cut feeding by hand and finish with a push stick.

To bevel an edge, fully lower the blade and move the fence close to its left side. Attach a sacrificial face to the fence. Power on and raise the tilted blade into the face **(22)**. Run a test piece into the blade to check the desired exposure. Since you can't overcut the bevel, this method gives a uniform result and doesn't require a feather board.

A future article will discuss more of the countless jigs, attachments and methods that wring the most out of a jobsite table saw.

Dave Holbrook is a freelance carpenter and a JLC *contributing editor, in South Orleans, Mass.*

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Q I'm remodeling a client's unfinished basement, which has just two small windows. Are windows required in a basement that is converted to living space, and if so, how many are needed and what size do they need to be?

A *Mike Whalen, a project manager (CRPM) with DBS Remodel in Poughkeepsie, N.Y., responds:* Most building codes not only require windows for egress, but also enforce criteria as to their size and placement. Natural light and ventilation requirements based on the square footage of the converted living space also typically have to be met.

In Dutchess County, N.Y., where I work, we're governed by the Residential Code of New York State (RCNYS), although a handful of municipalities, including the City of Poughkeepsie, tend to be more strict. We make it a point to stay on top of any changes or additions to the codes because some towns may have fine-tuned the requirements for basement conversions. In general, though, the requirements we adhere to regarding basements converted to living space are the following.

Emergency egress. The first priority is to provide egress or an "emergency escape and rescue opening" for the basement. All basement areas larger than 200 square feet and any habitable space must have a second means of egress with a minimum open area of 5.7 square feet. Where basements contain one or more sleeping rooms, an egress opening is required in each sleeping room. The RCNYS code mandates that "the egress openings are required to open directly into a public way, or to a yard or court that opens to a public way."

When a home or townhouse is equipped with an automatic sprinkler system, however, it may not be required to have emergency escape and rescue openings. I have yet to encounter that scenario; be sure to check with your local code officials regarding that exception.

Minimum opening area. The basement egress opening must have a net clear opening of not less than 5.7 square feet, a minimum net clear height of 24 inches, and a minimum net clear width of 20 inches. For basement conversion projects, we almost always install casement egress windows because they are the most efficient way to comply with this requirement. Double-hung egress windows can be used, but they require a much bigger opening, usually making them impractical for this application.

Window sill height. While the sill

Photos by Mike Whalen

Habitable basement space larger than 200 square feet needs to have a second means of egress with a minimum open area of 5.7 square feet, a minimum net height of 24 inches, a minimum net width of 20 inches, and a sill that is no more than 44 inches off the floor **(1)**. Window wells deeper than 44 inches require a ladder or steps **(2)**. This Wellcraft (wellcraftwells.com) prefab unit comes with a polycarbonate lid **(3)**.

cannot be more than 44 inches off the finish floor, we like to err on side of being lower when we install basement egress windows, so we plan for a maximum sill height of 42 inches off the finish floor. Having the concrete-cutting sub cut holes in an existing foundation is expensive and invasive, and we want to get it right the first time.

Below-grade window wells. According to the RCNYS, "the horizontal area of the window well shall be not less than 9 square feet, with a horizontal projection and width of not less than 36 inches. The area of the window well shall allow the emergency escape and rescue opening to be fully opened."

Back when we used to make the window wells out of railroad ties or landscape pavers, we took pains to coordinate the horizontal area of a well with the casement egress windows (the outswing of the casement had the potential to cut into the area of the escape well). But today's prefab polyethylene window wells take the guesswork out of meeting code. They are sized to meet nationwide International Residential Code (IRC) requirements related to horizontal area and are configured for any ladder-and-step stipulations that may be required due to the depth of the well (deeper prefab polyethylene well units have integral ladders and steps that conform to code).

Drainage. Window wells need to have proper drainage, either with a connection to the building's foundation drainage system or by a code-approved alternative method. A drainage system is not required where the foundation is on well-drained soil or sand-gravel-mixture soils. When we install a window well where the soils do not drain particularly well, we over-excavate the hole 2 feet on either side and in front of the prefab well, insert 4-inch drain that's ready to go to daylight, and backfill with washed stone. If the well still shows signs of slow percolation, we bring the pipe to daylight. That is often challenging, but it has to be done to prevent water from backing up and draining into the egress window.

Grade floor openings. A "grade floor opening" also qualifies. This means the sill height of the opening or window is not more than 44 inches above or below the adjacent grade. If this is confirmed, the opening can be reduced to 5 square feet. We run into this often on basement conversion projects where the grade allows for knee walls to be framed on half-height foundations. These walls typically have existing basement windows, but in almost every case, they do not meet minimum opening area specifications, so they need to be enlarged (see photos, below).

Light and ventilation. Under the RCNYS, habitable basement rooms are required to have an aggregate glazing area of not less than 8% of the floor area to provide natural lighting. The RCNYS also has a natural ventilation requirement that the window opening area has to be equal to at least 4% of the floor area. We typically comply with these natural lighting and ventilation requirements with the installation of an egress window, although there are exceptions.

Under certain circumstances, artificial lighting capable of providing an average of 6 foot-candles 30 inches above the floor is allowed in lieu of natural lighting, and a mechanical ventilation system capable of providing a 0.35 air exchange per hour is allowed. Of course, the requirements in your jurisdiction may be different, so always check with your local building official regarding these exceptions.

A typical occurrence at "grade floor openings" is that an existing window doesn't meet minimum opening area requirements. Here, an existing double-hung window was removed and the opening enlarged **(4)**. The author recommends erring on the side of caution when going to the expense of cutting concrete, with a maximum sill height of 42 inches off the finish floor **(5, 6)**.

Q When I'm trimming the junction between a wall and ceiling with crown, cove, or bed molding, what kind of paint finish should I apply to the trim? Complicating matters a bit, what if the ceiling is not drywall but is painted T&G beadboard?

A *Scott Burt, owner of Topcoat Finishes in Jericho, Vt., and a presenter at JLC Live, responds:* In most cases, molding profiles are painted to match the rest of the trim package in a room, not the ceiling. Think of situations where the trim is not white, but the ceiling is. So, for example, when door and window casings are finished with a light gray paint, you'd use the same color on any crown molding as well. In the case of a beadboard ceiling, both the crown molding and the beadboard would typically be painted to match the trim scheme in the rest of the room.

We typically paint moldings and other wood trim with a satin (rather than semi-gloss) finish to match the door and window casings. We find it to be the most forgiving finish, and pleasing to the eye and touch. In the case of a ceiling finished with a flat white ceiling paint, it might be tempting to use the paint on the crown as well, but it's rare to see wood features painted with flat paint.

Photo: Andrew Wormer

Crown molding is typically painted to match a room's door and window casings and other trim, not the ceiling … unless the ceiling is wood. Save the flat white paint for drywall ceilings.

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Photos by Michael Anschel

What started as a kitchen remodel became a major structural repair as the crew began demolition. With temporary walls shoring up the exterior wall, work to clean up the foundation begins **(1)**. The original rim beam was fairly massive, albeit cobbled together **(2)**. If it had been smaller, it would have slid off the foundation long ago.

An Innovative Rim-Joist Repair

BY JLC STAFF

The Minneapolis-based design-build firm Otogawa-Anschel recently began what was initially a large kitchen remodel on a turn-of-the-last-century home. But as often happens when working on older homes, the O-A crew encountered some significant structural issues as soon as they started to pull things apart. There is always pressure to keep costs down, but whenever unexpected problems arise, that pressure increases. Yet because the unexpected here was structural, O-A couldn't skimp; it had to ensure a sound result. Such a pull between budget and scope is a common complexity of working on older homes, and while the solution O-A landed on is specific to this job, the principles they employed have far-reaching value.

Like many complex kitchen renovations, this job required an extensive rework of the floor plan. O-A had planned to make significant structural changes to the interior walls in order to change staircase access, get rid of a narrow hallway, open up the kitchen onto the dining area, and even make the downstairs half-bath more functional. But as the crew was taking measurements, not all the surfaces were planing out the way they expected. In particular, they noted something wrong with the north wall: A window in it was recessed deeper than it should be, and on the outside, they could see a subtle inward bow. "We recommended to the client that we put $5,000 toward a contingency," owner Michael Anschel explained, "thinking worst case, we would have to reframe one wall. The problem was probably something like an undersized header or some rot."

As the crew began demo work, however, they started to uncover "layers of crazy," as Anschel put it. The most glaring discovery was that in one section, the floor joists had become completely disconnected. Elsewhere, floor joists had been drilled out and sliced up for mechanicals with no regard for the joists being part of a structural system. "We coined the phrase 'decorative framing' to describe the carnage of a previous tradesman's handiwork," Anschel said. In one corner, five floor joists had been cut during a past staircase modification, so the corner of the house had effectively been cut loose. The rim joist, now free-floating, was all that was left to support

The foundation is solid below-grade; only the top two courses of stone had come loose. The crew sets to work cutting out the crumbled mortar **(3)** in preparation for reinforcing steel and non-shrinking grout. Continuous lengths of angle-iron, bedded in grout, are clamped together along the deteriorated section of the foundation **(4)**. A welder then begins attaching angle-iron cross braces, which will hold the steel legs together and serve as brackets to secure the ends of new floor joists **(5, 6, facing page)**.

the balloon-framed exterior wall, which had begun to slowly slide off the crumbling foundation. "Thankfully the existing rim joist was an 8x8 beam," Anschel said. "If it had been anything less, it would have completely slipped off the foundation and the floor would have crashed in long ago."

Any one of these conditions would have been manageable on its own, but with all existing at once, two things became immediately clear: O-A would exceed its contingency, and the firm needed to run things past a structural engineer. This was not a light decision. Bringing in an engineer ran the very real risk of having to tear out and rebuild part of the foundation, or some other equally massive measure that would be too expensive for the homeowner. At the same time, the firm was facing an extreme condition and there was just too much risk to take on alone. To find the path through this quagmire, O-A proposed a solution and brought in an engineer to verify, and perhaps modify, its approach, rather than create a solution from scratch.

"We got lucky," said Anschel. "The engineer largely agreed with our solution." The engineer confirmed this was not a foundation failure; only the first two courses of stone had become unstable. The rest, which was largely buried, he deemed sound. "If we could grab hold, so to speak, of those top courses of stone, clamp them together and bind them in steel, we would have a solid structure to which we could reattach the floor framing," Anschel explained. Accepting this approach, the engineer helped O-A arrive at a cost-effective solution, specifying the exact details for an angle-iron ladder, welded up with angled cross braces that also functioned as brackets for securing new floor joists. Before installing the steel, the O-A crew had to first clean up the loose foundation courses—very much like drilling out tooth cavities—and remove the loose debris, which the crew replaced with rebar embedded in non-shrinking grout. Anschel was relieved the engineer agreed on grouted J-bolts at each cross brace to pin the steel to the rock, and that they wouldn't have to drill and set epoxy anchors. "We were worried that drilling the rock would potentially cause more damage to the foundation," Anschel explained.

As the engineer described it, the aim of the proposed fix was two-fold: to provide a more stable vertical load path and to provide a connection for the joists. For this scenario, he specified a triple-LVL rim joist. This much beam is needed to support several different loads: It has to tolerate the force of balloon framing, which has floor and roof load coming down in points. That load must be distributed or the rim would twist. It also has to resist the lateral force of the first-floor system pulling inwards on it. It has to distribute force in one direction and be stiff in the other. It's not your typical rim joist, but it did the trick at a price the owner could afford.

In addition to the joist brackets, smaller pieces of angle-iron serve as L-brackets, which are used to secure the new rim **(7)**. This new rim beam **(8)** is built up of three 1 3/4-inch-by-7 1/4-inch LVL members, sized to not only support the distributed bearing load from the balloon-framed wall but also resist the lateral force of the new floor framing that will tie into it.

New Pier for an Old Post

BY JAKE LEWANDOWSKI

Our company specializes in structural repairs. We have worked in every type of building, from some of Chicago's largest commercial buildings (which qualify as some of the largest buildings ever built) to grandma's Sears, Roebuck and Co.–home built by grandpa in rural Illinois. They all start with a concern, and the concern for the job shown here was signs of rot at the base of an 11-inch-by-11-inch timber post. This post supported a main girder of an old two-story, timber-framed factory that had been converted to luxury condos. The condo president had contracted with a structural engineer, who recommended our company to do the repair.

The engineer calculated that the current loads on the column were only 8,000 pounds; the first task was to get all of that load off the timber column.

TEMPORARY SUPPORT

We had identified early on that the existing concrete slab was thin. To avoid cracking the slab, we set cribbing on it to support our shoring and transfer the load to the sub-slab soil. This soil had a bearing capacity of at least 1,500 pounds per square foot, so a single layer of 4x6s on the flat would be enough cribbing to spread the load.

The existing footing was sound; only rot at the base of a post was of structural concern **(1)**. A single layer of 4x6 cribbing **(2)** supports the shoring. Two towers—each made with two frames and topped with two steel beams—flank the post to pick up the load on the main girder **(3, 4)**, while two ladder frames, one each on opposite sides of the post, pick up the loads on the intersecting joists **(5)**. With the shoring complete, the crew tightens up the U-heads **(6)** to remove the load from the post.

Photos by Jake Lewandowski

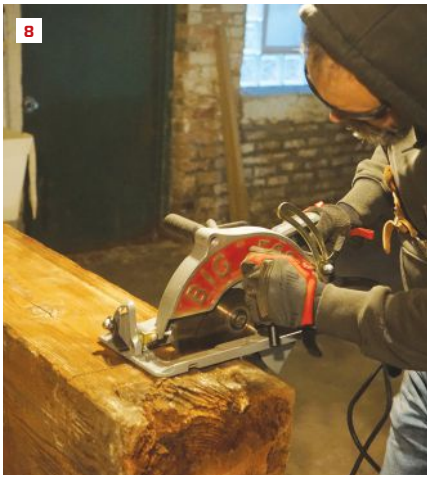
Our shoring consists of heavy-duty ladder sections, adjustable-length U-heads, and adjustable base plates. When installed correctly, the frames have the ability to handle 10 kips per leg (1 kip is equal to 1,000 pounds), or 20,000 pounds per frame. To support all of the structure that the post was carrying, we set a tower on each side under the main girder beams with two steel beams spanning from U-head to U-head.

We also set a frame on each side of the post directly under the intersecting wood joists. We used the adjustable feet to ensure the frames were plumb in both directions, and once the shoring was set, we snugged up the jack screws on the U-heads until the wood post became loose and we were able to remove it with ease. It's worth noting here that we were not jacking, or raising, the floor; otherwise, we would risk cracking plaster and causing other problems in the units above. By tightening the screw adjustment, we were only putting pressure on the floor structure so the loads transferred off the post to the shoring.

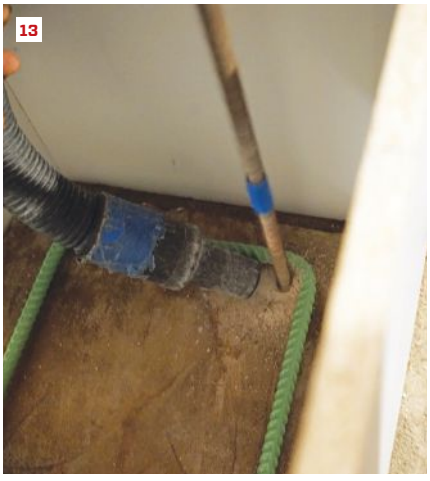
NEW PIER

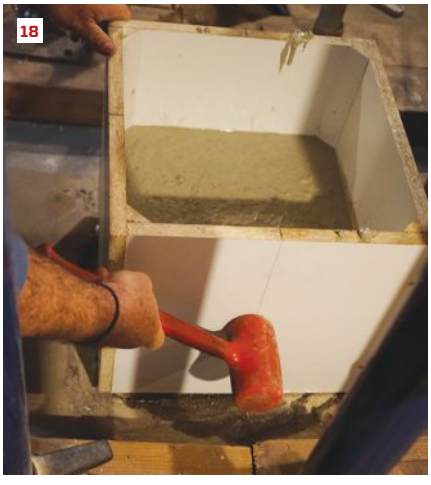
Once the post was removed and on horses, we cut off the compromised section, making sure we cut above the visible rot so the fresh end of the post was rot-free. While the post was still on horses, we preinstalled a 1/2-inch-thick steel setting plate on the bottom of it.

To prepare for pouring the new pier, we removed loose concrete from around the existing footing and made a melamine form, which we set plumb around the footing. The new pier would be anchored to the footing with rebar pins, so we drilled into the footing, cleaned



With the old post on sawhorses **(7)**, the author uses a beam saw to cut off the rotten end, cutting to full depth on all sides **(8)** and finishing the cut with a handsaw **(9)**. On the fresh end **(10)**, he attaches a 12-by-12-by-1/2-inch steel setting plate **(11, 12)**.





The crew drills into the existing footing for rebar pins **(13)**. A vacuum, a wire brush, and a blow-out pump **(14)** are used to clean the holes before the pins are set with epoxy **(15)**. The pier elevation is marked on the form with a combination square **(16)** and the form sprayed with water **(17)**. Tapping the form with a dead-blow mallet settles the concrete and helps eliminate voids **(18)**.

out the holes with a wire brush (being sure to blow and vacuum out the debris), set the pins with epoxy, and tied in a single cage.

