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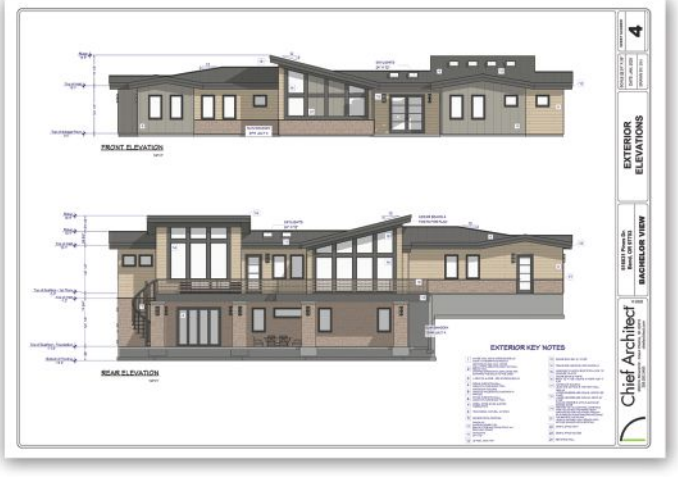

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On the cover: Bryan Uhler, of Pioneer Builders, installs a ventilation fan in a spec house in Washington state. See the story on page 26. Photo by Tim Uhler.

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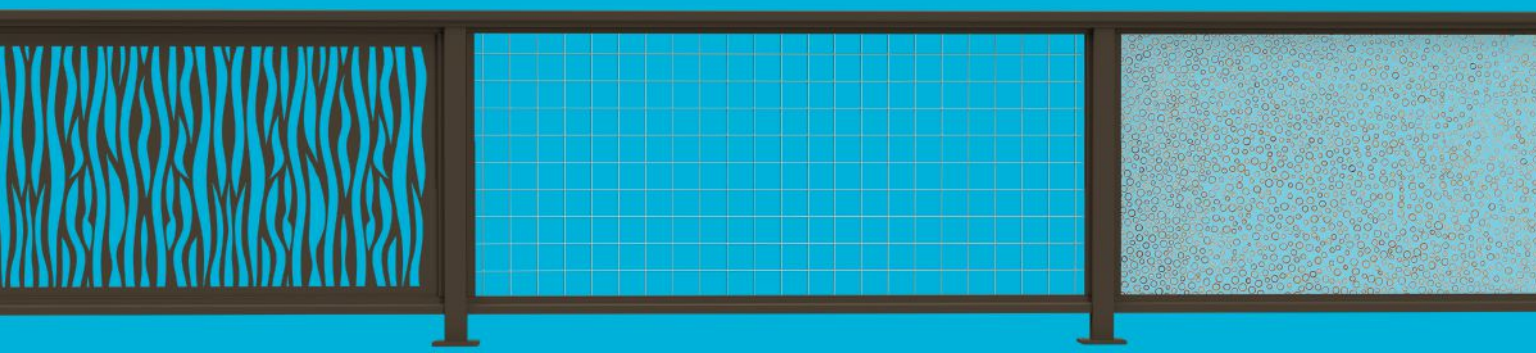

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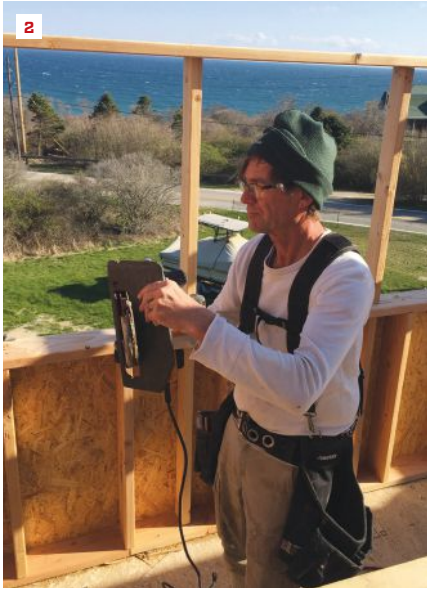
BY JOHN SPIER

Circular Saw Basics



Saw setup. Most circular saws have a blade-depth setting, but it's faster to hold the guard up and set the depth visually **(1)**. Calibrated markers on the front of the saw are used to set the bevel angle. Holding the saw up vertically keeps the weight of the table from moving the saw while you lock it in **(2)**. To avoid binding, adjust the blade depth so that cuts are only slightly deeper than the stock thickness **(3)**. To change a blade, hold the saw, blade lock, and retracted guard simultaneously with one hand while using the other hand to remove the arbor nut with the blade wrench **(4)**.

Photos by Gabriela Spier

Round about 1980, when I was a young carpenter-to-be, I bought my dad his first electric saw: a Sears Craftsman circular saw. Thirty-five years later, I found it in his shop, pretty much in mint condition. He gave it a try, but he never gave up on his razor-sharp hand saws or his chain saws, with which he could fashion anything from totem poles to tent pegs. For most of us, though, circular saws do the lion's share of the work on our framing jobs. It's the first power tool we ought to learn how to use.

I spent a few years production framing on the West Coast, where wormdrive saws—especially the venerable Skilsaw Model 77—ruled the jobsites. But here in the East, where I've spent most of my working life, the standard saw is the 7¼-inch right-bladed sidewinder. Don't ask me why; I'm one of those few bi-coastal guys who don't think that one is any better than the other.

Most of the major manufacturers make good saws for less than $150, and the difference between cheap junk and a good saw is a small part of that. So buy a good one. Features I look for are comfort, balance, a sturdy base that will stay flat, easy adjustments (even when I'm wearing gloves), a blade guard that retracts easily, and a blade wrench that stays on the saw. A cord that's at least 9 feet long is nice, as is a saw that can handle an 8-foot drop to the floor.