To establish the elevation of the concrete, we measured the length of the post with the setting plate attached. We set the elevation a little lower so we had 3/8 to 1/2 inch of wiggle room to insert the post on the new pier. The difference would be made up with a steel shim.

Just before pouring concrete, we saturated the existing footing with water from a spray bottle. This would prevent the form and old concrete from absorbing too much water from the concrete mix, helping to ensure a proper cure. After the pour, we tapped the sides of the form with a dead-blow mallet to remove any voids. The "high-early" bagged concrete we used reaches 3,000 psi within one hour—plenty to handle the design loads, so we could safely strip the form.

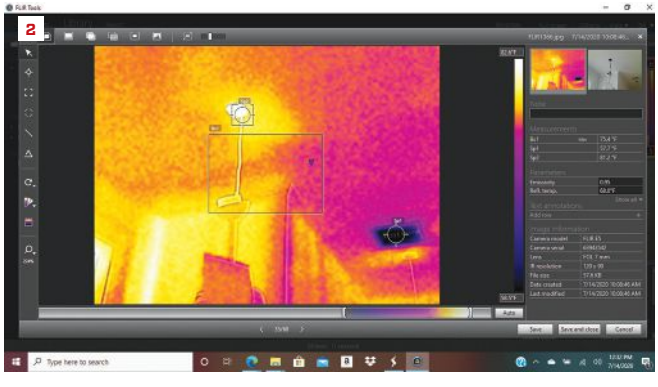
We were then ready to slide the post back into position. At this point, we measured from the top of the new concrete to the bottom of the girder and subtracted the length of the post with the setting plate from that distance. This gave us an exact thickness for the steel shim (the shim, called a "coupon" in our area, was cut from scrap steel).

The 4-inch-by-4-inch shim carries only part of the load, and we spread this load by filling the void between the steel setting plate and the top of the new pier with non-shrink grout. The non-shrink grout we use also reaches 3,000 psi within one hour, more than enough to support the 8,000-pound load. Once it set, we could remove the shoring, clean up the site, and move on to our next project.

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

A 4x4 steel shim **(19)** sits in the middle of the new pier as the crew slides the cut post into position **(20)**. The gap between the top of the pier and the setting plate **(21)** is soaked with water **(22)** before being filled with non-shrinking grout **(23)**. Then all that's left to do is to remove the shoring around the completed post **(24)**.

BY BILL ROBINSON



Photos by Bill Robinson

The author's inspection case **(1)** contains a range of tools for measuring moisture. Of these, the thermal camera is often the one he pulls out first to scan a site for possible hidden moisture. Dark areas on the image **(2)** indicate cool areas—places that may be wet and need further investigation.

Moisture Detection Tools

Several years ago, when I was contracting in California, a big part of my business was installing windows. At one point, a manufacturer representative told me that the manufacturer would void the warranty on windows in the 5- to 6-foot range if there were fasteners directly nailed through the mounting flange at the header. This warranty requirement existed because most header stock on the West Coast at that time was full-dimension, green stock. It was so heavy with water, you could be splashed when you cut into it with a saw. Understandably, window makers were concerned about what would happen to the flange fasteners as those big, wet headers dried out and shrank. The solution, the rep told me, was be sure to install fasteners into header stock that measured below 15% moisture content. If I could document that, the installation could be warranted. But at the time, I had no idea how to measure lumber moisture content.

Learning about measuring moisture content started me down a path that led to my acquiring a Pelican case full of diagnostic tools **(1)**, most of which are designed to measure moisture in one form or another within building materials and in the environment inside or outside buildings. These days, I live and work in New Orleans. I was drawn here shortly after Hurricane Katrina devastated large swaths of the city, and I saw how I could be useful in helping to rebuild the 9th Ward, which was particularly devastated by floods from Katrina and subsequent storms. For this work, and for ongoing work here in this hot, humid climate, reading moisture is a big part of defining effective building solutions.

In this article, I will "unpack" my case. Not only do the tools within allow me to derive quantifiable moisture measurements, but just as important, many of them streamline how I document the problems I encounter, which helps me communicate the solutions I come up with to clients and subcontractors. Data is everything. I have learned that to be convincing and to educate clients, it is essential to have tools that will quantify environmental conditions, including, but not limited to, wood and drywall moisture content (MC), relative humidity (RH), temperature, and observable (that is, graphic) conditions.

The scale on the author's Mini-Ligno **(3)** is set for drywall, for which 1% moisture content (MC) is the trigger point; a higher value would indicate an elevated moisture condition. The author finds that the readings from this relatively inexpensive pin meter from Calculated Industries **(4)** compare favorably to the ones from his other meters. The Delmhorst ProScan **(5)** can read wood moisture content to a depth of 3/4 inch without marring finished surfaces.

FIRST PRINCIPLES

First, I'll run through some key points to keep in mind when evaluating buildings that may be at risk from moisture.

BOG. In my reports, I use the term "microbial growth" or BOG (bio-organic growth) rather than saying outright, "You have mold in your home." This growth exists in homes all the time and becomes a problem only when a certain level is reached. But since I am not a licensed mold inspector, it is not my place to define when that level has been reached. My job is to stay in front of the problem and identify where the weak links are that might result in it becoming a problem over time.

Wood decay, or rot, typically occurs at 28% moisture content. Mold typically begins to grow on wood and other cellulose-containing building materials at 21% MC, and some mold can continue to thrive at 16% MC. This puts those green headers I mentioned earlier into perspective: 19% MC is a dangerous number because it's in a range that can support biological growth. For the work I do in New Orleans, we need to be careful not to cover things up at any time, but particularly after a flood, when the moisture content is high. I shoot for 15% MC on the meter before even considering burying a material in an assembly.

Termites are a big problem here in the South, and they are becoming a bigger problem in many places farther north. Keeping wood below 15% MC is also the threshold we strive for to help reduce termite destruction.

Drywall is not the same as wood. Though 15% MC is a reasonably safe threshold for wood, 1% MC is the threshold for drywall and plaster. It's critical to have a device that can be calibrated to read accurately in that range.

Wood products. Some engineered wood products come from the mill at 4% MC, while others can be as high as 25% MC. The wide range underscores the need to acclimate all these products to the environment where they will be installed. Inside, in conditioned spaces, the equilibrium moisture content (EMC) of building materials can range from 6% to 8% in dry climates to around 10% to 12% in more humid climate zones. On the exterior, wood and other hygroscopic materials will equalize to a moisture content matching the outside temperature and humidity. The range of these conditions varies widely in the U.S. (For more on understanding EMC, see "Managing Wood Movement," Feb/21).

As we build with more precision to meet energy codes, and we increasingly face storms, fires, and flooding, we need to understand environmental conditions with precision. If we can't measure those conditions, we don't have a prayer of a chance of building durable, efficient, healthy, and resilient homes.

THERMAL CAMERAS

A thermal camera reads infrared radiation, and shows surface temperatures. But it can be used to highlight moisture problems as well as thermal losses. When wet materials dry, they become cooler—like what happens to the temperature of skin when you perspire: The skin surface cools. The same thing happens with building materials, provided the air temperature is warm enough to allow evaporation. The cooler surfaces show up on a camera as darker colors. Of course, something showing up on the image at a lower temperature can simply be cooler, not necessarily wet. But if I scan an area, and it shows up with patches

that are cooler, that gives me a clue to chase down: It may indicate a wetter, not just a cooler, area, and I know a little analysis is called for.

I always begin a building investigation looking for moisture accumulation using a thermal camera, and work it in tandem with a moisture meter to check for elevated moisture content. The thermal camera simply gives me the best place to "look" further with my moisture meter.

The camera image is especially useful for identifying potential condensing surfaces, where liquid water exists. These are the most likely places for microbial growth to occur. In image **(2)** on page 27, the AC register, shown clearly in dark purple, had been cooled enough by the supply airflow to drop the grille surface below the dew point. This resulted in dripping water and led to biological organic growth on the surface. I will discuss the environmental conditions detected using Kestrel meters later in the article.

Flir thermal camera. Thermal cameras are becoming more available and more affordable. I use a Flir E5, which is relatively inexpensive for a thermal camera. I paid around $1,500 for mine several years ago. There are less expensive models and even devices that will connect to a smartphone to provide some thermal imaging. I like standalone ones that can connect to a computer and provide more-precise images that can be output as records. The camera I use can take two images: a thermal image and a black-and-white image that highlights the dark areas most likely to be moisture. With the Flir tools, temperatures can be pinpointed on the image where there might be an anomaly of interest.

MOISTURE METERS

The one most important diagnostic tool every building contractor should own is a moisture meter. In my work, I use two general types—lower-cost pin meters, which require you to push two small metal pins into the wood surface—and more expensive, contactless meters.

Mini-Ligno S/DC. This pin-type moisture meter runs about $100. It's the first one I bought, and I still use it quite often, particularly for evaluating building materials before I install them or when scoping out a house that has suffered a flood or a leak.

With the Mini-Ligno, I can select from four scales: "Relative" compares different locations; I use this to establish the baseline moisture content in a known dry area to compare with other areas that may be wetter. "Drywall" checks the moisture content of drywall and plaster; in this case, the scale is set to a trigger point around 1% MC. In addition, the meter has two scales for wood, depending on how wet the wood is. In most cases, I do not concern myself with selecting different species of wood. I am more interested in relative readings.

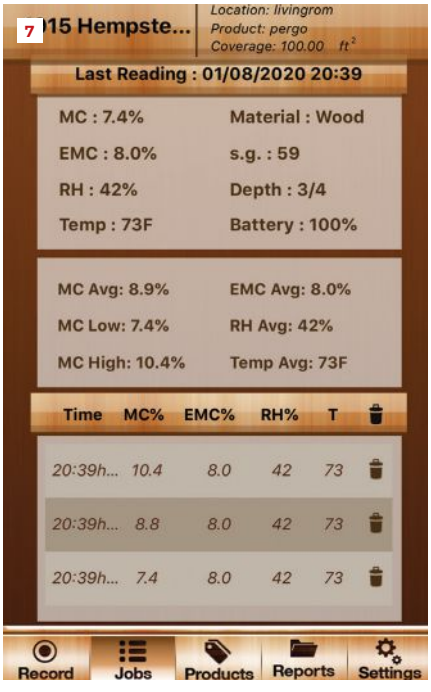
AccuMaster XT. There are lower-cost pin meters available that can provide accurate readings. One stand-out is the AccuMaster XT from Calculated Industries, which costs about $45. Its readings compare favorably to my Mini-Ligno's, and while it might not be as adjustable, it can still be adjusted to low, medium, and high percentage ranges for different types of materials and moisture levels. It would make a great starter meter for someone beginning to develop a habit of checking moisture content. If I succeed at anything with this article, I hope it's to persuade every contractor to use a moisture meter. Cost is not the issue.

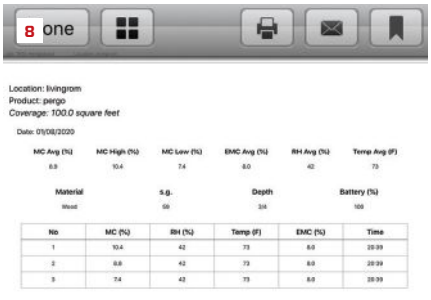
Delmhorst ProScan pinless moisture meter. This meter uses scanning technology to detect moisture below the surface of materials. The two main attractions of pinless meters are:

- Moisture detection to 3/4 inch.
- No marring of surfaces.

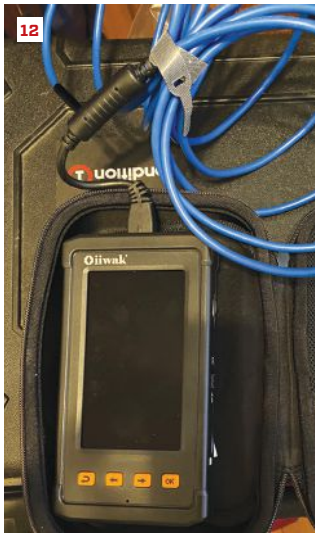
The ProScan can be set to several different species of wood and to a reference scale for nonwood materials. It is the first pinless meter I used, and I have always been satisfied with the reading. But recently, I have been attracted to devices that can also help me document jobs.

Wagner Orion 950 pinless meter. I like this pinless meter primarily for its ability to save and record several readings, including moisture content, equilibrium moisture content (EMC), relative humidity, temperature, time, date, and location. EMC is a particularly good reading for use in acclimating building materials—it's a calculation of the moisture content relative





The Orion 950 **(6)** is a contactless moisture meter that can deliver calculated results on the author's phone **(7)** and can send a report via email **(8)**.



The Kestrel 5200 **(9)** senses a broad range of environmental factors; for evaluating buildings, the author relies most often on the humidity ratio. He can read and record this device via Bluetooth on his phone **(10)** and share the results via email. The author also uses a pair of smaller, Kestrel D2 sensors **(11)** for measuring the humidity ratio at various elevations in a room. For looking into building cavities, he uses an Oiiwak borescope with a digital display **(12)**.

to the temperature and humidity recorded in the surrounding environment. It's the target moisture content, so to speak, for the actual environmental conditions of the space you're in.

DATA RECORDERS

Increasingly, I have become interested in not only measuring moisture in materials, but also tracking and recording environmental conditions on the jobsite. This helps me better understand condensation potentials and predict where problems might occur. There is quite a range of environmental data to measure, but for my purposes, what I find most useful is humidity ratio, or grains. When the humidity ratio is above 100, comfort and moisture problems tend to result.

Kestrel environmental data recorders. I use two types of recorders made by Kestrel: The larger 5200 is useful for more detailed reports, and the smaller D2 (I have two) I like for quick readings in attics, in crawlspaces, and on poles at various elevations in a room. These readings are essential to analyzing why certain things are happening.

For example, when there is water dripping from HVAC registers on high ceilings, I can attach one of the small D2s to a ZipWall pole and take temperature, relative humidity, and dew-point readings at the ceiling register to compare with readings at countertop height and floor level. I have discovered that in older homes when new high-SEER HVAC systems replace older, less energy-efficient systems, the newer system puts out colder air. And humid air, much like hot air, is buoyant. This means that the RH and dew point are likely to be higher near tall ceilings. Combine that with cooler air that may be cooling the register grille to below dew point, and you get dripping water. Using the Kestrel recorders, I am better able to document and explain what is happening. Both models allow me to capture a range of conditions and output those in an email to the client.

OTHER USEFUL GADGETS

So far, I have covered the most basic devices for measuring critical environmental conditions. Here are a few others I depend on.

Manometer. Measuring air pressure dynamics deserves its own article. Positive and negative pressures with reference to the outside play a big role in how a building takes in and expels air along with moisture and energy. Here in the hot, humid South, a negative pressure with reference to the exterior can pull hot and humid air into the interior, triggering moisture accumulation, microbial growth, staining, and compromised health. For measuring pressure dynamics, I use a Retrotec manometer (ones from Energy Conservatory are also highly recommended) to develop strategies for air-sealing and duct reconfiguration.

Borescope. For looking inside building assemblies, I use a 5.5mm Oiiwak borescope. The Oiiwak has a nice interface that allows me to capture and output images that I can share with clients.

Not to be left off this list of essential tools are those I use to capture the data: a smartphone, a tablet, and Rite in the Rain note pads (when it's pouring outside, I prefer not to pull out my electronics). These are essential and deserve a place in the case.

Bill Robinson is based in New Orleans, where he focuses on solving building envelope and hot/humid-climate performance issues. Follow him on Instagram: @bandannabil.

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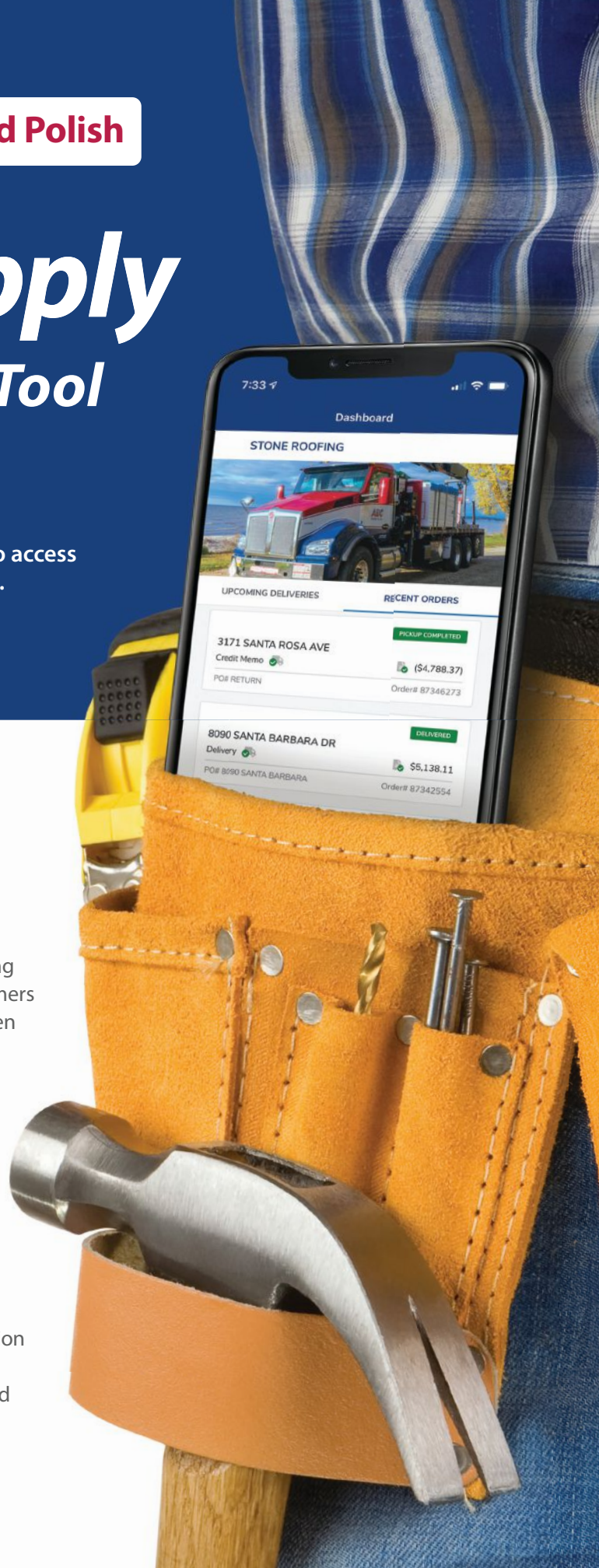

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BY ROB CORBO

The Future Is Now: Making Retirement Savings Work

IBIS World, a market research company reporting on businesses, estimates there are 455,608 remodeling companies in the United States employing 692,673 people. It reports that the top three remodeling companies account for less than 5% of total industry employment. The rest of the remodeling industry, including the trades, is dominated by sole proprietors and individually owned private companies with three to five employees, followed by a huge number of one-person businesses. The smaller the company, the fewer the revenues and resources, and the harder it is to plan for the future. We are an industry in crisis when viewed from the perspective of our retirement prospects.

SAVING OPTIONS FOR BUSINESS OWNERS

Individuals operating as a business can open a solo-401(k), which currently allows yearly contributions up to $57,000. If you can rake in enough income as an individual each year, you can set a decent amount aside and accrue something of a retirement in a fairly short time. But not all of us can do that as individuals. For the majority of us who are running small companies with employees, our retirement saving options are far more limited.

How does the owner of a small construction company with employees plan for retirement? There are several options that I will cover in other articles; here, I'll focus on the first, easiest answer: the lowly but powerful individual retirement account (IRA). I say lowly IRA because your contribution is limited to $6,000 a year if you are under 50 years old and $7,000 if you are 50 years of age or older. By comparison a 401(k) has an individual contribution limit of $19,500, a portion of which may be matched by the employer (though this is not available to the business owner). How do you compensate for the contribution difference? You start now, you never stop contributing, and you let time work for you. When it comes to saving for retirement, you can't start early enough, and it's never too late to start. The more time you have, the better.

The importance of time should not be underestimated. It is time that creates the power of compounding. Simply put, compounding means that when you make a profit on your original investment—perhaps through interest—the combined total of original investment and profit produces a larger investment base that then grows at an accelerated rate, exponentially. Albert Einstein has been reported to have said, "Compounding interest is the 8th wonder of the universe. He who understands it, earns it; he who doesn't, pays it." Establishing a retirement account, contributing to it annually, and leaving it to grow tax-free is an example of "he who understands it."

Say, for example, you invest $2,000 yearly into an IRA for 45 years (from 20 to 65 years old). At 5% interest compounded annually, your total contribution of $90,000 will earn $263,340 in interest, for an ending balance of $353,340.

IRA OPTIONS

Sole proprietors and employees of small businesses without retirement plans must save for retirement on their own. Three retirement saving accounts available for individuals are the traditional IRA, the spousal IRA, and the Roth IRA. The advantage of using an IRA to save versus saving outside an IRA is that the money contributed to an IRA is allowed to grow tax-free. Growing tax-free means your investment base is larger and your annual growth is greater.

When it comes to saving for retirement, you can't start early enough, and it's never too late to start.

The traditional IRA (maximum contributions $6,000/$7,000) is a tax-deferred investment vehicle. You must have taxable income equal to or greater than your contribution. The annual contribution is tax deductible as an adjustment to gross income on your federal tax return, lowering your adjusted taxable income. Funds are allowed to grow tax free until age 72 at which time required minimum distributions (RMD) must be withdrawn and added to your annual income. (When the traditional IRA was established in 1974, it was assumed you would make less money during retirement.) Early withdrawals are taxed as income and incur a 10% penalty. Nonspouse beneficiaries who inherit traditional IRAs have 10 years to close the account; distributions are added to their annual income.

A Roth IRA, unlike a traditional IRA, is not a tax deduction against income and is therefore not a tax-deferred investment. However, once you retire, withdrawals are tax-free, which is a beautiful thing. In addition, in case of an unexpected need, you can take contributions, but not earnings, before retirement without a

penalty. Earnings can be withdrawn tax-free starting at age 59 1/2, as long as the account has been open for at least five years.

Contribution limits are the same as for a traditional IRA—$6,000/$7,000 for individuals—but there are income conditions that cannot be exceeded. An adjusted gross income of up to $124,000 for an individual allows you the maximum contribution. Above that amount and up to $139,000, contribution limits are reduced.

A Roth IRA has no required minimum distributions at retirement age. Beneficiaries have no close-out date and are allowed to withdraw contributions at any time but must meet the five-year rule to withdraw earnings tax-free.

The spousal IRA was created by the passage of the 1981 Economic Recovery Tax Act. A spousal IRA is an opportunity for a couple to boost their retirement contributions. A nonworking spouse with little or no income can open a Roth or traditional IRA based on household income. Prior to 1981, contributions to an IRA were based on what you, not your household, made in a year.

RETIREMENT BENEFITS FOR EMPLOYEES

Finding money to contribute to an IRA can be challenging with life's everyday expenses competing for retirement dollars. But there are some answers for that, too.

In the example used above of how a retirement investment can compound, $2,000 was used for a reason: In business, $2,000 represents a one-dollar-an-hour charge for an employee year. An employee year is 40 hours a week for 50 weeks. One dollar an hour dedicated to retirement over 45 years, as the example shows, amounts to some serious money.

A remodeler can decide what hourly rate his market will bear, and add $1, $2, or $3 an hour for retirement benefits. Or, you can start with 50 cents an hour dedicated to retirement and increase the rate as your reputation and business grow. The important point here is to start now, no matter the amount, and let time work for you.

A sole proprietor who wants to provide a retirement benefit to an employee can follow the same strategy. A one-dollar-an-hour retirement charge paid as a $500 quarterly bonus with the understanding that it is to be used for retirement buys a lot of loyalty, reduces turnover, and helps you build your business.

The important point here is to start now, no matter the amount, and let time work for you.

A small business with fewer than 100 employees without access to another retirement account also has the option of creating a Savings Incentive Match Plan IRA—known as a SIMPLE IRA. It is a tax-deferred, employer-provided plan.

Under a SIMPLE IRA, an employee does not have to contribute to the plan, employees are immediately vested, and employer contributions are tax deductible. A SIMPLE IRA requires an employer to meet one of the following: Either match your employee's contribution up to 3% of their total salary or contribute 2% of their salary even if the employee does not make a contribution.

Employees can contribute up to $13,500 a year ($16,500 a year when 50 years old or older). SIMPLE IRAs are more detailed than a traditional or Roth IRA, so an accountant should be consulted to discuss its suitability for your business. Providing that benefit would no doubt enrich the lives of your employees, increase productivity, and up the quality of your hires.

Having a matching option is by far the best way to compound a retirement investment. For a business owner, it can be a great thing to provide to employees as a way to help attract and retain top talent. But for all the little guys, traveling the universe on their own, there's only one option: Start now. Cue up the Chambers Brothers: "Now the time has come. (Time); There are things to realize. (Time); Time has come today ..."

Rob Corbo, a frequent contributor to JLC, *is a building contractor based in Elizabeth, N.J.*

AZEK Exteriors

THIS EXTERIOR CONTRACTOR EARNS TEARS OF JOY

An unexpected homeowner reaction to a siding remodel project with cellular PVC trim.

You've probably had homeowners say thanks in all sorts of ways, like a handshake or, lately, an elbow bump.

"We had the entire back wall installed the first day," explains Kelly Wysienski, owner of South Carolina-based East Coast Exteriors, discussing a recent residential residing project.

"The owner returned from work, took one look, walked over to me and gave me the biggest hug with tears of happiness in her eyes '*It's so beautiful*,'" Wysienski says.

Fiber-cement siding highlighted with cellular PVC trim replaced the 28-year-old, over-caulked, over-repaired, and over-painted hardboard panels. "There was rot around the windows where water penetrated the Masonite," Wysienski says. "Repeated caulking and painting didn't help. The owners were tired of the hassles and expense."

Wysienski credits the trim for recasting the exterior with a clean, seamless look. A big contributor to the wow factor is the absence of caulk, nail penetrations, and touchups, thanks to AZEK J-Channel Trim Series, a comprehensive system of cellular PVC trim profiles that eliminates many of the downsides of traditional trim.

NO CAULK. NO NAILS. NO PROBLEM.

Wysienski is no fan of caulk or nails. With caulk, the homeowner faces deterioration and discoloration over time. With nails, unsightly penetrations, and ongoing touch-up expense. For contractors like East Coast Exteriors, time is the other factor. "My team puts up a 20-foot length of AZEK corner trim in 10 to 15 minutes. Compare that to the 30 to 45 minutes we used to take. It's not often you work with a product both the owner and the crew loves," she says, also noting other reasons to minimize caulk:

1. **Continuous expense.** "You have to re-caulk every two years or so because of caulk expansion and contraction. It cracks and peels."
2. **Joint headaches.** "Pre-finished fiber cement siding with fiber cement trim requires a welded joint." Applying a welded joint is a skilled craft that less experienced applicators can struggle with. "Even the best effort isn't good enough," she says.
3. **Higher labor cost.** Caulk is usually applied by specialized subcontractors. No caulk eliminates a significant installation step, saving time and money.
4. **It's ugly!** "When you eliminate caulk, you eliminate a lot of siding ugliness."

And one more: There's a far better solution available. "Every single trim piece was AZEK J-Channel trim," she reports. The product, as the name suggests, has the J-channel built-in which provides a pocket for fiber-cement siding to slide into providing a neat, caulk-free finish. When installing with premium vinyl siding, this all-in-one design eliminates the need to apply a separate J-channel pocket which eliminates extra labor and another seam. What's more, cellular PVC is impervious to moisture, mold, and rot, and painting isn't required, another time-saver.

WINNING EDGE

Wysienski has heard all the PVC trim arguments, notably expense. "I always ask, 'Do you spend 15 percent more now or twice as much in five years for replacement trim?'" she says

No trim product is perfect. But after 20-plus years in the business, Wysienski has seen more than her share of alternatives for trimming vinyl, fiber cement, and wood composite siding. About two years ago she made the switch to the J-Channel Series from AZEK, unheard of then in that market. Today? "It's everywhere," she reports. "All it takes is a few thanks you's like the one I received."

To learn more about trim and moulding products for your next project, visit **AZEKexteriors.com**.

Produced by Hanley Wood Strategic Marketing Services Group

Building a High-Performance Window Wall

Large triple-glazed windows create an energy-efficient alternative to traditional storefront glazing

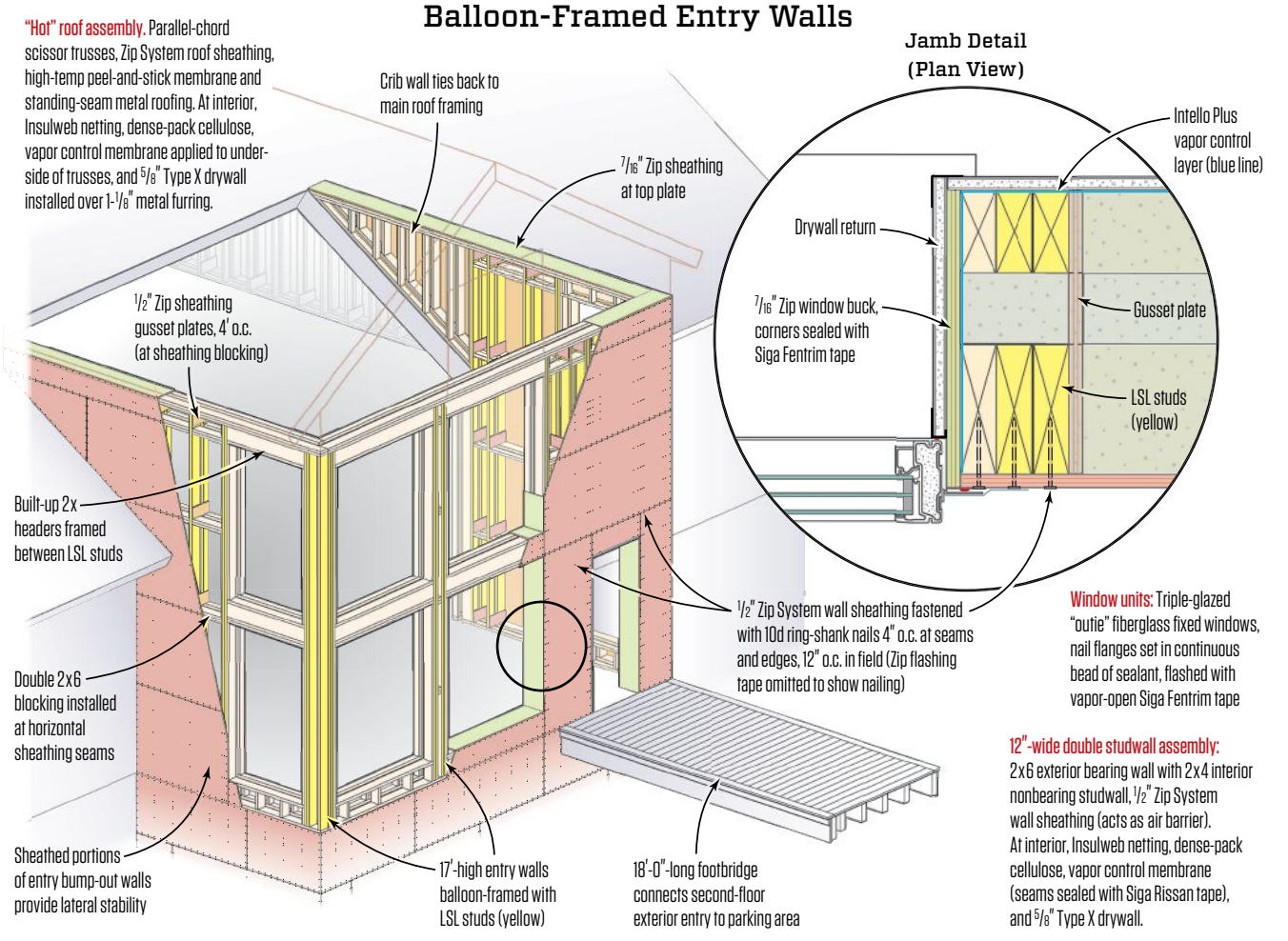
BY NATE HAYWARD

In June 2019, after years of leasing commercial office space, we broke ground on a new office building for my company, Hayward Design Build, in South Hero, Vt. Our firm is known for building high-performance custom homes and light-commercial buildings in northern Vermont, and we approached the construction of our new headquarters in the same manner.

Some of the building's high-performance features include a super-insulated double-wall shell with a carefully taped-off Intello Plus vapor control barrier membrane; triple-glazed windows set in rugged fiberglass frames (some with insulated glass units (IGUs) as large as 7 feet high by 6 feet wide); a VRV (variable refrigerant volume) mini-split system, which supplies heating and cooling to offices and common areas with localized thermostats that allow occupants to control the temperature of individual spaces; and two large-capacity ERV (energy recovery ventilator) units to provide a balanced air supply throughout the building.

Architectural features. The building was designed to accommodate multiple tenants on three floors. On the second- and third-floor mezzanine levels, we planned for shared office space split between my design-build company, a local law firm, and a real estate company,

Photos and illustration by Tim Healey



LSL members were used to balloon-frame the bump-out entry's 17-foot-high wall, while 2-by stock was used to infill shorter-length pieces such as trimmer studs, sills, and blocking. Sheathed areas on the south, east, and west walls helped provide lateral stability to these tall walls with big openings (the sheathing was nailed off per an engineer's specifications).

while the first floor was divided into two units, one occupied by a local catering company. We provided at-grade access to the first and second floors, which eliminated the expense of installing an elevator to meet ADA requirements (the third-floor mezzanine has less than 1,000 finished square feet and doesn't require ADA access).

Structural. The wall system throughout the entire building is a 12-inch-thick double-stud wall with a 2x6 exterior bearing wall and 2x4 nonbearing interior wall—the thick wall is essentially an insulation holder for dense-pack cellulose. A structural engineer helped design a steel frame, which was needed to support the wood I-joist floor system on multiple floors and the quadruple-ply ridge beam truss running the length of the building. The "hot" roof was framed with parallel-cord trusses, dense-packed, and the roof sheathing was covered with a high-temperature self-adhered roofing underlayment, then metal roofing.