I know many people are framing with cordless saws now, and I certainly have a whole fleet of them on my truck. They're unbeatable for carrying around the job, working on staging or on the roof, trimming sheathing, cutting openings, and all sorts of light-duty work. But corded saws are still faster, more powerful, and better for heavy-duty cutting. I'm always after my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Crosscutting and notches. By setting sawhorses apart slightly less than half the length of your stock (for example, 7 1/2 feet for a stack of 16 footers), you can cut pretty much any length, from either end, without moving the horses or sliding the lumber very far **(5)**. When cutting off an end, reach across the saw before you finish the cut and catch your piece so you don't need to bend over and pick it up **(6)**. When cutting between the horses, use slight pressure up and back with your off hand to prevent binding. When the cut is done, hold one piece with your hand and the other one balanced with the saw—again, nothing drops to the floor where you would need to pick it up **(7)**. When notching a board, make the edge cuts first, setting the blade depth to avoid over-cutting **(8)**. Then sight the blade over the cut line and ease it into the board to make the plunge cut **(8)**, flipping the board over to finish the cut.

crew to run power cords—but they don't care as much about speed as I do, and they're not the ones buying the batteries.

Setting up the saw. It used to be that we'd routinely use a handful of different blades for our circular saws, depending on what we were cutting. But now, with specialty saws taking over many of the other jobs that we used to adapt our saws to, most of us just use the same basic 24-tooth thin-kerf carbide blades for all of our carpentry. These cost about $10 and do most cuts well enough. I keep a stack of used ones for demolition jobs too. If you were going to use your circular saw for cutting trim or paneling, you could get a 40- or 60-tooth finish blade, and of course, there are specialty blades for cutting plastic, steel, cement board, masonry, tile, or just about any other material you might have.

Many people don't change blades as often as they should, and as a result, work themselves and their saws harder than they need to. If you use your hands efficiently, changing a blade is only about a 20-second procedure (see photos, page 7).

Circular saws are dead simple to adjust, but unlike more advanced tools, they are not precision instruments: You don't fine-tune them for fractional degrees or cabinet-quality cuts. Out of the box, you just want to make sure that the table is square to the blade when set to zero degrees, that the built-in stop at 45 degrees is accurate, and that the depth scale is readable and close to right. When I get a new saw, or after I drop an old one off the roof, I make those quick checks with a layout square.

One of the things that sets a good saw apart from a bad one is a blade guard that works well. A good guard should retract easily as you start most cuts, and it should be easy to retract manually for more difficult cuts, like sharp angles or compound bevels. And of course, it should spring back into position reliably after every cut.

In the bad old days, we used to routinely pin up the guards or even remove them altogether, and even today, I see people doing that. It's not worth the risk. In 40-plus years of construction work, I've seen a few bad accidents, not to mention countless cords cut and a lot of damaged materials.

Even if you yourself can use an unguarded saw safely, remember that someone else may pick it up and hurt themselves, or you.

Crosscutting. The first thing to know about cutting stock to length is how to support your material. On many framing jobs, we cut a lot right off the stack, or on the floor, but there's a reason we call those jobsite caballos "sawhorses." It's because they're for sawing stuff. I often see people set their horses as though their primary purpose was to hold stacked material, but that's a mistake. Horses should have almost half the material hanging off the ends. For example, for a stack of 16-foot material, sawhorses should be placed about 7 1/2 feet apart. That way, you can cut any length without binding up or straining (see photos, page 8).

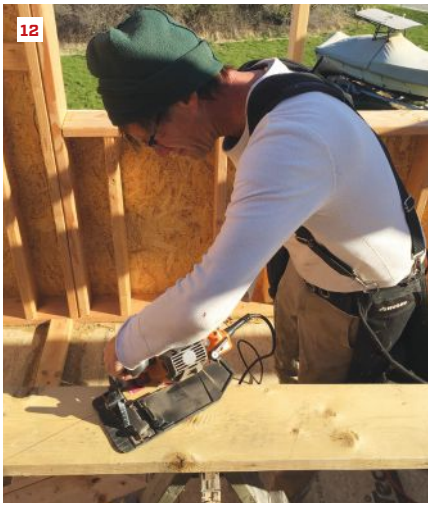
The next thing to understand is the physics of making a straight cut through square material with a round blade. The blade needs to enter the material aligned with the cut and go straight through without turning. Until you're good, use the handy notch on the front of the table to align the blade with the cut. As you make the cut, the stock needs to balance or be held so that the kerf doesn't tighten on the blade, or it will bind or kick back. At the same time, you can't let the kerf open too much, or the board will split and break before the cut is finished.

After you master the basics, you can work on refinements like cutting multiple lengths, gang cutting, or holding on to your offcuts so that you don't need to bend over and pick them up.

Angles and bevels. I explain to new carpenters that an "angle" is when you draw the cut line other than square and a "bevel" is when you set the saw to an angle. If you do both, it's called a "compound angle" or a "compound bevel" (see photos, below).

There are three keys to making these tricky cuts:

1. Starting the cut so that it goes in a straight line
2. Supporting the stock so that the kerf doesn't bind
3. Getting the guard to retract, either on its own or manually



Angles and bevels. Start an angle cut by aiming the blade; if the notch is on the cut line and the blade also starts there, the saw is oriented correctly **(9)**. You'll need to lift the blade guard to start most angled cuts **(10)**, but if the angle isn't too acute, you can just lift the back of the saw slightly to get it started. When making a bevel cut, use the alignment notch on the front to keep the saw aimed straight along the cut **(11)**. You almost always need to lift the guard to start compound cuts, while the saw angle makes lifting the guard and holding the front handle at the same time a little tricky **(12)**. Follow the cut line carefully to avoid binding the blade **(13)**.

Sheet material. When cutting sheathing, lift the top sheet (or several, if you're gang cutting) and throw one or two scrap pieces of lumber under it **(14)**. With two scrap pieces about 3 1/2 feet long, you can make wide rips, notches or odd shapes, and diagonal cuts right off the stack **(15)**. When making narrow rips, clamp your fingers on the front of the base after starting the cut to help guide the saw **(16)**. Alternatively, you can do it visually using the scale or notches on the front of the table. For repetitive narrow rips, clamp locking pliers to the table to help guide the saw **(17)**.