Tall walls with big openings. The south-facing bump-out entry was a transverse gable-end wall. We used engineered LSL studs to balloon-frame the entry's 17-foot-high double-stud walls, installing them one stick at time rather than building the wall and standing it up, then infilled with 2x6 and 2x4 stock as needed for shorter-length pieces like jack studs, sills, and blocking (see illustration, above).

We sheathed the walls with 1/2-inch Zip System sheathing. We provided double 2x6 horizontal blocking between LSL exterior-side studs at horizontal seams and nailed off the sheathing in a tight pattern per the structural engineer's specifications (the small sheathed areas on the bump-out's south, east, and west walls helped provide

Selecting a High-Performance Window Package

A common challenge with office buildings and HVAC is satisfying the comfort level of all the occupants. Battles for control over too few, centrally located thermostats can be commonplace. Combine this with occupants cracking open windows to cool off, warm up, or let in fresh air, and you have the recipe for an unbalanced, inefficient HVAC system.

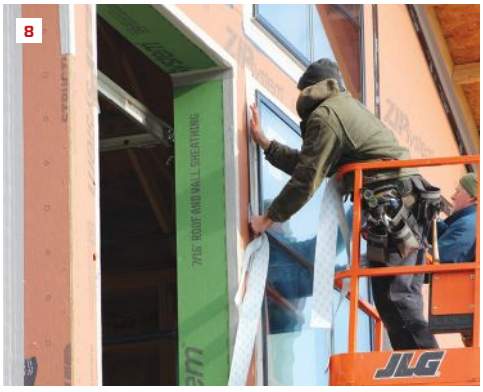
In an effort to mitigate these issues, we installed a VRV mini-split system with localized thermostats allowing occupants to control the temperature of their individual offices and small common areas. For fresh air, we installed two large-capacity Zehnder ComfoAir Q600 ERV units to provide a balanced air supply throughout the building. The planned ERV units afforded us the opportunity to install mostly fixed windows throughout the building, the simple design of which provided substantial savings in window costs and later, energy. After a year of occupancy, the combination of the VRVs, ERVs, and fixed high-performance windows has proved to be a success. Although on occasion, occupants have cracked open some of the few code-mandated operable egress windows, which necessitated a polite request to close them and rely on the HVAC system.

Window options. All-fiberglass window frames are durable, and I like that they are silica-based products that will expand and contract a bit with the glazing. So I selected Fibertec Windows (fibertec.com) out of Canada. Its 300-Series windows offer triple-pane glazed windows in sturdy 3¼-inch-deep fiberglass frames, and they're available in large sizes (the 7'-0" x 6'-0" windows we used for the entry were the maximum size they make). The windows' IGUs are one piece of glass with simulated divided light (SDL); the SDL effect is created with 1⅞-inch-wide surface-applied muntins.

The U-Factor numbers of the Fibertec windows are pretty phenomenal at 0.14 to 0.17 (0.32 or less is considered a good U-factor in a cold climate). The company was amenable to our using different specialty coatings for the windows on different sides of our building, which is not always the case with window manufacturers. Our window glazing package included a higher SHGC (solar heat gain coefficient) of 0.46 for south-facing windows, while on east-, west- or north-facing windows, we selected a lower SHGC of 0.27. The visible transmittance (VT) numbers increased with the rise in solar heat gain coefficient (see photos, below) *—N.P.*

East-, west- and north-facing windows had an SHGC of 0.27 (above left), while south-facing windows had a higher SHGC of 0.46 (above right). Crew members move a 7-foot-high-by-6-foot wide, 500-pound fixed window to the lift staging area on a footbridge that connects the entry to the parking area; they pass under a wall-mounted mini-split unit in the entry's reception area (right).

Prior to installing the big windows, the crew cuts Zip System Stretch Tape flashing to length inside **(1)** and installs it on the sill **(2)**. Four crew members manhandle the 500-pound window onto the lift, transferring the unit from a carpeted mover's dolly using 8-inch-diameter hand-held vacuum cups to grip the unwieldy window **(3)**. The JLG rental lift is equipped with a "skyglazer" tray to support the base of the window. The unit is attached to the personnel cage with rachet straps, with pieces of XPS insulation used as padding. Prior to installation of the window, a continuous bead of Geocel Pro-Flex tripolymer sealant is applied around the opening where the window nailing flange will be set **(4)**.



The window is set on 1/2-inch bearing blocks, then leveled from the interior **(5)**. The nailing flanges are nailed off with stainless steel roofing nails **(6)**. Before the crew installs the vapor-open sill flashing tape, a dab of sealant is applied to each corner to seal the opening where the window frame and nailing flanges intersect **(7)**. After the sill flashing tape is installed, tape is applied over the open corners (see photo 11, facing page). Then the jamb flashing tape is applied **(8)**. The top inch of the tape is peeled back and the tape worked down the window to adhere it a few inches at a time. The jamb tape is lapped onto the sill flashing tape.

After the jamb flashing strips are installed, pieces of Siga tape are applied at the "open corners" at the top of the window unit on both sides **(9)**. The head flashing strip is then applied, lapping onto the jamb flashing **(10)**. On a lower window, a small piece of flashing tape is added to seal the intersection of the three planes **(11)**. The four large south-facing window units are installed working counterclockwise from the top right. Here, the last of the 7'-0" x 6'-0" entry windows is installed **(12)**. Four smaller, 420-pound fixed windows on the east and west walls (two per wall), as well as a window unit high in the gable-end wall, were installed on the previous days. The finish entry is clad with Galvalume siding over a drainable housewrap **(13)**.

lateral stability to these tall walls with their big openings). Finishing up the wall framing, we joined the two stud walls together with plywood gusset plates at 4-foot centers and installed crib walls to tie back to main building's roof framing. After we installed and taped off the remaining Zip System sheathing, we set the entry's parallel-cord scissor roof trusses, which ran back to the main ridge.

Muscling windows into place. It took four crew members using 8-inch hand-held vacuum cups (wpg.com) to lift the 500-pound window onto a carpeted mover's dolly. The unwieldy unit was then rolled out onto the footbridge, which was used as a staging area to lift the windows into place. The JLG 600S rental lift came equipped with a "skyglazer" tray attached to supporting forks under the lift's personnel basket. Again, using the vacuum cups, we lifted the window into the tray, padded it out with pieces of XPS insulation, then attached the unit with rachet straps and lifted it up to the rough opening. The unit was placed on setting blocks on either end of the opening and leveled as needed. The windows were then sealed and flashed (see photos 1 to 12 for the flashing sequence).

Finishing up. We installed Hydrogap drainable housewrap over the Zip System sheathing to provide a small drainage plane and installed Galvalume siding on the entry bump-out's three walls.

Nate Hayward is the owner and principal of Hayward Design Build, in South Hero, Vt.

ADVERTISEMENT

If You Are a Single Family Home Owner in the United States with Allura Fiber Cement Siding

You Could Get Benefits From a Class Action Settlement

Para una notificación en Español, llamar o visitar nuestro website: www.PlycemSidingSettlement.com

WHO IS INCLUDED?

Single family homeowners with Allura branded fiber cement lap siding manufactured in Plycem's plant located in White City, Oregon between February 1, 2014 and May 7, 2014 or in Plycem's Roaring River, North Carolina plant between February 1, 2014 and February 18, 2015 ("the Siding").

WHAT IS THIS CASE ABOUT?

Plaintiffs allege that due to fly-ash in the Siding formula, the Siding is prone to cracking, bowing, shrinking, warping, breakage, or gapping. Defendants contend that the Siding is not defective and performs well when installed properly. The Court has not made any determination as to the quality of the Siding.

WHO REPRESENTS YOU?

The Court has appointed six law firms to serve as Class Counsel on your behalf.

Lead Class Counsel plans to request attorneys' fees, costs, and expenses of up to $4,000,000 in the aggregate, which will be paid from the Fund. These fees, costs, and expenses and service awards will be decided by the Court and will be paid by Defendants. The Court may award less than this amount. The payment of attorneys' fees, costs and expenses, and the service awards will not reduce the benefits to the Settlement Class.

WHAT DOES THE SETTLEMENT PROVIDE?

The Settlement covers claims for Qualifying Damage, evidenced by cracking, bowing, shrinkage, warping, breakage, or gapping in the Siding not caused by improper installation and, if available, evidence of the alleged property damage resulting from such failed Siding. Eligible claimants can choose between three compensation options: (1) a repair and replacement option that provides compensation for replacement siding and $4.75/square feet for additional costs for installation, labor, painting, and other work on an elevation where Qualifying Damage exists on more than 30% of the elevation; (2) a quick cash option that provides $4.25/square foot for areas exhibiting Qualifying Damage; or (3) a cash option that provides additional compensation for labor upon proof of repair. This option is only available for claims with Qualifying Damage that does not exceed 30% of an elevation. Under this option, eligible claimants receive $4.25/square foot for areas exhibiting Qualifying Damage within 30 days of final approval of the claim, plus $4.25/square foot for the remainder of the elevation within 30 days of submission of approved proof of replacement of the claimed area.

WHAT ARE YOUR OPTIONS?

If you exclude yourself, you cannot get money or benefits from this lawsuit if any are awarded, but you will keep any rights to sue about these claims and will not be bound by any orders or judgments in this case. The detailed notice explains how to exclude yourself. The deadline for exclusions is **March 18, 2021**.

Get a detailed notice and other information by visiting:
www.PlycemSidingSettlement.com
or by calling toll free (844)530-0355

Adobe Stock

The Strength of Wood

Wood is exceedingly strong, but it's a mistake to assume that the wood safety factor in engineering designs is excessive

BY JLC STAFF

The strength of wood is typically measured by a number of "strength properties," including:

Modulus of rupture in bending. This reflects the maximum load-carrying capacity of a wood framing member in bending, and is proportional to maximum moment borne by the test specimen.

Work to maximum load in bending is the ability to absorb shock with some permanent deformation and more or less injury to a specimen. Work to maximum load is a measure of the combined strength and toughness of wood under bending stresses.

Compressive strength parallel to grain. Also known as the maximum crushing strength, this is the maximum stress sustained by compression applied in line with the grain to a specimen having a ratio of length to least dimension of less than 11.

Compressive stress perpendicular to grain is the maximum stress sustained by a compression force applied perpendicular to the grain. This is reported as a proportional value. There is no clearly defined ultimate stress for this property.

Shear strength parallel to grain is the ability to resist internal slipping of one part upon another along the grain. Values presented in design tables are average strength in radial and tangential shear planes.

Tensile strength perpendicular to grain is the resistance of wood to forces acting across the grain that tend to split a member. Values presented are the average of radial and tangential observations.

Tensile strength parallel to grain is the maximum tensile stress sustained in direction parallel to grain. Relatively few data are available on the tensile strength of various species of clear wood parallel to grain. In the absence of sufficient tension test data, modulus-of-rupture values are sometimes substituted for tensile strength of small, clear, straight-grained pieces of wood.

Grading rules limit the number of knots in structural lumber because the distortion of grain around the knot reduces a board's strength. All these tight, intergrown knots **(1–3)** are in #2 SPF. The severe checks in knot 3 occurred at drying; it is the only kiln-dried sample shown here. A loose, or encased, knot **(4)** resists (or transmits) little or no stress, but there is usually less distortion of grain around one, and therefore it is graded as equivalent to a tight knot of equivalent size.

As for many properties of wood, the basis for these measurements assumes clear, straight-grained wood. But wood products used for building structures vary because of the natural growth characteristics of trees—knots and the localized slope of grain—plus a number of natural defects caused by biological or climatic elements influencing the living tree.

GRADING LUMBER

Lumber producers have graders who grade every piece of lumber as it is produced. The key factors considered in the grading process are knots and slope of grain. Grading also considers a low number of growth rings per inch in some species (for example, southern pine) as a visual indication of the presence of low-density material and, to some extent, juvenile wood. The regional inspection groups, which monitor the process, visit each mill at least 10 times a year to check the grading. These regional groups contend that mill-based inspectors are better trained and more sophisticated now than at any time in the past. Because of this improved inspection process, structural lumber reaching lumberyards today is more "on grade" than in years past. So even if some of today's lumber looks worse than in days gone by, builders have great assurance that a piece of lumber graded "No. 1" will perform at its grade level.

Photos: Clayton DeKorne

This framer has optimally oriented this board **(5)** for use as a stair stringer, keeping the knots closest to the compression (top) side where they will have the least effect on strength. Laminated veneer lumber (LVL) is stronger than comparably sized sawn lumber in part because any natural defects like knots and splits are only one ply deep.

Knots and slope of grain are two of the characteristics used to sort lumber visually into stress grades. Others include splits that appear as the lumber dries, shake, density, decay, annual ring count and percentage latewood, pitch pockets, and wane.

KNOTS

The influence of a knot on the mechanical properties of a wood member is due to the interruption of continuity and change in the direction of wood fibers associated with the knot. The influence depends on size, location, shape, and soundness; attendant local slope of grain; and type of stress to which the wood member is subjected. The shape (form) of a knot on a sawn surface depends upon the direction of the exposing cut. A nearly round knot results when lumber is sawn from a log and a branch is sawn through at right angles to its length (as in a flatsawn board). An oval knot is produced when the saw cut is diagonal to the branch length (as in a bastard-sawn board), and a "spiked" knot when the cut is lengthwise to the branch (as in a quartersawn board).

Although a knot itself is as strong as the rest of a piece of wood, the area near the knot is weak because of cross grain. If a piece of lumber is milled from a green log, the knot is said to be "tight." If the growth layer of the tree is dead, however, the knot will be loose or will fall out when sawn.

In general, knots have a greater effect on strength in tension than compression; in bending, the effect depends on whether a knot is in the tension or compression side of a beam (knots along the centerline have little or no effect).

Intergrown (or live) knots resist (or transmit) some kinds of stress, but encased knots (unless very tight) or knotholes resist (or transmit) little or no stress. On the other hand, distortion of grain is greater around an intergrown knot than around an encased (or dead) knot of equivalent size. As a result, overall strength effects are roughly equal, and often no distinction is made in stress grading between intergrown knots, dead knots, and knotholes.

In tension, knots along the edge of a member cause an eccentricity that induces bending stresses, and they should therefore be more restricted than knots away from the edge. In simply supported structural members subjected to bending, stresses are greater in the middle of the length and at the top and bottom edges than at midheight. Some grades account for these facts by having different limitations on the sizes of knots in different locations.

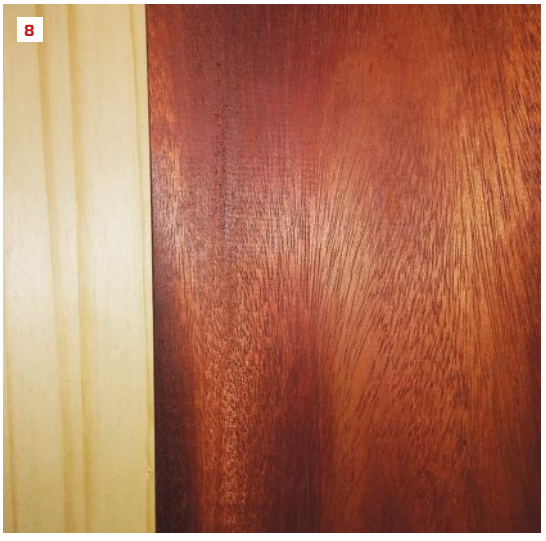
Knots have a greater effect on the strength of wood loaded in axial tension than in axial short-column compression. The effect on tensile strength manifests most often in a beam in bending: In a simply supported beam, a knot on the lower side (the side subjected to tensile stresses) will compromise a beam's ability to support a load more than a knot on the upper side (the side subjected to compressive stresses).

In long columns, knots are important because they affect stiffness. In short or intermediate columns, the reduction in strength caused by knots is approximately proportional to their size; however, large knots have a somewhat greater relative effect than small knots do. Knots in round timbers, such as poles and piles, have less effect on strength than do knots in sawn timbers. Although the grain is irregular around knots in both forms of timber, the angle of the grain to the surface is smaller in naturally round timber than in sawn timber. Furthermore, in round timbers, there's no discontinuity in wood fibers, which results from sawing through the grain.

SLOPE OF GRAIN

The term "slope of grain" relates to the fiber direction relative to

Photos: 5, Tim Uhler; 6, Ted Cushman



Bark pockets often occur when bark gets trapped by the tree's growth at the crotch of a tree, evident here **(7)** by the grain pattern of the center board. Interlocked grain can be identified by bands of alternating grain **(8)**, as in this purpleheart board at right, which is shown next to a pine board for comparison.

the edge of a piece of wood. In ordinary lumber, two important forms of cross grain are spiral and diagonal, though there are others, such as wavy, dipped, interlocked, and curly.

Slope of grain reduces the mechanical properties of lumber because the fibers are not parallel to the edges. Severely cross-grained pieces are also undesirable because they tend to warp with changes in moisture content. Stresses caused by shrinkage during drying are greater in structural lumber than in small, clear, straight-grained specimens and are increased in zones of sloping or distorted grain. To provide a margin of safety, the reduction in design properties resulting from cross grain in visually graded structural lumber is considerably greater than that observed in small, clear specimens that contain similar cross grain.

Spiral grain is caused by winding or spiral growth of wood fibers about the bole of the tree instead of vertical growth. In a sawn board, spiral grain can be defined as fibers lying in the tangential plane of the growth rings, rather than parallel to the longitudinal axis of the board.

A visual method of determining the presence of spiral grain is to note the alignment of pores, rays, and resin ducts on a flatsawn face. Drying checks on a flatsawn surface follow the fibers and indicate the slope of the fiber.

Diagonal grain is cross grain caused by growth rings that aren't parallel to one or both surfaces of the sawn piece. Diagonal grain is produced by sawing a log with pronounced taper parallel to the axis (pith) of the tree. Diagonal grain also occurs in lumber sawn from crooked logs or logs with butt swell.

Interlocked grain. A regular reversal of right and left spiraling of grain in a tree stem produces the condition known as interlocked grain. Interlocked grain occurs in some hardwood species and markedly increases resistance to splitting in the radial plane. Interlocked grain decreases both the static bending strength and stiffness of clear wood specimens. The presence of interlocked grain alters the relationship between bending strength and compressive strength of lumber cut from tropical hardwoods.

Other common defects due to the natural growth of trees include:

Bark pockets are small patches of bark embedded in dressed lumber. They usually only affect appearance, but they can reduce the withdrawal strength of a nail or screw. Grading rules limit the amount of bark, but because of its location near the outside of the tree, it may pass graders' tests for strength and stiffness.

Checks and splits. Checks are separations of the wood that normally occur across or through the annual rings, usually as a result of seasoning. Splits are a separation of the wood through the piece to the opposite surface or to an adjoining surface caused by tearing apart of the wood cells. Unlike shake, checks and splits are rated only by the area of the actual opening. An end-split is considered equal to an end-check that extends through the full thickness of the piece. The effects of checks and splits on strength and the principles of their limitation are the same as those for shake.

Shake is a separation or a weakness of fiber bond, between or through the annual rings, that is presumed to extend lengthwise without limit. Because shake reduces resistance to shear in members subjected to bending, grading rules restrict shake most closely in those parts of a bending member where shear stresses are highest. In members with limited cross grain that are subjected only to tension or to compression, shake does not affect strength greatly. Shake may be limited in a grade because of appearance and because

Photos: 7, Justin Cline; 8, Clayton DeKorne

As they dry, boxed heartwood beams (with full-circle growth rings) tend to check **(9)** more than free-of-heart beam stock does. However, the effect of center splits, while dramatic looking, minimally impacts strength. Wane **(10)** is common on ungraded framing stock in old buildings. However, it is rarely a structural problem except when it reduces the bearing area of a beam.

it permits entrance of moisture, which results in decay.

Density. Strength is related to the mass per unit volume (density) of clear wood. Properties assigned to lumber are sometimes modified by using the rate of growth and percentage of latewood as measures of density. Typically, selection for density requires that the rings per unit length on the cross section and the percentage of latewood be within a specified range. Some very low-strength pieces may be excluded from a grade by excluding those that are exceptionally low in density.

Decay in most forms should be prohibited or severely restricted in stress grades because determining the extent of decay is difficult, and its effect on strength is often greater than visual observation would indicate. Some decay that occurs in knots may be permitted if the decay does not extend into the surrounding wood.

Heartwood and sapwood. Heartwood does not need to be taken into account in stress grading because heartwood and sapwood have been assumed to have equal mechanical properties. However, heartwood is sometimes specified in a visual grade because the heartwood of some species is more resistant to decay than the sapwood is; heartwood may be required if untreated wood will be exposed to a decay hazard. On the other hand, sapwood takes preservative treatment more readily than heartwood does, so it's preferable for lumber that will be treated.

Pitch pockets ordinarily have so little effect on structural lumber that they can be disregarded in stress grading if they are small and limited in number. The presence of a large number of pitch pockets, however, may indicate shake or weakness of bond between annual rings.

Wane refers to bark or lack of wood on the edge or corner of a piece of lumber, regardless of cause (except manufactured eased edges). Requirements of appearance, or the need for full edge bearing, generally impose stricter limitations on wane than strength does. Wane is therefore limited in structural lumber.

OVERCOMING DEFECTS

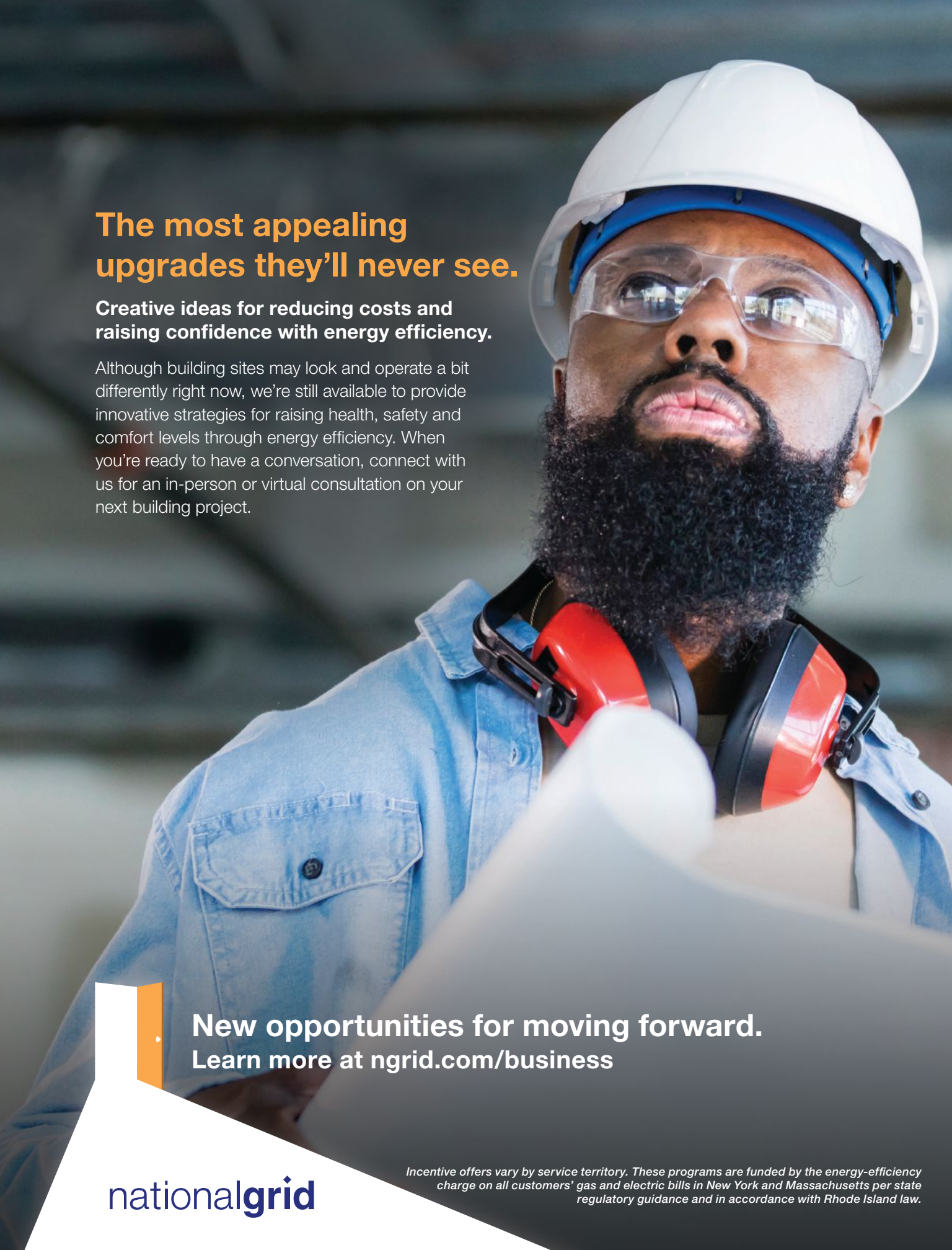
In the design of a wood structure, engineers apply safety factors to account for reduced strength, since you can't test and tabulate every defect in the lumber used in a building. Here's how safety factors work:

To arrive at the design values used in wood building design, thousands of pieces of lumber of representative sizes, grades, and species are tested. Tests are run for about 10 minutes to determine the stress that will cause a piece of lumber to fail. The test data for every piece of lumber of a given grade, size, and species is recorded. In a test of bending strength, for example, the values from a batch of lumber might range from 3,000 to 15,000 psi. By convention, the value of the fifth percentile is calculated (in other words, 95% of the pieces tested fall above this number, 5% below). Choosing a value at the fifth percentile is a way of accounting for the wide variability in the strength of pieces of visually graded lumber (due to knots, slope of grain, and so on).

This number—let's say 4,000 psi—is then divided by 1.62 to convert it to a 10-year-duration value, the load duration that's used in the design of wood floor systems. (Remember, the test lasts only 10 minutes; lumber can resist more stress for short periods.) Finally, the 10-year value is divided by a safety factor of 1.3. So a fifth percentile value of 4,000 psi would become 1,899 psi. This is the number published in the allowable design stress tables.

It's a grave mistake to make design decisions based on an assumption that the wood safety factor is excessive.

Photos: 9, Adobe Stock; 10, Clayton DeKorne



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professional deck builder

March 2021

TIM HEALEY

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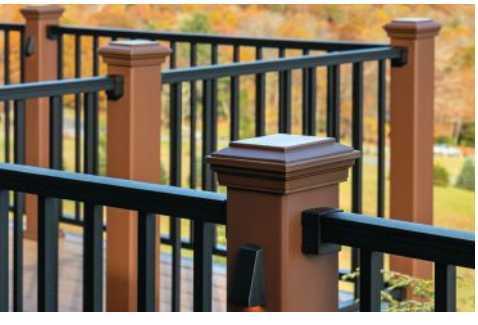

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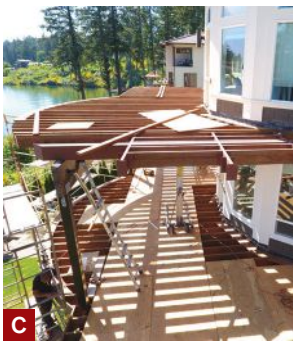

To complete the curved detail on the top deck (A), a custom-fabricated steel girder (B) was required. Bolted to the deck framing and house (B, C), the girder doesn't require a support post (D).

A Curved Deck With a Hidden Framing Secret

by Jason Russell

In pre-COVID times, one of my largest and most challenging projects was a 2,500-square-foot deck and matching dock system, part of an extensive outdoor living project for a home on Lake Tapps, in Washington. For the deck's multiple levels across the home's lakeside elevation, one of the organizing design elements is a pair of stacked, semi-circular balcony-style projections extending from the home's central turret.

The framing for the second-story curved balcony was straightforward, with 2x12 pressure-treated (PT) hemlock joists cantilevered over the deck's 6-inch-by-24-inch dropped PT glulam beam. Forming the curve was a simple matter of swinging an arc across the cantilevered joists and cutting them to length. On the third story, however, the curve circles all the way back to the house. Figuring out how to frame this section—an unsupported 4-foot-deep curved cantilever—without installing another support post or interfering with the planned underdeck drainage system was a head-scratcher.

The solution that our engineer devised for this framing problem is my favorite feature on the deck, but one that is

PHOTOS BY JASON RUSSELL

After covering the girder with two layers of 3/4-inch marine plywood to provide a nail base for the decking fasteners (A), the author covered the plywood with a layer of self-adhering butyl roofing underlayment (B). Underdeck drainage systems on the upper and lower decks capture water in EPDM troughs hung between the joists, funneling it into gutters hung off the support beams (C). The hidden steel girder eliminates the need for an additional support post (D).

hidden from view: a 1,200-pound steel girder hidden inside the third-story deck framing. Fabricated primarily from 2-inch-by-10-inch and 6-inch-by-10-inch rectangular steel tube, the assembly is bolted to the deck framing, the dropped glulam beam, and an existing glulam rim joist inside the house framing.

With no crane available to lift the massive girder into place and only a two-man crew, installation required a bit of Egyptian-style ingenuity. I began by flipping the forks on my skid steer upside down and used those to carefully hoist the girder up onto the lower deck. From there, my helper and I leveraged the girder into position, then set up two Genie manual 650-pound-capacity lifts (one that I own and one that I rented for this project) and began cranking away.

After the girder was lifted into position and bolted to the deck and house framing, we installed two layers of 3/4-inch treated marine plywood over the steel to match the 11 1/2-inch height of the wood deck framing and provide a fastening base for the decking's hidden fasteners. On top of the plywood, we laid down sheets of Grace Ultra self-adhering roofing membrane.

Instead of trying to kerf PT lumber to create curved rim joists, I like to use composite deck boards, which conform to a curve more smoothly. On this project, I installed an upper and lower rim board, with a 1/2-inch gap between them so that they were flush with the tops and bottoms of the 11 1/2-inch-wide joists. Then I covered the rims with a two-piece fascia detail.

Under both the upper and lower decks, we installed site-built underdeck drainage systems using EPDM pond liner material. This creates a lot of usable outdoor living space, even in the rainy Pacific Northwest.

The entire structure rests on four engineered 4-foot-square footings and PT glulam posts specced by our engineer (standard 6x6 posts weren't quite strong enough). Most of the sawn framing is evenly spaced on 14-inch centers, but under the hot tub on the upper level, the joists are spaced 6 inches on-center. It took two of us about seven months to complete the project. ❖

Jason Russell owns Dr. Decks, in Tacoma, Wash. Follow him online at @drdecks on YouTube, Instagram, or Twitter, or go to drdecks.com.

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An Advance in Steel Deck Framing

An experienced steel-deck builder checks out the Fortress Evolution framing system

by Dan Watson

My company has built numerous outdoor living projects using a multitude of materials and products, but when it comes to the framing for decks, our go-to has been light gauge steel (LGS). When we first started using LGS approximately seven years ago, it was new to the market and the options were limited. With the help of our architect and approval of the local building inspector, we cobbled together our first design from several LGS manufacturers.

Since that time, it has become easier to obtain steel deck framing materials, with several manufacturers now offering exterior steel decking products. On our most recent deck project, the homeowners wanted to use Fortress Evolution steel framing, primarily because they liked the look of the framing once completed. Because the deck is 11 feet above grade, the underside would be highly visible.

Corrosion-Resistant Design

Evolution framing has a duplex coating system—the steel is first galvanized and then powder-coated—which drastically increases the expected life span of the steel, even in harsh conditions. Because of this corrosion protection, Fortress offers a 25-year limited warranty on the product (10 years when installed within one mile of saltwater).

This compares favorably with pressure-treated (PT) lumber, which in our area is southern yellow pine, though even the premium PT products containing water repellents and mold inhibitors don't have the same life expectancy as the CCA-treated lumber of the past. Meanwhile, several composite-decking manufacturers offer 30- to 50-year warranties on their products. To us, it didn't make sense to frame a deck with PT or LGS (neither came with warranties a few years ago) to support decking that's expected to last several years or even decades longer than the framing. Now that there are manufacturers backing their framing products with warranties, it is easier to upsell premium decking products to our clients.

System Details

For help with our project, we contacted

PHOTOS BY DAN WATSON

Figure 1. In the Evolution system, ledger brackets are screwed to the S-ledger, or fit into punched openings in the S-ledger without requiring additional fasteners (A). In comparison, an LGS ledger track has bent tabs for fastening the joists to the ledger (B) and requires five or more fasteners per joist-to-ledger connection. Evolution joists just slip over the brackets, and are held in place with a pair of screws per bracket (C).

the Evolution design staff, who provided us with technical help, material take-offs, and help with engineering. Load and span charts for the joists and beams are available in the company's detailed installation instructions, where you'll also find typical designs and spans for both single and double beams. With the documentation and guidance provided by Fortress, our architect was able to produce drawings that allowed for the most efficient use of the materials, with limited waste.

Ledgers. Evolution has a unique ledger and joist-hanger system. Its S-ledger, which comes in 12-foot or 20-foot lengths, is available prepunched with standard 12- or 16-inch-on-center spacing. Matching ledger brackets are then inserted into those openings before the ledger is fastened to the house. The ends of the joists then slide over the brackets. Because only one screw is needed on each side of a joist to attach it to a bracket, laying out and installing the joists is much faster than with other systems we've used (**Figure 1**).

The ledger also comes with prepunched 3/8-inch-diameter holes for attachment to the house; somewhat like with joist hangers, a fastener is required in each hole. If local building codes require larger-diameter fasteners, the factory-drilled holes can be enlarged. For this project, the architect specified 1/4-inch-diameter fasteners with tapered shafts that fit perfectly in the openings.

To support the other end of the joists, prepunched, prespaced U-Rim Joists are available, though these aren't the only rim-joist options. Where the start points of the ledger and rim align, no measuring is needed to install the joists.

On this deck, we needed to space some of the joists 12 inches, rather than 16 inches, on-center to support an outdoor kitchen. For nonstandard spacing of joists, there are solid ledger and rim joists available, along with adjustable joist brackets. Changing the ledger and rim to accommodate the closer

Figure 2. Evolution support posts are sized to fit standard 4x4 PT post hardware, such as the U-shaped helical pier brackets used on this project (A). The beams measure 2 inches by 11 inches and can be fastened together with tracks at both top and bottom to form double beams (B). The author found that the tracks—which can also be used with the joist material, but are available only in 4-foot lengths—made multi-ply beam assembly more labor-intensive than with LGS framing (C) and added to the size of double beams and joists.

joist spacing for those areas was easy and made layout simple and mistake-free. When, for example, additional joists for decking are needed or blocking for railings is required, we can use F50 brackets to attach the joists to the ledger and rim, similar to the way we frame LGS decks.