The first two, starting the cut and supporting the stock, simply take practice and experimentation, but for getting the guard to retract, there are a few tricks worth passing along. For some cuts, you can lift the back of the saw slightly as you start the cut, or just compensate for the resistance of the guard by holding tight and forcing it to start. On most saws, another option is reach across with the thumb of your front hand and hold the guard up manually. For compound cuts, you almost always need to do this. Once the cut is started, let the guard spring back into its normal position.

Cutting sheet material. A circular saw could be described as an upside-down hand-held table saw; it rips lumber and sheet material quite well. Rip fences are available—they either come with the saw or are an optional accessory—but I rarely see them used. Most of us rip by marking a pencil line or snapping a chalk line and following it; by eyeing a mark (or the edge) on the saw base; by using our off hand as a fence; or by clamping small Vise Grip-style locking pliers to the front of the saw (see photos, left).

Watch a good drywall hanger attacking a job, and you'll understand the basics of what you need to know about cutting sheet stock. Work right from the pile; don't move anything twice; measure, mark, and cut efficiently; and keep your scrap organized.

Depending where you're cutting, either slide part of the sheet off the edge of the pile, or lift it up and throw a scrap or two under it for blade clearance. And of course, if you need a bunch of the same cuts, do them all at once—most saws will cut through three or four layers of sheathing at the same time.

Finally, whether you're cutting sheet goods off the stack or dimensional lumber on a set of sawhorses, always set the depth of your blade to just a quarter inch or so more than the thickness that you're cutting. This protects the material underneath, takes a lot of load off the saw, and reduces the chance of kickbacks.

John Spier owns Spier Construction, a building and remodeling company on Block Island, R.I.

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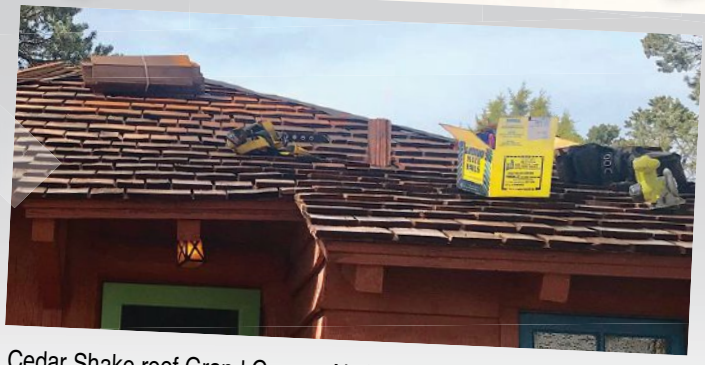

Cedar Shake roof Grand Canyon National Park, circa 2018

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Photos by Roe Osborn/JLC

Tiling Over Existing Tile

BY TOM MEEHAN

Recently, I was called in to look at a 12-year-old shower floor. The floor was intact, but the grout lines had darkened over time, and it was unsightly **(1)**. The house is a seasonal rental on the beach that rents for top dollar, and the owners wanted the bathroom to be presentable.

Often, a situation like this can be addressed by cleaning with a strong detergent acid. So I tried that, but the powerful cleanser didn't touch the grime. Apparently, the grout had never been properly sealed.

Since I couldn't clean the shower floor, I suggested a simple solution: Given that the existing tile floor was sound and wasn't leaking, why not tile over the floor with new tile? I've done this many times before. The owners liked the idea, so I went ahead.

Before I started, I removed the existing drain cover **(2)**. I wanted the new drain cover to be flush with the new tile, so I inserted some spacers cut from a sheet of Schluter Ditra mat. I applied a little dab of thinset mortar to the Ditra pieces and set them in the corners of the existing drain **(3)**. That way, the new drain I would install later would come flush to the surface of the new tile.

In this case, the existing floor was porcelain tile, but this tiling technique can be used over any kind of tile—porcelain, ceramic, or natural stone. I started by scarifying the surface of the tile using a grinder with an aggressive blade **(4)**. I roughened up about 85% of the surface, which is enough to give thinset mortar a powerful grip. I was careful to ventilate the space, and I wore a respirator mask to protect my lungs.

Before I started to apply mortar, I checked the pitch of the existing tile floor **(5)**. I made sure that the pitch was at least 1/4 inch per lineal foot and that there were no low spots. Had I found a problem, I would have made up for it when I applied the cement. But in this case, the floor had an adequate pitch and there were no low spots.

Having roughened up the floor, I began to apply a skim coat of thinset mortar, about 1/16 inch thick, to the existing tile **(6)**. I used Laticrete Platinum 254, an extremely tacky, dense polymer-modified formula that bonds tenaciously to anything (laticrete.com). This is the kind of stuff that if it gets on your jeans, you don't launder them—you just throw them away.

Next, I set the new drain and drain cover. I buttered the back of the drain first **(7)**, and then, with its cover


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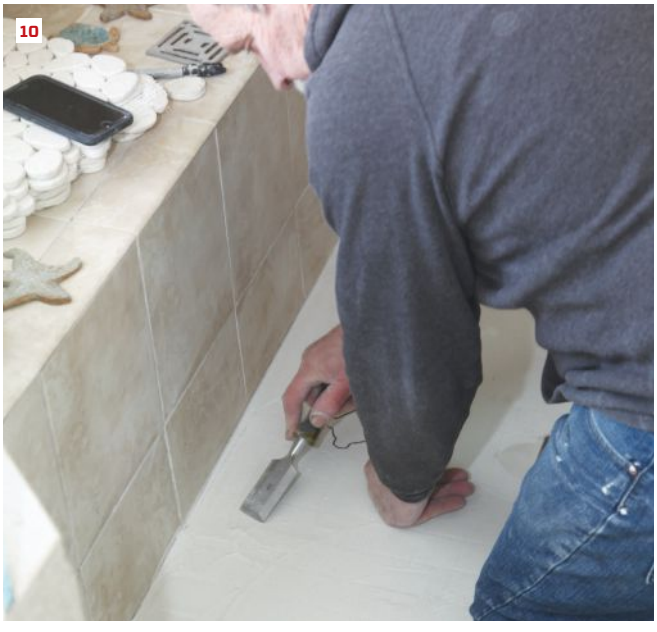
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screwed on, I set the drain carefully in place over the existing one **(8)**. I buttered it carefully, putting on just enough to make a good seal but not so much that it would squeeze out and go inside the drain.