Posts and beams. Like 4x4 PT wood posts, Evolution steel columns measure 3½ inches by 3½ inches. Because they install the same way, they can be attached to standard footings using post brackets. Fortress also manufactures a column base that can be used with concrete footings, though on this project the posts are supported by 10 Techno Metal Post P2 helical piers. TMP's standard U-shaped bracket for 4x4 wood posts perfectly fits the Evolution column, and the fastener holes were the correct size for the screws specified by Fortress **(Figure 2)**.

Evolution beams are designed for long spans between support columns. Measuring 2 inches by 11 inches, the rectangular beams can be either a single or double, depending on the load and span. They can also function as either drop or flush beams. The longest beam span on this deck was 15 feet 6 inches, but according to the load charts provided by Fortress, the beams can span up to 20 feet.

To create a double beam, 4-foot-long top and bottom tracks, similar to steel stud tracks, have to be fastened to the beams. We did not fully account for the time and materials required for this assembly; compared with wood or LGS multi-ply beams, these took longer to put together and created inconsistent heights and widths for the beams. Because we had temporarily built part of the deck and set elevations before all the materials were on site, we needed to adjust the column heights because of the unexpected thickness of the final beam assembly.

Joists. Unlike the C-shaped joists in LGS and some other steel framing systems, Evolution joists are rectangular tubes. With a look that mimics a more traditional wood-framed deck, the joists are a full 2 inches wide by 6 inches deep, and are available in 12-foot to 20-foot lengths. We used 16-gauge framing on this project; 18-gauge also is available. Compared with LGS, the rectangular joist shape allows for longer spans, doesn't hold water on the bottom leg (holes along the bottom edge of the framing members allow for drainage), and eliminates the possibility of the top leg bending down when the decking is fastened.

Another major advantage of the Evolution framing over LGS is that the system requires fewer fasteners. For example, there are several areas of LGS-framed decks that require a boxed joist, where track is connected to the joist to create a tube. This requires additional material, changes the height of the framing in that location, and requires fasteners through the top leg of the joist, which pose a problem when decking. We use rivets when possible, but they have a reduced load

Figure 3. Evolution joists measure 2 inches by 6 inches and can be fastened to dropped beams either with 12- or 16-inch-on-center blocking brackets (A) or with F10 angle brackets (B). Cantilevers of up to 5 feet are possible with the steel joists, which here are capped at the ends with U-Rim Joist material (C). The maximum beam cantilever is 24 inches.

Figure 4. Where joist spans exceed 8 feet, midspan blocking is required, typically with Evolution prenotched 12- or 16-inch-on-center straps. Here, the straps simply lie across the tops of the joists and don't require fasteners (A), but they could be fastened to the underside of joists. Diagonal strapping was also added to the deck framing to reduce lateral movement (B).

capacity compared with screws. Also, because most manufacturers don't include rivets on their fastening schedules, we need an architect or engineer associated with the project to approve their use.

In addition to allowing longer spans, Evolution joists have the capacity for exceptionally long cantilevers. According to the Fortress span charts, cantilevers can measure up to 5 feet; one portion of this deck has a 4-foot cantilever **(Figure 3)**.

Blocking and bracing. Another feature unique to the Evolution system is the method for blocking between joists, which is required for joist spans greater than 8 feet. Evolution strapping for midspan blocking comes in 4-foot lengths and is prenotched for either 12- or 16-inch-on-center joist spacing. The straps lay on top of the joists and don't require any fasteners (though fasteners are required when the straps are installed on the underside of joists) **(Figure 4)**.

As is the case with the ledger and rim, nonstandard spacing needs to be adjusted for in the field. In our case, we used a grinder to make the necessary notches in the straps.

On this deck, in addition to midspan joist blocking, we installed diagonal strapping on the underside of the joists. Our architect added cross bracing to the bottom of the deck because of the long spans and because half the deck was freestanding. At the bottom of the stairs, a small section of framing was added to act as a trellis, but that was aesthetic and not structural.

Where extra reinforcement is needed for railings, stairs, or picture framing, Evolution joist material can be cut to length for blocking and fastened to the framing with F50 brackets. To maintain the warranty, all cut framing members have to be sprayed with a touch-up paint, supplied by the manufacturer in a rattle can. Beam and joist caps are available to seal up the ends of framing members and prevent pests from taking up residence.

Decking Installation

We have tried several decking fasteners with our steel framing. On this deck, we used Starborn's Proplug system of

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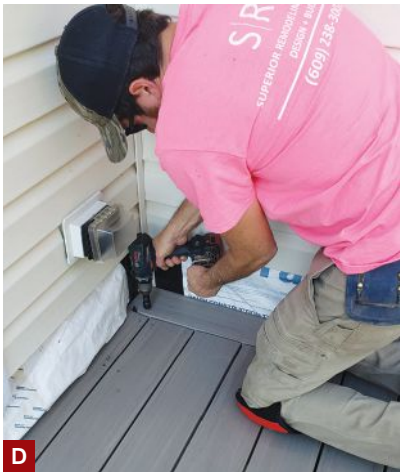

Figure 5. Workers used Camo Edgexmetal clips to fasten the grooved decking to the steel framing (A), working several courses at a time and using the Camo lever tool to straighten the boards and snug them up as they drove the fasteners in (B). Workers trimmed the decking to length for the deck's picture-frame detail with a track saw (C), then used Starborn Proplug face screws and plugs to fasten the border decking to the framing (D).

face-plugged screws and Camo Edgexmetal clips to fasten the decking to the steel framing.

This was our first time using the Camo hidden fastener system, which allowed us to dry lay most of the field boards, and then work backward to install several rows without having to face-screw any boards down. Using the Camo lever to make sure the boards were tight together before going back to install the screws, we were comfortable working with up to 15 rows of boards at a time (**Figure 5**).

To me, the biggest benefit to the Camo Edgexmetal fasteners is that the screws are already preloaded into the spacers. While we had a little trouble with the Drive stand-up tool (probably because the long fasteners were difficult to orient vertically while we waited for the self-tapping threads to engage the steel), we came away impressed with the system, which is at least twice as fast as anything else we have tried.

Stairs

Building stairs with LGS is less than ideal, and the stairs for this deck required a long set of stringers that would have been impossible with standard PT lumber. The Fortress system—which incorporates standard Evolution joists, stair trays, and adjustable stair brackets—solved many of the problems that we would have had using these other methods. While it's not perfect, I consider it to be the best we have used so far.

There are three stair bracket options: one with a 7-inch rise and 11-inch run; one with a 7 3/4-inch rise and 11-inch run; and one that's adjustable, with rise and run constraints forgiving enough to make just about any situation work (**Figure 6**).

Once the brackets are fastened to the joist/stringers, the stair trays make final assembly fast. Because we used rivets for all of the top fasteners, we didn't have to counterbore the back of every deck board where a screw head was located. One downside that we weren't aware of until the stairs were started, however, is that the tread dimension is locked in by the stair trays. At 11 inches deep, a standard two-board tread made with 5 1/2-inch-wide deck boards wouldn't have the required nose overhang. Because the decking the client had chosen

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Figure 6. To build stair stringers, proprietary brackets are fastened to standard joists (A), which are then fastened to the framing with adjustable strap-like hanger brackets (B). A midspan bracket enabled the author to build the stairs before the hardscaping was completed (C). Wider, 7-inch deck boards created an overhang for the two-board treads (D).

was available in a 7-inch-wide board, we were able to use the wider decking for the second board and rip it to fit the tread.

Usually we have a landing or use helical piers to support the bottom of the stringers. On this project, the hardscaping was being done after the deck was built, and we had to temporarily support the stairs on a stone pad. Though it was not necessary structurally, we added a brace at the middle of the stringer span both to reduce any vibration or nuisance swaying of the stairs and to support them while the new hardscaping was being installed.

Our client liked the look of the black framing so much, they decided to leave it exposed as much as possible, so we did not cover the trellis, fascias, stringers, and risers with decking or vinyl. Because of the height of our rise and the dimensions of the stair tread, we were able to leave the risers "open."

Cost

One of the downsides of metal deck framing has always been the cost of the materials. In our area, as is the case across most of the country, the cost and availability of building materials has been turbulent. At the time we built this deck, we would not have been able to source pressure-treated materials from the manufacturer we prefer to use. And even if we had been able to, the expected cost would have been more than double what it was a year prior. Today, the cost for the Fortress Evolution framing would be a little less than double the cost of pressure-treated lumber and about 35% more than LGS. When labor and future maintenance is included in the calculation, the Evolution framing pencils out to cost only about 25% more than pressure-treated lumber and LGS. This, added to the fact that the steel will last as long as the decking being installed on it, makes this steel framing system a worthwhile investment for any of our composite deck projects. ❖

Dan Watson owns Superior Remodeling Solutions in Sicklerville, N.J.

Double-Decker Porch Restoration

A three-rail balustrade preserves the home's character while meeting local code

by Nate Plasha

When the owner of a multifamily rental property first approached me about repairing the building's two-story front porch, my schedule was full, but I agreed to shore up the porch to prevent it from collapsing while the owner looked for another contractor to complete the job. More than a year later, the repair job remained uncompleted, mainly because the porch had scared off every other contractor who had looked at it.

Their hesitation was understandable. The porch structure was compromised by rot and undersized framing members, and neither the pair of stairs that led up to the porch nor the railing met code. Not only that, the house that the porch was attached to was more of a parallelogram than a rectangle, leaning 5 or 6 inches from side to side. Correcting the house's defects wasn't practical and was outside the scope of the budget, but with time in my schedule, I eventually agreed to tackle the porch repair.

Meeting Zoning Requirements

Listed on the state historic register, the house is located in an old Burlington, Vt., neighborhood where historic preservation requirements are linked to the local zoning permit process. For example, while either wood or composite decking is allowed in repairs to an existing porch,

PHOTOS BY TIM HEALEY, EXCEPT WHERE NOTED. INSET PHOTO BY NATE PLASHA

Figure 1. The author shored up the porch roof, then hired a demo company to remove the existing two-story porch (A). The new porch was conventionally framed with pressure-treated lumber, with the joists parallel to the front of the house (B). The oversized ledger was blocked out away from the wall (C) to clear the house's irregular stone foundation (D).

exposed pressure-treated (PT) framing is not. According to the city's guidelines, the goal is to maintain the distinctive features, finishes, and craftsmanship that characterize a property. Repair rather than replacement is preferred, but in this case we had no choice: The structure was toast.

Visually, the posts and balustrade would have the biggest impact on the project, but I had repaired or replaced a number of porch railings in that neighborhood and was confident that the design my partner on this project, Sean Laughlin, and I proposed—which would raise the guardrail height to 42 inches, per local code—would satisfy the zoning board. Covering up the new pressure-treated framing with trim per local requirements would also be straightforward.

One of the main wrinkles in the project was replacing the existing two sets of nonconforming stairs leading up to the two entry doors on the porch. Instead of building two separate stairs, we proposed consolidating them into a single set of stairs that would lead up to a central dropped landing. This would allow us to stay within current rise and run requirements for exterior stairs without encroaching on the sidewalk, which was adjacent to the front porch.

Reframing the Porch

After the demo company we had hired demolished the existing porch (**Figure 1**), we dug into the sandy soil to inspect the existing concrete piers and determine whether they could be reused. Two of the four piers were fine, while the third one just needed reinforcement. The final pier needed to be replaced, so we pulled it out and poured a 24-inch-diameter footing 4 feet below grade with an 8-inch-diameter pier on top of it.

Figure 2. The author installed dense tropical hardwood decking, orienting the boards perpendicular to the house to mimic the traditional look of tongue-and-groove porch flooring (A). While the decking was left unfinished to reduce maintenance costs, the ends were treated with a wax sealer (B).

Figure 3. Per local code, the pressure-treated framing was covered with painted wood trim to help maintain the original look of the house; blocking between the framing and wood trim allows moisture to escape from the assembly (A). A local craftsman turned the custom 6x6 Douglas fir posts (B), which the author primed and painted prior to installation (C).

Deck ledger installation was complicated by the home's stone foundation. The red rock used in its construction was too dense for us to drill holes in it for epoxy anchors, and irregular enough that we considered a free-standing porch foundation. Our solution was to install an extra-wide 2x12 ledger, which could be solidly attached to the house's mudsill while allowing us to drop the porch framing so that the tops of the joists would be flush with the top of the foundation (a detail needed to accommodate the geometry of the porch stairs). Still, we needed to block out the ledger away from the house sheathing, as well as cut away part of the ledger where one of the foundation stones projected out from the house. It also created a kind of a step detail at the house, which we eventually covered with custom-fabricated copper flashing.

Historic porches are typically finished with tongue and groove (T&G) porch flooring that's perpendicular to the house and pitched for drainage. So we framed accordingly, installing double 2x8 flush beams about 6 feet on-center between the ledger and outer rim, and then hanging the joists parallel to the house. Because we planned to use square-edge decking instead of T&G porch flooring, we didn't pitch the framing; with gaps between the deck boards for drainage, we weren't concerned about water pooling.

On the second level, we used similar floor framing and installed a new box beam to support the existing porch roof. Then we installed 1-inch-thick blocking around the perimeter of both the ground-level and second-story porch framing.

We like to install blocking prior to trimming out a PT frame for several reasons. One is that the blocking creates a gap behind the wood trim, allowing for ventilation and preventing moisture from being trapped. The blocking also helps to flatten out the PT framing, which is sometimes cupped or twisted (sometimes shims between the framing and blocking are needed to correct the worst problems). The gap is also handy when we use structural screws with heads that sit proud of the framing. And on this project, the blocking created space behind the fascia trim for the skirt detail that would enclose the area underneath the porch.

PHOTOS 3A & 3B: NATE PLASHA

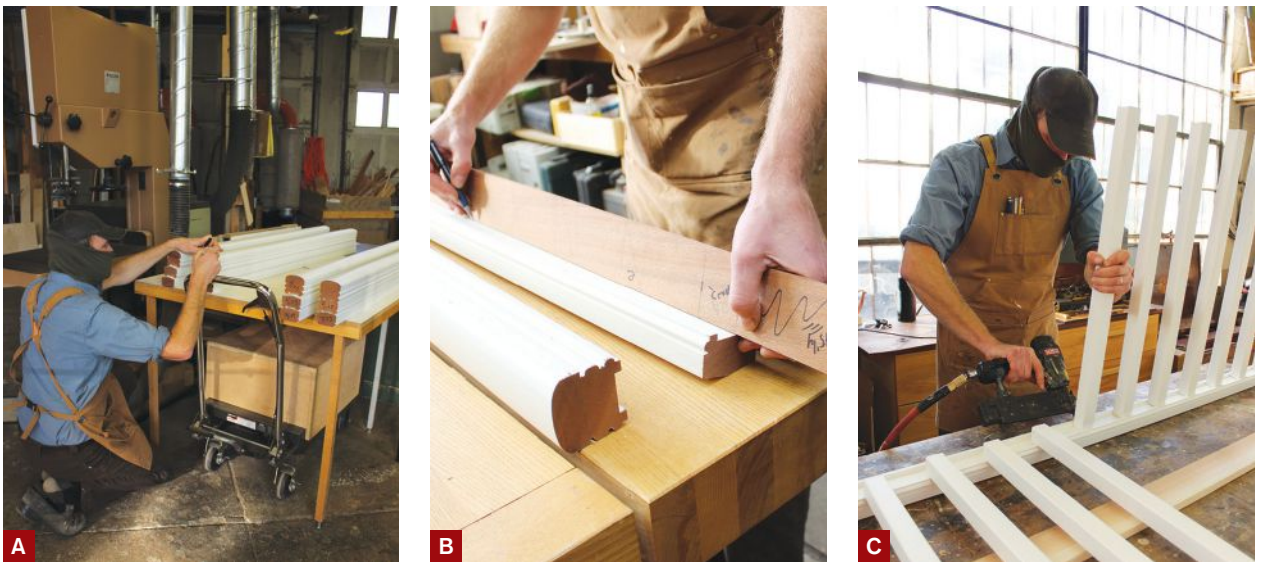


Figure 4. The author shaped and painted the railing parts in his shop (A), then used a story pole to lay out the baluster locations (B). He started assembly by pinning the balusters to the dado cut in the underside of the middle rail (C).

Decking

On a single-family home that gets regular maintenance, fir or mahogany flooring with a paint or penetrating oil finish are reasonable options, but on this rental property, reducing maintenance was a priority. We were able to source a dense, ipe-like tropical hardwood 1x6 decking for a reasonable cost that wouldn't require any finish prior to installation, and virtually no maintenance afterward (we did treat the end grain with Anchorseal, a wax-emulsion end sealer) (**Figure 2**).

I'm not a big fan of hidden fasteners with hardwood decking, especially in high-traffic areas, in our northern New England climate. In my experience, the decking looks great for a year or two, but then loosens up and moves around as the wood shrinks and swells. So on this project, we face-screwed the decking to the framing with stainless steel screws, predrilling holes through the dense wood.

We used 5/4x6 Angelique decking for the 11-inch-deep treads on the three 60-inch-wide steps leading up to the dropped landing. While the first tread projects a few inches out from the front of the porch, we set it back far enough from the sidewalk to avoid contact with the city's sidewalk snowplow.