When I had applied thinset to the entire shower floor, I stopped for the day and allowed the cement to harden overnight. The next morning, I positioned the decorative tiles, marking their locations with a Sharpie marker **(9)**. These custom-made tiles, in the shape of sea creatures such as fish, crabs, and clams, came from my wife's business, C Shore Designs (cshoredesigns.com), so I got them locally, but they're available worldwide by mail order. Earlier, I had asked the homeowners to position the sea-creature tiles on the shower floor, and I took a picture so I would remember where to place them. Now I would use the Sharpie markings as a guide.

Laticrete Platinum 254 is extremely strong and tenacious, but it's as sticky as salt-water taffy to work with. It's hard to apply it perfectly flat and smooth it the way you can a traditional mortar bed. After


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I applied it, there were a few ridges in the surface. So the next day, when the Laticrete was set up but still not fully cured, I used a sharp chisel to cut off the ridges and make a flat surface **(10)**.

Now it was time to start setting tile. I used natural stone tiles in a mesh sheet, supplied by Island Stone (islandstone.com). I like this brand because tiles always interlock perfectly—you can turn them left or right, and they still mate up. This variety was flat river stones. I started by cutting the edge of a sheet to make a flat side **(11)**. You have to cut the stones on a wet saw—you can't score and snap them the way you would a ceramic or porcelain tile. But for trimming or cutting small pieces, you can use hand tile nippers.

With a 1/4-inch V-notch trowel, I spread a second coat of thinset mortar to make a setting bed. For this coat, I didn't use latex-modified thinset—I used regular thinset. Then I began to set the sheets of river stone **(12)**. Where the sea-creature tiles would be, I cut out the shapes in the sheets of stone, cutting the plastic mesh with a utility knife.

As I worked, I set the decorative tiles in the voids I had created. I back-buttered the decorative tiles carefully **(13)**, making sure to evenly spread the mortar over the claws of the crabs and the fins of the fish and the arms of the starfish. The decorative tiles are strong, but they're still delicate until they're supported evenly by mortar. I put on enough mortar to hold the decorative tiles a hair higher than the surrounding stones, to make a lifelike presentation **(14)**. When the sea creatures were in place, I cut some small pieces of stone with the nippers and pieced in around them.

Once all the tile was in place, I pressed the stones down with a rubber grout trowel to make sure there were no high edges **(15)**. That way, I knew the floor would be flat, with a smooth pitch to the drain.

The next day, before grouting the floor, I cut some mortar out around the decorative tiles using a utility knife. I wanted to be sure that the grout would go down at least 1/8 inch below the surface of the tile, so that the grout would have enough substance to take hold. I used a vacuum to pull out the dust as I cut **(16)**.

After grouting the tile using Power Grout from TEC (tecspecialty.com), I cleaned the surface of the stones with a sponge **(17)**. When I was finished, I had a brand new floor **(18)**.

There's one more step that you don't want to skip: sealing the tile. I used 511 Impregnator by Miracle Sealants (rustoleum.com). And in this case, because I was using natural stone, I applied sealer twice: once before grouting, and once a few days after grouting and cleaning. It's always good to put two coats of sealer on natural stone (overkill is always a good thing).

If you didn't know about this method, you might think that to replace an existing tile floor, you have to chisel out the old tile and start over again. But this way is much simpler. In addition to saving labor, it has the advantage that you don't jeopardize the integrity of the existing drain and shower pan by chiseling.

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


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A Classic Room Divider

BY GARY STRIEGLER

Most people will tell you that the secret to a good open floor plan is to define room spaces without interrupting sightlines. That's the concept behind a trim detail we completed on a recent remodel job. While open floor plans might seem like a hot new trend, room dividers aren't; if you are a fan of historic homes, you probably have seen variations on the trim detail described in this article.

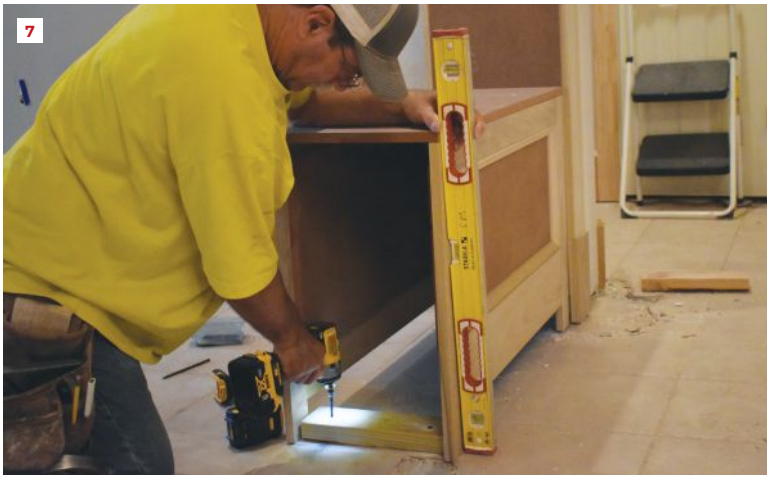
A classic design. The home had a large living room with a couple of large bookcases capped with a short end wall that defined the room. To open up the space, we removed the bookcases, but our client still wanted some kind of architectural feature that would help signal where the foyer ended and the living room began. He was open to suggestions, so I shared several pictures from my design album that I had saved over the years, and it didn't take long for him to pick one—which I think of as a classic room divider—as the inspiration for our design.

Fortunately, the room had 9-foot ceilings. I have seen versions of this detail in bungalows with 8-foot ceilings, but it's tricky to make the proportions work out with a standard ceiling height. In our interpretation of the detail, we build a false beam across the ceiling and two short paneled wall sections on either end to serve as pedestals for a pair of 12-inch round columns. These trim details are almost always painted, which helped a lot on this project because it allowed us to use fiberglass columns and a healthy mix of MDF stock, poplar trim, and finger-jointed moldings to build the beam, pilasters, and paneled walls.

Structurally, there was a large LVL beam in the attic that carried

The crew began by fastening 2x4 cleats to the ceiling directly underneath an LVL beam that supports the second-story floor framing **(1)**. After tacking MDF sides to the cleats **(2)**, the crew added stacks of blocking **(3)** as they continued to build out the false beam. MDF cleats were tacked and brad-nailed to reinforce the spliced butt joints **(4)**.

Photos by Gary Striegler and Mark Gannaway



The author fastened an MDF panel to the wall underneath each beam end, building out the pilaster detail with short MDF returns as needed **(5)**. Then he assembled four frame-and-panel sections with pocket screws for the short walls **(6)**. After PT plates **(7)** and vertical 2x4 blocking were added to support the columns, the end panels were glued, pinned, and clamped into position **(8)**.

the ceiling joists and some roof bracing. The two short walls we removed didn't carry much of the beam load, but to prevent any settling, we supported the beam with a temporary 2-by post until we placed the round columns **(1)**. I planned to reinforce the beam above the column locations with solid blocking and to install vertical 2-by legs under each column as we built the new wall sections.

Building the beam. Working from the design in my inspiration photo, which showed a beam wider than the column capitals, we started by snapping a pair of chalk lines on the ceiling 12 inches apart and nailing 2x4s to the lines. Instead of removing long pieces of existing crown molding to accommodate the new beam, we used a multi-tool to cut out just the areas of crown that were in our way.

The room was more than 16 feet wide, so each part of the beam required a splice. When nailing up the MDF sides of the beam **(2)**, we used just enough fasteners to hold them in place, then sighted down the entire beam to make sure the sides were straight. If you don't trust your eye, you might want to pull a string, but most good trim carpenters can see any adjustments that need to be made to keep the pieces aligned. We just made a simple butt splice, but each joint is backed by a 6x10 piece of MDF fastened with glue and brad nails **(3)**.

At each end of the beam—directly above the future column location—we stacked 2x4 blocks **(4)**. The trick is to make sure the blocks are stacked plumb or even slightly leaning in (easy to shim out to plumb, but impossible to correct if the blocks bow out). We also added stacks of 2-by blocks every 3 feet across the length of the beam to make it rigid.

The author used a flexible wood batten to mark the cut lines on the round columns **(9)**. To help ensure that the tapered columns were installed plumb, he used a spirit level to align the centerlines that he marked on the columns' capitals and bases **(10)**.

A number of different elements were used to trim out the false beam, starting with another wide MDF band applied to the sides of the beam, followed by a 1/2-inch-by-2-inch bead **(11)** and other panel and crown molding profiles **(12)**.

I needed to add a solid shim between the 2x4 blocks and the beam bottom to make sure that any loads from above would be transferred down to the round columns, so we spliced the beam bottom just beyond each column. Then we installed a solid lumber shim that had been carefully planed down for a tight fit. It added a splice, but I didn't want there to be any chance the beam would bow under load. To attach the rest of the beam bottom, we added short nailer blocks, using a scrap of MDF as a gauge block as we went.

Pilasters and short walls. The round columns would sit at the ends of short paneled wall sections, but first I had to build a pair of full-height flat pilasters, one at each end of the beam right at the wall **(5)**. I started by drawing plumb lines down from the beam ends, then added blocking as needed at the top and bottom and along the wall. I built the flat pilasters out of MDF ripped to width and nailed to the wall.

Next, I ripped stiles and rails to width from S4S poplar and cut MDF panels from 3/4-inch-thick sheet stock. Then I used pocket screws to assemble the four frame-and-panel sections and the two end-cap panels for the short walls.

After setting the short wall panels in place **(6)**, we added MDF tops, and PT plates between the panels **(7)**. To make sure loads from the beam were transferred to the slab, we added three vertical 2-by blocks under each column location before installing the end caps.

To make seamless joints in the assembled pilasters, I used a four-step process. First, I applied a generous amount of wood glue to the joints. Then, after positioning the pieces, I tacked the joints together

Panel molding was also used to create the simple frame-and-panel detail on the pilasters **(13)**. Once completed **(14)** and painted **(15)**, the classic room divider helps define the transition between the entry foyer and the living room.

with a headless 23-gauge pinner, to keep the pieces aligned. Next, I clamped the joint together until glue started to squeeze out **(8)**. After about an hour, I removed the bar clamps and sanded the joints smooth with a small random orbit sander.

Wrapping the MDF tops with panel molding and the wall bases with baseboard finished off the short-wall detail.

Fiberglass columns. After making sure there was solid blocking inside the beam and the wall below, now I had to carefully measure and cut the fiberglass columns to fit snugly between the two. Cleanly and accurately cutting a round post can be challenging, but I've always had good success bending a thin wood ripping around the column to mark the cut line **(9)**. I don't typically cut fiberglass columns using my best saw blade; they cut well enough with a good carbide-tipped blade.

These columns were tapered, so I marked the centers of the capital and base and then used a long level to plumb the columns up in both directions during installation **(10)**. To attach column capitals and bases, we typically use long trim-head screws, in addition to a little construction adhesive.

Trim details. With the columns installed, we returned to finishing up the beam by filling in the remaining bottom pieces. To match the design in our inspiration photo, we ended up almost totally covering up the basic beam with multiple layers of trim, starting with a wide band of MDF held one inch up from the beam bottom **(11)**.

The rest of the trim detail resembles a header detail we often use on windows and doors. We started by adding a 1/2-inch-thick-by-2-inch-wide site-made bead detail under the MDF band **(12)**, then stacked a 3/4-inch-by-5-inch strip of poplar above the bead. The final piece of the header detail is a 1-inch by 2-inch-tall panel molding with a crown-like profile. A small crown or bed mold would work here too, but I like the solid top of this molding. Before we put away the stepladders, we finished running the finger-jointed crown molding around the room.