Turned Posts and Ceiling

We had a local wood turner fabricate 10 turned posts out of Douglas fir. While the post profile suggests the original posts, the design is new, with five slightly shorter 90-inch-long posts for the upper level and 108-inch-long posts for the lower level, and all 10 posts turned to accommodate 42-inch-high rails. At my shop, we primed them with an oil-based primer and gave them two finish coats of acrylic latex paint using both a 4-inch microfiber roller and a brush (**Figure 3**).

We cut 6x6 plinths from 2-by PVC stock, giving them a 3/8-inch bead profile. Then we spread plenty of OSI Quad Max sealant between the plinths and post bases before screwing them in place. We repeated this process for each post as we installed it, allowing the porch's weight to settle on each one and squeeze out excess sealant, which was still pliable. We spaced the posts as equally as possible and used a string line to make sure the post faces were exactly parallel to the house (to simplify railing installation).

Meanwhile, we trimmed out the porch with 4/4 P5 trim, a treated plantation-grown product that we prefer over PVC. It comes primed, and we painted it prior to installation. We first tacked the trim up with trim-head stainless steel screws, then nailed the trim off with galvanized siding nails.

On the ceiling above the first-floor porch, we left the joists exposed to match the appearance of the old porch. After the PT framing dries out, we'll return and paint it. On the ceiling above the second-floor deck, we installed T&G beadboard fir, first brushing a clear Sikkens oil finish on the 1x6 boards. On the exterior, we patched and repainted any missing siding and trimmed out the new box beam.

Shop-Built Custom Balustrade

With the posts installed, we made a couple of story poles to help build the balustrade in my shop: one for the spans between posts across the front of the porch, and one for the returns on either side of the porch. I use a smartphone app called BuildCalc to lay out the balusters, aiming for a consistent spacing in all of the sections. To reference the original

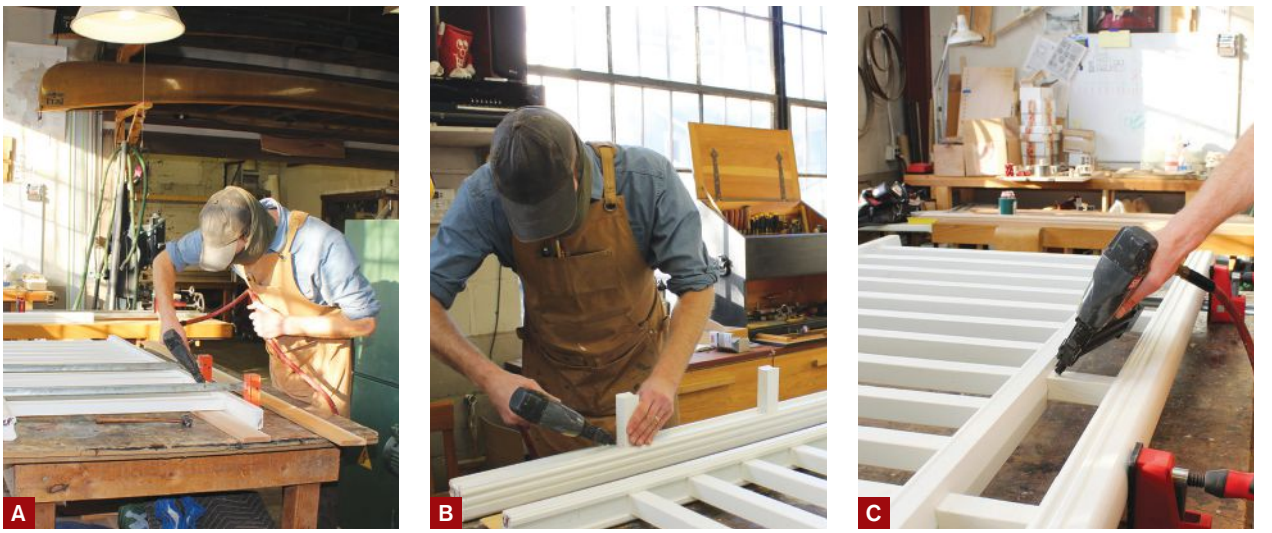


Figure 5. Using clamps to draw the assembly tightly together, the author then fastened the balusters to the bottom rail (A). To complete the rail section, he first pinned the short spacer balusters to the dado in the base of the upper rail (B), then clamped the upper rail to the rest of the assembly and finished pinning everything together with a brad nailer (C).

porch railing while meeting up-to-date code, we designed the 42-inch-high balustrade to have an intermediate rail representing the original 28-inch baluster height. In addition to the historic preservation issue, "squashing" the balustrade with intermediate rails creates a less generic look.

In the shop, we started by milling the stock for the 2 5/8-inch-by-2 5/8-inch handrails out of sapele, a tropical rot-resistant wood that is harder and heavier than African mahogany. After shaping the handrail profiles on the sapele blanks, I used a groove-cutter head on a shaper to precisely cut dadoes in the bases of the upper rails to snugly capture the 1 1/2-inch square clear-red-cedar balusters. Because the balusters would have three coats of paint, the dadoes are slightly oversized to accommodate the finish.

Next, we milled and shaped the bottom and middle rails, each with a slightly different profile. Formed with the aid of a sled for the planer that tilted the rail stock 9 degrees, the inverted-V-shaped top edge of the bottom rail is designed to shed water and to help lock the bottom of the balusters in place. The middle rail has basically the same profile, but we also cut dadoes in the base of the rails identical to the dadoes in the top rails. Finally, we cut all the balusters to length, first making the V-shaped profile at one end to match the inverted V on the rails using a cross-cut sled and a table saw tilted 9 degrees. Finally, after a light sanding to clean up the cuts, we primed and painted all of the parts, including the ends of the balusters (**Figure 4**).

Assembly. When building a balustrade for a two-story porch, I want everything to align vertically. So I use a consistent baluster layout, which I mark on story poles and transfer to the rails. To allow for adjustment, I start from the same side on each rail, leaving a couple of inches of extra material at the other end that can be trimmed to fit in the field. On this project, the balusters were laid out 5 1/8 inches on-center, leaving about a 3 11/16-inch gap between balusters.

We pinned the balusters to the dado in the underside of the middle rail with 1 1/2-inch-long stainless steel brads. Then, with the assembly laid on its side, we fastened the balusters to the bottom rail, using long clamps to draw the rail section tightly together. To complete the assembly of a rail section, we pinned the short balusters to the dado in the underside of the top rail (**Figure 5**).

With the top rail clamped to the lower assembly, we checked to make sure the short balusters were centered over the V in the rail and aligned with every fourth lower baluster. Then we pinned everything together with stainless steel brads.

Installation

On site, we began installing the rail sections, temporarily propping the sections up on pairs of 2-by blocks to provide 3 inches of clearance underneath the bottom rail for snow removal. We butted the "factory" end of each section to a post, scribed the "long" end of the section to the opposite post, then trimmed the rails to length with a Festool TS 75 track saw. During installation, our goal was to make sure the negative space between the last baluster and post on both ends of each rail section would be equal (**Figure 6**).

We primed the cut ends prior to installation, and fastened the rails to the posts with 4-inch-long GRK coated structural screws. At the house, we notched and

Figure 6. After cutting the rail sections on site to fit, Sean Laughlin sealed the end grain with primer (A) and then fastened the rails to the posts with structural screws (B). Making the railing connection at the house was complicated by the existing siding and trim (C).

Figure 7. Post sleeves were fabricated from 1x6 stock using glued T&G box joints, which didn't require fasteners that would interfere with cutting the corner chamfers (A). The skirt around the base of the porch has screened cutouts that allow for ventilation while blocking out insects, cats, skunks, and other neighborhood pests (B).

scribed the rail ends around the trim and siding as necessary to make a solid connection to the house framing.

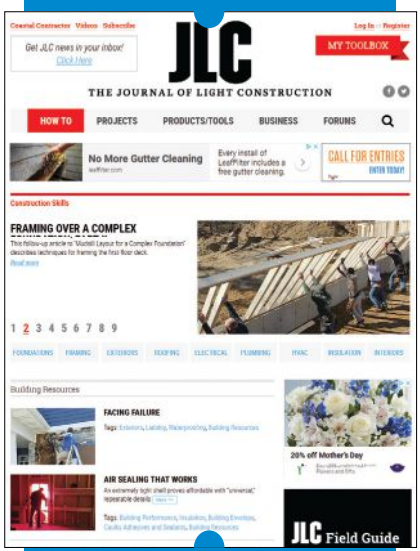
When installing the upper porch railing, we made sure that the vertical elements were aligned with the lower sections before we cut the rails to length.

Final Details

We had bolted a pair of 4x4 PT posts to the framing at the landing to create mounting points for short handrails on either side of the front steps. To cover these posts, we fabricated sleeves out of 1x6 P5 stock, using T&G box joints and urethane glue at the corners. We wanted to add a chamfer detail to the post corners, so we avoided using metal fasteners when assembling the post sleeves. We slipped the sleeves over the posts and used wedges to plumb them before screwing them on. The posts are topped with caps that we fabricated from 2-by PVC, which are rabbeted to fit inside the sleeves. Short handrails fastened to metal brackets mounted to the posts completed the assembly (**Figure 7**).

Around the base of the porch, we installed a simple skirt fabricated from 1x8 P5 stock. A pattern made up of opposing and offset elliptical cutouts in the skirt boards adds a whimsical element to the design, while black stainless steel screening stapled to the back of the skirt board panels blocks insects, cats, skunks, and other urban pests from taking refuge under the porch. ❖

Nate Plasha owns and operates Black Locust Craftsmen (blacklocustcraftsmen.com), a small artisan construction company, located in Burlington, Vt.



JLConline.com offers sound technical advice, practical how-to articles, expert hosted forums, as well as networking opportunities.

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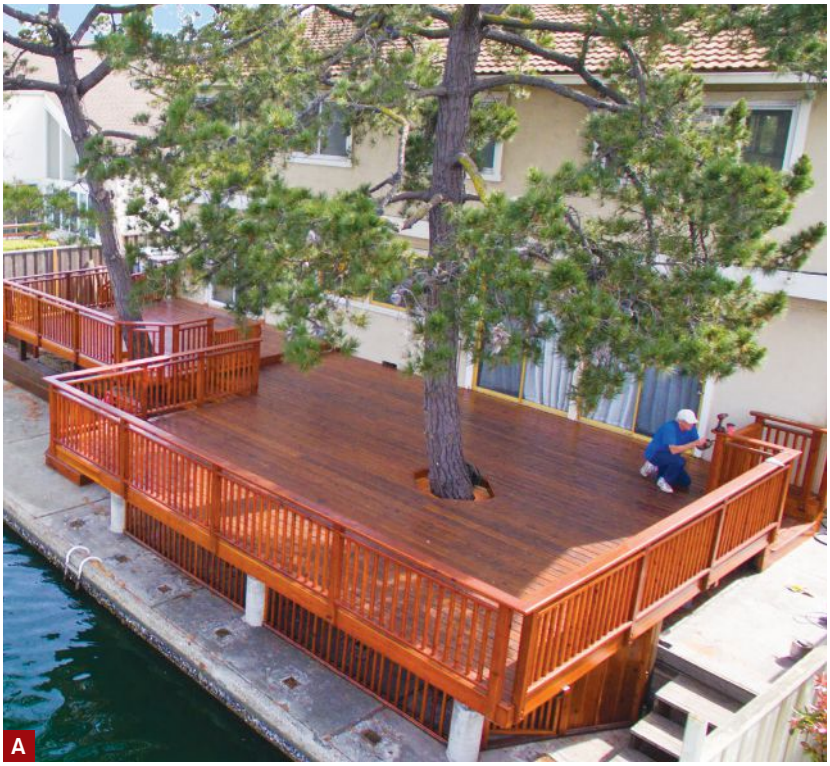
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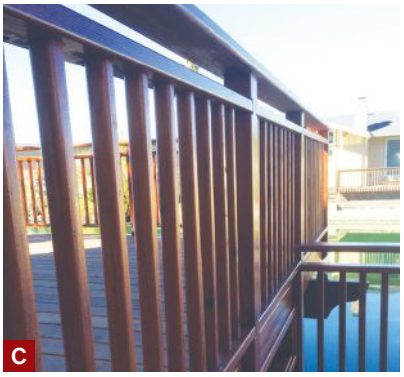
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D

Redwood Deck on a Blue Lagoon

by David Bullene

In 1958, real estate developer T. Jack Foster spent $200,000 to buy an island and several square miles of San Francisco Bay marshland on the east edge of San Mateo, Calif. In order to build houses there, he spent several years dredging wetlands and pumping millions of cubic yards of mud and sand onto the island to raise it above sea level. The 218-acre lagoon he created—technically a drainage detention basin to collect stormwater runoff—became the centerpiece of Foster City, now a city of over 30,000 residents.

The home where I built the redwood deck featured here is located on one of the 16 miles of drainage channels that make up the lagoon. In the 1960s, Foster promoted his development as the "island of blue lagoons," and the claim is still true, thanks to the pond dye added to the water to disrupt photosynthesis and aquatic weed growth.

I framed the deck with pressure-treated Doug fir, rounding over the edges with a 3/8-inch-diameter router bit wherever the framing is exposed to view. On the ends of the support beams, I cut my signature scroll detail, also rounded over (B).

I milled the decking, railing, and trim material on site from rough-sawn #2 grade redwood from Big Creek Lumber, one of two primary sources of redwood in the Bay area. After ripping and planing the material to size, I used a belt sander to prep it for the final finish, up to 120 grit for the decking and treads, and up to 220 grit for the rails and balusters (C).

I like to notch rail-to-post connections, then round over the notches with a 1/4-inch-diameter bit to highlight the joints. Virtually all the other trim details on the deck, such as the coping around the tree wells surrounding the pine trees, are rounded over too. For an informal, "beach-like" feel, I gave the stairs down to the concrete patio next to the lagoon a wave-like design (D). To bring out the redwood's beautiful natural color, I painted on two coats of Sikkens ProLuxe transparent matte penetrating oil finish. ❖

David Bullene is a craftsman with over 40 years of woodworking experience now living in Nevada (bullenedesigns.com).

PHOTOS COURTESY DAVID BULLENE

Classifieds

Advertising Index

BY VINCENT SALANDRO

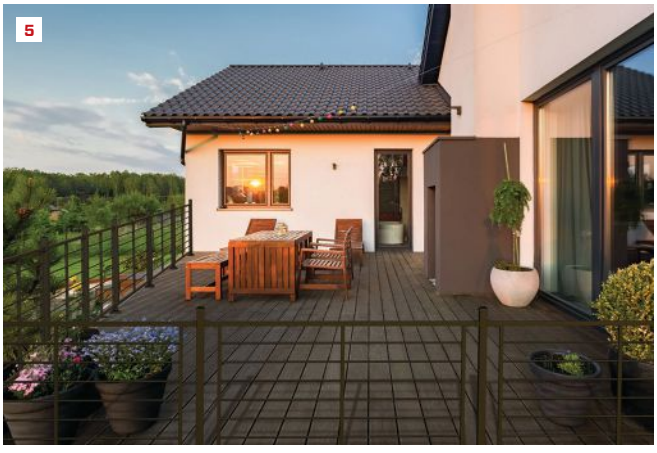
1. Wood-Grain Composite Decking
Sporting a wood-grain finish and reduced pattern repetition for a more natural look, MoistureShield Meridian capped decking also offers the scratch resistance and low maintenance of a wood-plastic composite. The 1x6 deck boards come in three colors, in square-edge and grooved versions, and in 12-, 16-, and 20-foot lengths. Meridian is currently available in the Northeast and will roll out to additional regions later in 2021. Pricing varies. moistureshield.com

2. DensDeck Gypsum Roof Coverboard
Georgia-Pacific's DensDeck StormX Prime Roof Board, a water-resistant gypsum roof coverboard, is designed to help prepare commercial rooftops to resist impact and punctures caused by wind-borne debris as well as severe hail (defined as hail more than $1\frac{5}{8}$ inches in diameter). StormX is classified for use in approved assemblies meeting FM Global's Very Severe Hail (diameter greater than 2 inches) Standard set in 2019. Contact distributors for pricing. buildgp.com

3. Smart Air Control System
When Fantech's new Eco-Touch Auto IAQ controller recognizes elevated VOCs in the home, it ramps up ventilation from Fantech Fresh Air appliances to bring in more fresh air while removing stale air to the outdoors. The controller also monitors relative humidity and adjusts air intake accordingly. Homeowners use a touchscreen control panel to set automatic night and day preferences or to operate the controller manually. The system retails for $165. fantech.net

4. Composite-Fiber Siding
Rise Siding is composed of 94% recycled carpet fiber, but its vertical wood-grain texture mimics the look of real wood. Notably, the siding comes in 20-foot lengths, which will help installers minimize seams and reduce jobsite waste. Available in two widths, the siding is prefinished in a choice of white or one of seven colors. According to the manufacturer, the siding resists decay, rot, and freeze-thaw damage; features two-sided water protection; and has minimal expansion and contraction rates. Priced competitively with composite and fiber-cement siding, Rise Siding is available nationwide. risebuildingproducts.com

5. Horizontal Steel Rod Railing
A new style in RDI's Metalworks Excalibur line, Latitudes Horizontal Rod Rail preassembled panel features horizontal 1/2-inch-diameter round steel rods and a matte black finish, in both 36- and 42-inch finished rail heights. The rail panels are available in 6- and 8-foot lengths for level sections and in 6-foot lengths for stairs; uprights can be removed so panels can be cut to size. According to RDI, welded center supports and bushings in the uprights increase strength, and the bracketed posts make level installation simple while providing code-compliant bottom spacing. rdirail.com



6. Expanded Ridge Premium Collection
Envision Building Products added 20-foot-long square-edge boards and 16- and 20-foot grooved-edge boards (to meet demand from deck builders who prefer to use hidden fasteners) to its Ridge Premium collection. The boards feature a high-density cap, which the manufacturer says is bonded to the core with heat and pressure to squeeze out air pockets and create a deeply grained surface. The boards are available in black walnut, gunstock, and vintage oak colors, with companion skirting available in all three colors as well. envisiondecking.com

7. Residential Aluminum Railing
Designed for easy installation, Fortress Building Products' Al[13] Home railing consists of powder-coated aluminum panels with preattached brackets. The railing system comes in 2- and 3-inch over-the-post or proud-post options, and in a black-sand or white-matte finish. Customers can customize the panels with vertical cable or Pure View Glass infill. fortressbp.com

8. Optimized Spray Foam Insulation Kits
Dap optimized its one- and two-component Touch 'n Foam Professional and Touch 'n Seal spray foam products to provide better insulating properties and lower their Global Warming Potential (GWP) for a reduced impact on the environment. The kits were developed to meet changing hydrofluorocarbon regulatory requirements for low-pressure polyurethane spray foams. The one- and two-component closed cell–foam kits feature an improved R-value of 6.6, are ICC and CCMC Listed, and consist of a fast-drying formula that is Class A fire rated. Pricing varies based on the size and components featured in the kits. dap.com

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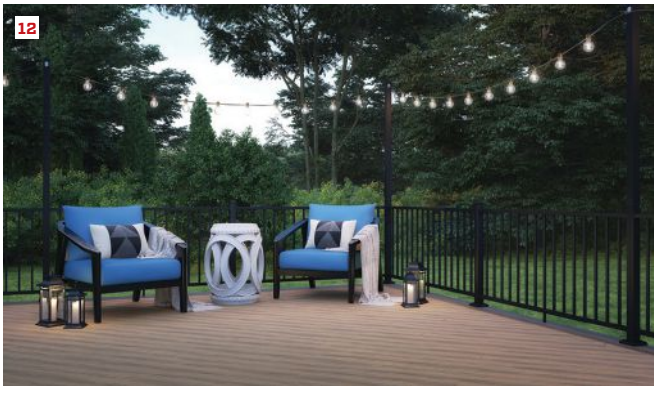


9. Glass and Tile Drill Bits

Milwaukee Tool says its Glass and Tile Bits are engineered with sharpened carbide to drill faster than the standard alternative. The carbide head provides increased durability when drilling at high speed into tile and glass. The bits are designed for use with drill drivers only (not impact drivers) and are not recommended for use on porcelain tile. Available in four sizes, from 1/8 to 5/16 inch, the bits retail between $7 and $15. milwaukeetool.com

10. Premade Outside Corner Boards

LP Building Solutions recently added SmartSide Outside Corners to its line of engineered wood siding. This accessory promises to save time and, because the corner seam is prefixed, will reportedly reduce water intrusion. The Outside Corners are available in deep-grain cedar texture and come preprimed for better paint adhesion, according to the manufacturer. lpcorp.com

11. Charred-Wood Cape Cod Perfection Shake

Tando expanded its Cape Cod Perfection line with shakes in a "char" color, which gives them a charred wood appearance—a look rooted in a centuries-old Japanese wood-preserving process known as Shou Sugi Ban. The new shakes have a 5-inch exposure with crisp edges. Tando claims that Cape Cod Perfection shakes are impervious to moisture and are suitable for ground contact and roofline applications. The shake collection also has received a notice of approval from Miami-Dade County for high-wind and high-impact resistance, and reportedly meets all severe weather rigorous testing criteria. tandobp.com

12. ALX Aluminum Deck Post Extensions

Deckorators is now making post extensions for hanging string lights as part of its ALX aluminum deck railing series. The ALX post extensions, compatible with 2 1/2-inch-by-2 1/2-inch posts in both the ALX Classic and ALX Contemporary railing systems, allow users to install and hang outdoor lighting with ease, according to the manufacturer. The extensions are available in a textured black finish and measure 66 inches high, extending 39-inch railing posts to 105 inches or 44-inch posts to 110 inches. Each extension features a preinstalled insert for fastening to a post and a carabiner clip for attaching outdoor lighting. The average retail price is between $60 and $70. deckorators.com

Three Levels of Awesome Toolbox

BY MARK CLEMENT

I've owned one version or another of the Craftsman 3-in-1 Rolling Workshop (model CMST18614) for a long time (similar versions are available under the Stanley FatMax and DeWalt brands). But regardless of the logo on the packaging, this toolbox is essential to my day-to-day deck building and other construction activities. It just works.

While you probably don't want to hire me to hip your rafters or perspire your pipes, perhaps the one true superpower I have is tool-storage domination. I know where my stuff is and don't have to spend much time looking for it; whether it's a caulk gun, a cat's paw, or other specialty tool, I know where to find it when I need it. This box, and how it's designed, is a big part of my success.

I try to store stuff in "categories," which is important when you are a remodeler and tasked with doing it all, all of the time: decks, bathrooms, demolition, painting (ack, yes, I paint), crown, and so on. I have colleagues who are skilled at plumbing or electric or whatever, and they have a "box" or "bucket" for trade-specific tools, too. But the problem with the box or bucket gambit is that it's just a pile, with sides. The Craftsman box, on the other hand, is a trilayer, telescoping chest of drawers that undoes the pile mojo. With cubes, bins, and mobility, it's sublimely sized at 22-by-16-by-30-inches, including a steel roll-a-board-style handle, wheels, and drawer slides. All ruggedly built in the USA.

When I did design/build for television, I had a number of these toolboxes for my team of seven carpenters. We kept trim tools in one and framing gear in another; we even had a box for cordless equipment with holes drilled in the side for charger cords so we never needed to take the chargers out. I lined these boxes up centrally on site, so that nobody was wobbling around at midnight wondering where the narrow crown stapler and staples were. Boom. Go. Then we could easily put it all back, close them up, and roll.

Today, I have two rolling toolboxes. For my decks, which are built primarily of wood, I can store most of the tools I'll need in a single rolling toolbox. In the large bottom bin, I keep my cordless router, cordless circular saw, and cordless impact driver. In the center compartments, I keep screws, bits, and bit holders, an Allen wrench, gloves, phone charger, and other small items. The "toolbox top" (it has a tray) is deep enough to keep the chargers and batteries and back-up impact driver. And I roll all that stuff neatly to the site in one trip, not 80.

I also have a rolling box that I've kitted out for painting. Drop cloths, roller frames, and other big stuff all go below, while I put caulk tools, putty, and the like in the middle. In the top tray, I store brushes, brush combs, openers, putty knives, and other hand tools.

Loaded up with gear, these boxes can get pretty heavy, but fortunately they have a good set of side handles along with the wheels. Rolling the boxes works well on level terrain, but when you need to hurl one into the truck or carry one upstairs, there's a place to grab hold. $100. craftsman.com

Mark Clement is a member of the JLC Live Demonstration team, author of The Carpenter's Notebook, A Novel *and a deck builder/remodeler in Ambler, Pa.*

The Craftsman Rolling Workshop has a large lower bin that can hold circular saws and other power tools, a center tray with adjustable dividers for fasteners and hand tools, and an upper storage area for batteries, chargers, and other accessories. Integrated wheels make it easy to roll the toolbox around the job.

Photos: Mark Clement

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

A Cool Hard Hat

BY JEFF KIRBY

Having worn many hard hats over my 20-year career as a construction manager, I can say without hesitation that Ergodyne's Skullerz cap-style vented hard hat is my favorite. I've worked outdoors in all kinds of conditions, so I've experienced the scientific phenomenon created when you wear a hard hat in bright sunshine: a mini "hot box" sitting on top of your head. Anyone who has worn a hard hat is familiar with the uncomfortable result of exerting yourself when the sun is beating down. But I found that the sweat and elevated temperatures during the summer months are almost completely eliminated by the vented design of this hard hat, which prevents the temperature from rising in the small space above your head and under the lid.

The four-point suspension rig that comes with the hat is well thought out. You can adjust it from a hat size of 6 1/2 to 8, one-handed, while you wear it. The rig's moisture-wicking sweatband works great and keeps annoying sweat trickles out of your eyes. The hat also comes with a circular pad that sits on top of your head and prevents the annoying and sometimes painful pressure that strapping can cause.

The hat has a built-in slot for an LED headlamp. Because of the slot's location, the hat remains balanced on your head and doesn't become front-top heavy with the headlamp, as can happen with third-party clip-on after-market lights. It also includes slots for other accessories, like hearing protection and a chin strap. It is ANSI Type I Class C rated (construction and related trades).

I could find little to nothing with these helmets that I could be critical of. They feel light and comfortable, don't get hot, and adjust easily. Most importantly, they protect your noggin. At about $45 each, these hard hats are probably a little more expensive than the ones you can get at the big box stores, but in my experience, the old cliché "you get what you pay for" applies here as well. I suspect that I will be wearing this particular piece of gear for the rest of my career and suggest that everyone who works in an occupation where hard hats are either required or recommended carefully consider wearing them as well. ergodyne.com

Jeff Kirby is a project manager with Graulich Builders in Lewes, Del.

The hats are available in both orange and white versions, which help with visibility (top). They feature an adjustable suspension system for ventilation, and can be worn backwards, which is not only stylish but also helpful when you are looking at things above you (center). Replacement suspension rigs, pads, sweatbands, and an LED headlamp that fits in the slot on the front of the helmet are available on the Ergodyne website (bottom).

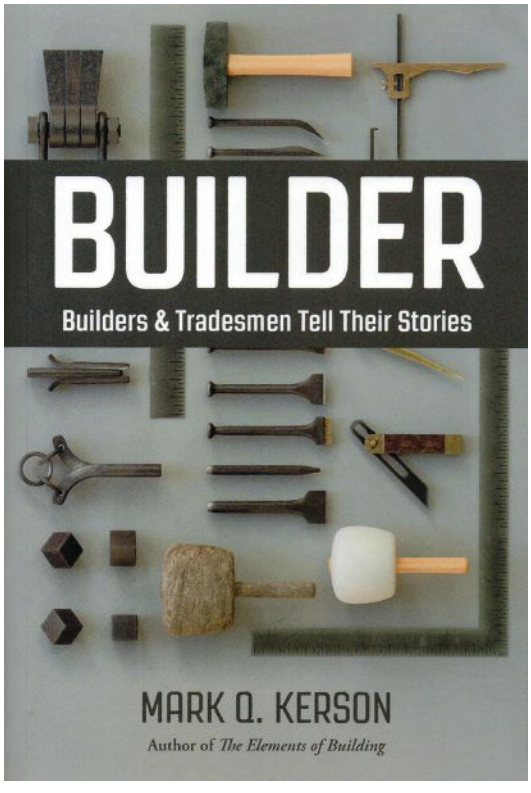
Photos: Jeff Kirby

BY CLAYTON DEKORNE

The Essential Education of Builder Stories

Many readers of *JLC* are familiar with the book *The Elements of Building* by Mark Kerson. It captures the essence of the business of building, distilled into graspable ideas that reflect true experience and the rich layers of what makes the business of building homes different from other businesses. *The Elements* is a must-read for anyone running a building company or contemplating getting into the business. Matt Risinger wrote an engaging review of that book in *JLC* in October 2016, and I would have asked him to write the review of Kerson's latest book, *Builder*, except for the fact that Risinger is one of the subjects.

In his new book, Kerson adopts a completely different style from the one he used for his first book, and with it, he reveals different dimensions of the same thing: what it means to be a builder. Those who are familiar with Studs Terkel—the author who pioneered storytelling in his seminal book *Working* as a way to write true history and reveal an authentic account of labor in late-20th-century America—will recognize the style that Kerson has adopted for his latest venture. The narrative is divided up into chapters named for "builders"—individuals that made or make a living working on new or existing homes—and each provides an important history of the trade.



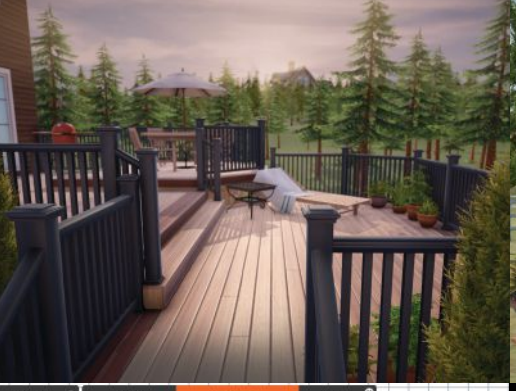
For starters, let me express my gratitude to Kerson for choosing this title. Whether we build in new or existing homes, we all identify as builders. The industry has become unnecessarily fractured by splitting off "remodelers" to a separate industry. A minority of firms work exclusively on existing homes. The majority of those who do work on existing homes build large additions or new homes, custom or on spec, as well as perform kitchen and bath remodels, gut rehabs, restorations, and other "builds." Production builders who function primarily as developers are perhaps outliers—and they are missing in Kerson's book, which is one minor flaw—but they too deserve to be included. They, like all builders, celebrate their roles as providers of an essential human staple. Builders of homes of all kinds have more to gain from focusing on this role, and joining one industry, than they do pursuing separate identities based on the relative condition of homes. Creating a sense of home is the universal quest we all share and the fundamental quality every client seeks. Kerson's book goes a long way towards defining the center of the profession providing that quality.

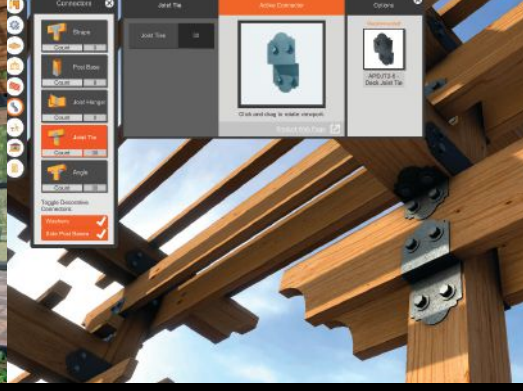
To the larger public, *Builder* seems destined to sit alongside Tracy Kidder's *House*, not only to inspire active and prospective carpenters, trade contractors, and custom builders (as it was inspirational to my early career), but also to reveal to the larger world what it means to build, beyond the stereotypes and biases that lurk in the general population. It is my deep hope that *Builder*, like *House*, creeps into the consciousness of the American public and continues to erode the image cast by too many news articles that focus on "contractor as scam artist" and not enough on "contractor as craftsperson." We need more stories in the world that celebrate builders driven by compassionate human concerns, which *Builder* does best of all.

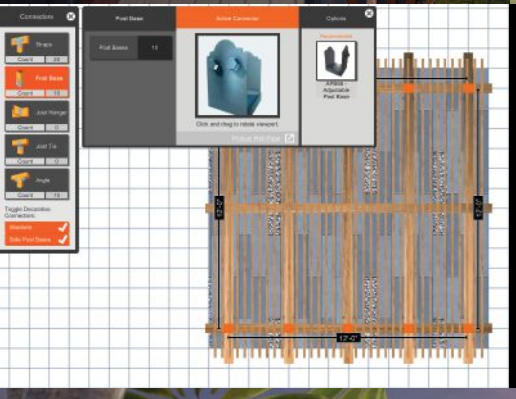
The narrative, based on in-person interviews and punctuated by headings that reveal the author's questions, flows like a conversation. We as readers are treated to a sit-down with some of the best and brightest in the field.

I am not a fan of celebrities. Indeed, "celebritism," which elevates public figures based on how relentless at messaging and bombastic they are over any other quality, is a phenomenon that social media is designed to promote. The format in *Builder*, while text heavy, forces us down another path. By reading unadulterated text, we are driven to contemplate the substance and experience of the individual "speaking"; it's a refreshing antidote to modern media.

The cast of characters we are invited to sit down with includes some of my favorites—friends, mentors, and heroes of our industry, including Sal Alfano, Dan Kolbert, Matt Risinger, David Gerstel, Heather Thompson, Jesper Kruse, and Iris Harrell, who have all contributed to *JLC*. And there are others, each one a voice in the great conversation that builders throughout time have joined and that this collection brings forward in modern history.







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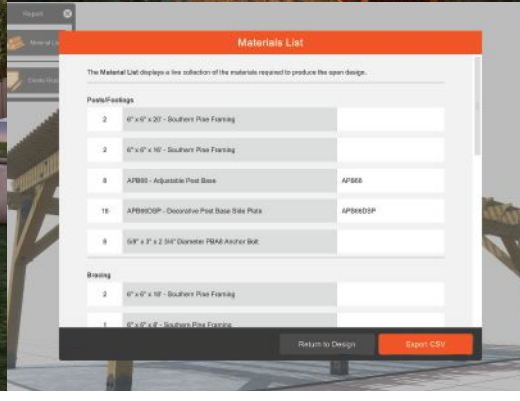

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