I was starting to get excited about how the project was looking, but I could see two places that needed a little more attention. We added frames made of a small panel molding to the flat pilasters at the wall **(13)**. The joint between the beam sides and bottom had only been nailed. I didn't have enough clamps to do the whole joint at once, so we added a small clover-leaf molding instead of trying to make a perfect joint with glue and clamps.

The room divider is the first thing anyone coming in the front door sees **(14, 15)**. Before the painter even got to the job, we were getting compliments from everyone who stopped by. It looked like it was part of the original trim package. Most important of all, my client absolutely loves it.

Gary Striegler, a JLC contributing editor, owns Craftsman Builders (craftsmanbuildersnwa.com), in Fayetteville, Ark., and teaches workshops at the Marc Adams School of Woodworking. Follow him on Instagram: @craftsmanbuilders.


Photo credit: Todd Crawford

Solving the Riddle of Tricky Cladding Transitions

There's a reason why two-piece profiles are gaining traction with more and more cladding contractors.

Let's face it. There are few things more frustrating than aligning and sequencing siding fiber cement (or lap siding) panels to get the termination profiles right. Or, how about that odd panel size required between two windows? Doesn't look like a big deal to most people passing by the project. Only you know how many cusswords were muttered to install that blankety-blank six-inch cladding strip.

So, what are growing numbers of siding contractors and remodelers turning to? Two-piece profiles.

True, two-piece formats may not be much of a time-saver, especially when you factor in the required adhesive for the cover cap. But they can be a comparative dream to work with in difficult detailing. Consider these applications:

- **Fiber cement panel cladding.** A two-piece profile takes some of the strict, regimented work out of the cladding process by allowing a bit more leeway in panel arrangement. A two-piece profile makes fitting into the profile easier and also simplifies the masking of field cuts.
- **Window separation.** Two-piece panel J molds do a great job in handling tight space applications, like a small separation area between windows or between a window and building corner. Maybe you need a six- or eight-inch piece to complete the façade. It's not easy to trim out a piece for unusual sizes. A two-piece profile allows you to apply the base part first and then snap the cover cap in place at your convenience. Try it sometime. You may find it beats a standard termination profile in a lot of situations.
- **Columns.** You know the drill here. The first three corners lay out with no sweat. The fourth? A bit of a challenge. What do you do with it? A two-piece corner profile might provide an easy answer. The cap component provides the wiggle room you need without the usual fussing over the demanding fourth side.

If you haven't given two-piece profile trim a try, it's certainly worth considering. You may find it a real problem solver for tricky conditions.

To learn more, visit **www.tamlyn.com**.

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BY RICHARD STEVEN

Flexible Pricing: A Strategy for Uncertain Times

Pricing work has long been an issue for remodelers. I well remember my early days in the 1970s when, with no understanding of operating expenses or profit, I fumbled to justify any charges above direct costs. Only after frustrating business losses drove me to self-education through reading, workshops, and the school of hard knocks did I begin to understand concepts such as burdened labor, gross margin, and the need to make a real profit.

Over the past 30 years, industry educators such as Walt Stoeppelwerth and others have taught business principles to remodelers who essentially found themselves in business by accident as they plied their craft. One such principle was the need for remodelers to price their work at a markup of 1.5 to 1.67 for a gross margin of 33% to 40%.

Many remodeling companies have been built on this principle, and many of them have focused on doing large projects for fixed, non-itemized bids. Their pricing system consists of listing projected direct costs and marking up each item by their chosen multiplier to arrive at a total price. This system has the benefits of being easy to understand and, when costs are estimated accurately, effectively aligning individual job prices with company gross-margin needs. However, there are also drawbacks to this pricing system—especially in a marketplace where proposals are scrutinized with a fine-tooth comb—and some companies using it find themselves struggling today.

One drawback of lump-sum pricing is the difficulty it creates for explaining prices to clients. You may need an overall 33% gross margin, but do your clients see the fairness in marking up the dumpster by 1.5? Should commodities and unique services be marked up equally? To facilitate client communication and to build trust, it may be better to attach a higher markup to demolition and rebuild and a lower markup to the dumpster.

Another drawback of lump-sum pricing is that it starts with a focus on your costs. What if your costs are out of line? What if your direct labor includes fat or your operating expenses include fluff? The marketplace rewards efficiency, especially in competitive times.

HALF-TRUTHS

It's often said that the major reason for lack of company profitability is the failure of remodelers to charge adequate prices, with the clear implication that the solution is a price increase. It is also frequently said that you can't concern yourself with what others are charging; you must base your prices on your costs and charge whatever you need to be profitable. These statements are only half-true. The flip side of prices being too low is that costs may be too high. If that's the case, the solution lies in lowering costs, not raising prices.

One drawback to lump-sum pricing is that it focuses on costs. What if your costs are out of line? What if your direct labor includes fat or your operating expenses include fluff? The marketplace rewards efficiency, especially in competitive times.

And while it's true that your prices must be set for your specific business costs, we do still need an awareness of what others are charging for similar work. Our business costs do not automatically translate into client benefits. Potential clients compare options, and we must make sure that our higher prices are justifiable by higher value and are not simply the consequence of higher expenses.

GETTING A GREAT DEAL

Flexible pricing is an alternative to lump-sum pricing. Flexible pricing starts with a focus on the clients and the things they value. As consumers, we enjoy buying when we believe we're getting a great deal—not necessarily the cheapest one. When car shopping for our college-bound daughter, we checked the Kelley Blue Book value and prices on Craig's List so we could recognize a great deal when we found it.

What would constitute a "great deal" to your potential clients? Is there any way you can provide it for them? Or can you provide it with only slight modifications? Why are they interested in the project? What are they willing to pay? If your company budget calls for an average gross margin of 30% and the client's project

budget is $100,000, what can you provide for $70,000 or less in direct costs?

Flexible pricing might mean explaining what you can do within the client's budget rather than trying to convince them to increase it. It might mean allowing clients to provide more products or services themselves. It might mean applying different markups to different project components.

Flexible pricing does not mean ignoring your costs or basing your prices on what others are charging. Rather, it means focusing first on what clients want and value, then reconciling client desires with your costs. To meet a client's budget, a remodeler I know recently decided not to mark up the roofing portion of a large project. He had used the subcontractor for years and knew the sub would stand behind his work. The remodeler charged six hours of project management at a healthy margin, but passed along the roof itself at his cost. He was delighted to get the four-week job, which had a sufficient gross margin without the roof to pay a month and a half's worth of operating expenses.

Gross-margin dollars are more important than gross-margin percentage. You need a certain number of gross-margin dollars every month to pay operating expenses and generate profit, but the percentage of total sales will vary, depending on that month's volume.

KNOW YOUR NUMBERS

There are definite risks to a flexible pricing strategy. Projects become more complex and project management more difficult. Most crucially, overall company gross margin will decrease unless you offset lower-margined items with increases elsewhere.

If your company budget requires a 30% gross margin, you must achieve that as an average. When individual projects include elements with varying multipliers, the significant margin is the bottom-line total.

Your budget must be based on your average achieved gross margin, not the target margin for your unique services.

NAVIGATING CLIENT UNCERTAINTY

We learned a lot during the Great Recession last decade that might help us with the current moment of uncertainty as building businesses reemerge and prospective clients tread cautiously into spending on new projects. As in the post-Great Recession period, it is likely that homeowners will increasingly pick and choose between vendors and suppliers to put together projects that feel to them like great deals—ones that deliver the highest value for the lowest cost in their own minds.

A flexible pricing strategy can help you offer great deals. The

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trick is to call out your unique services—the type of work that you do better than anyone else does—and treat them differently from commodities—what is easily found elsewhere. The goal is to persuasively justify your prices and the value you provide to the client.

Of course, offering great deals requires that you price with your sharpest pencil. To do this, yet still achieve the margin you need, you must know your numbers. This holds true at any time, but it is especially important in these uncertain times, when, in many markets, the client base may be smaller and the pressure to price jobs competitively that much higher. But even with clients who can afford to move forward with a project, there is likely to be a strong inclination to expect a good deal.

Above all, it's important to question your assumptions. How many gross-margin dollars do you need each month? Are operating expenses as lean as they can reasonably be? Is your target gross margin set correctly in light of actual operating costs and projected volume? Can direct costs be lowered by better project management?

If you are in a bidding environment (as many in the most competitive remodeling markets are), you don't want to become the low bidder. That's not your goal. The goal is to achieve the margins you need by fine-tuning your business for higher performance.

Richard Steven, president of Fulcra Consulting, specializes in helping remodeling companies create and implement effective management plans; www.fulcraconsulting.com.

BY BRYAN UHLER

A Simple Ventilation Strategy

We're spec builders in western Washington state, and while we're not in the luxury home market, we do want to make sure our brand is associated with quality. That principle applies across the board, including in the area of home ventilation: When it comes to choosing and installing ventilation fans, we like to go a step beyond "builder basic."

Like any modern house, our homes have quite a few fans installed. For an example, consider the spec home we're currently building. This 3,800-square-foot house has a Panasonic Intelli-Balance 100 energy recovery ventilator (ERV); a Zephyr Gust kitchen range hood exhaust fan; and seven Panasonic WhisperValue bath fans with a variety of options.

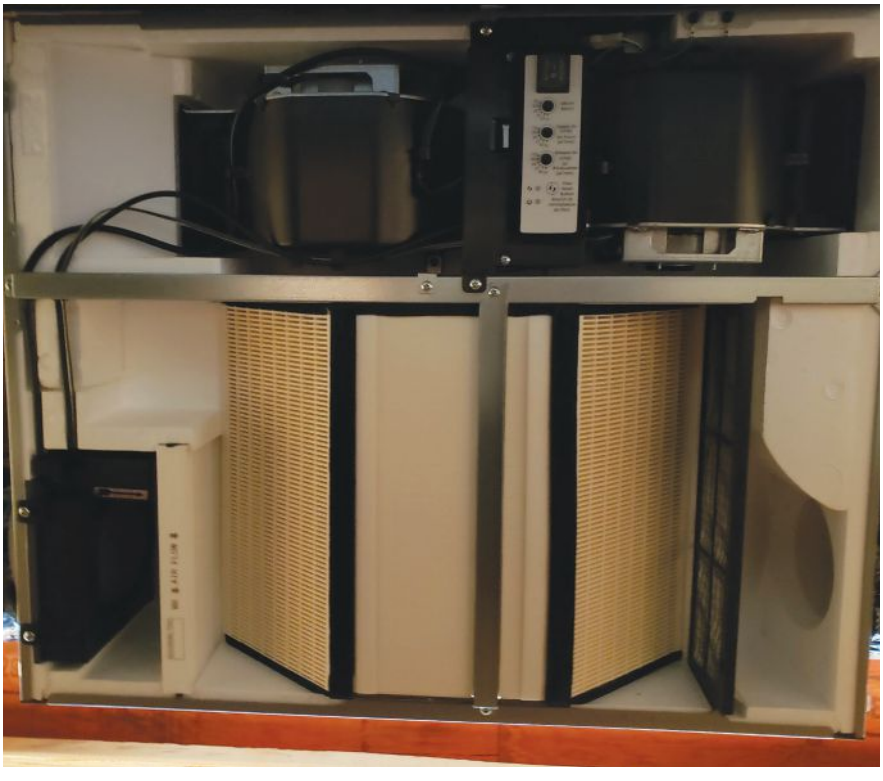
TWOFOLD STRATEGY

We test our homes for airtightness with a blower door. Code in our area requires every new house to test out at 5 air changes per hour at 50 pascals of pressure (5 ACH50) or better, but we choose performance options in the Washington state energy code that require us to achieve 3 ACH50 or better. We don't go all out to maximize airtightness (our tightest homes have measured between 1 and 2 ACH50); this is part of our general strategy to provide a high-performance home without pricing ourselves out of our market.

Homes that are tighter than 3 ACH50 require mechanical ventilation, based on the options that we choose from tables in the Washington energy code. To meet this criterion, we typically install a Panasonic Intelli-Balance 100 ERV, which can be adjusted to provide between 50 and 100 cfm (cubic feet per minute) of supply and exhaust airflow.

Our strategy for ventilation relies on a combination of continuous ventilation using the Intelli-Balance ERV, and intermittent ventilation using kitchen and bath exhaust fans and a utility-room exhaust fan. The ERV provides continuous fresh air to the house, while the ventilation fans remove moisture and odor at the point where they're created. We're not required to provide makeup air for the range hood, because it draws only 400 cfm.

In the past, we used an exhaust-only ventilation strategy, relying strictly on a point exhaust fan with a timer, located in the utility room. But that didn't allow us to control the source of our fresh air: Air drawn into the house came in through random cracks in the envelope, and it wasn't filtered. We switched to an ERV in order to provide a reliable source of fresh air and also to recover the heat contained in the outgoing air, including the enthalpy (the heat contained in the outgoing moisture). Using an ERV also helps us maintain a comfortable level of humidity in the home in the winter, when there's a tendency for the air to dry out, causing shrinkage of wood floors.



The inside of the Intelli-Balance 100 ERV is shown above. External controls on the unit allow the installer or owner to set the intake and exhaust airflow independently, allowing the house to be placed under a slight positive or negative pressure if desired. The unit accepts either a MERV 8 or a MERV 13 filter.

Photos by Tim Uhler and Bryan Uhler

One interesting wrinkle with the Intelli-Balance 100 is that the airflow speed of its intake and exhaust fans can be independently set using dials on the outside of the unit, in a range from 50 cfm up to 100 cfm. This means that the home can be set up to operate at either a positive or a negative pressure. In this house, we set the fan for supply-side inflow to be slightly higher than exhaust-side outflow. The idea is that this will compensate somewhat for times when the point ventilation exhaust fans are running; the rest of the time, the house will operate at a slight positive pressure.

The ERV draws in a steady supply of clean, filtered fresh air. But we don't rely on the ERV for removing polluted air from point sources of pollution in a house. Split over multiple bathrooms in a house, the ERV's 100-cfm capacity wouldn't divide out to provide sufficient exhaust, and extending ducting from the ERV to all those areas would be complicated. Instead, we use dedicated exhaust fans in the areas where air pollution and humidity are generated. This provides ample capacity and keeps the ductwork simple.

What about that point ventilation? There could be a temptation to simplify the specifying of exhaust fans by just ordering one type and calling it good. However, tailoring the fan unit to the specific room results in maximizing value while minimizing costs. It might seem like a small thing, but done correctly, the humble exhaust fan can be a selling point to differentiate a business from the competition.

EXHAUST FANS

At Pioneer Builders, we have had a good experience with Panasonic fans. From its products, we select the options for each fan according to the room it will operate in.

We've found Panasonic WhisperValue fans to be excellent fans to use. These fans are low-profile, and they are UL rated for ceiling or wall installation. While we're a new-construction, single-family

The author places a Panasonic WhisperValue fan, one of seven in the 3,800-square-foot house (above left). A look inside the housing shows the controls inside the fan that allow the installer to select an exhaust airflow of 50, 80, or 100 cfm (above right). The relative humidity set point of the room can also be dialed in for the condensation sensor.

residential builder, these fans would work well in retrofit or remodel situations as well. Remodelers who run into situations with shallower studwall cavities or ceiling joist cavities may find that this fan fits the bill. The fans' low profile may also be valuable in a multifamily situation where you don't want to penetrate a fire-rated ceiling.

The motor is an ECM (electronically commutated motor) that is engineered to run continuously. The motor increases the fan speed automatically when the unit senses static pressure, to maintain the selected cfm. The more bends in ductwork, the more difficult it is to push air through it. The fact is, not all ducting ends up being perfect, so having a fan that adjusts to real-world conditions is a valuable feature.

Another feature of these fans that we like is the manual adjustability of the fan speed. While there is a more powerful model, we typically install the one that can be set at 50, 80, or 100 cfm. We set the fans to 50 to begin with, which is the quietest setting, but also moves the least air. As part of our home-selling package, we include four visits to the homeowners for the first year after purchase, and one of the things we check is how happy they are with their fans. For example, if they aren't moving enough air out of the bathrooms quickly enough, we can increase the speed. At any cfm setting, these fans are very quiet: The noise created varies in a range from less than 0.3 sones (at 50 cfm) to 1.3 sones (at 100 cfm). They're also energy-efficient: The cfm per watt for the fan operation can range from 7.2 to 12.8.

An exhaust-only ventilation strategy didn't allow us to control the source of our fresh air. We switched to an ERV in order to provide a reliable source of fresh air and to recover the heat contained in the outgoing air.

Like other fans in the Panasonic lineup, the WhisperValue is a versatile brand. You can buy the basic model, which is only a fan, or you can add in several practical modules including an LED (light emitting diode) light, an LED night light, and a condensation sensor. The option that we are most likely to include is LED lighting. Depending on the size of the room and the height of the

ceiling, that may provide sufficient light for the room. Note that the color temperature is 3,000 Kelvin, so you may want to take that into consideration when specifying lamp colors for additional fixtures located near the exhaust fan.

Another option that we specify depending on the room is a condensation sensor. We select units with sensors for high-humidity rooms, such as a bathroom with a shower or bathtub.

All this flexibility and performance comes at a price: These fans cost about double what a builder basic model would cost us. But the bottom line for the whole package of Panasonic equipment, including the ERV, is modest at about $2,000 (our cost).

ROOM BY ROOM

As noted earlier, in the 3,800-square-foot home we're currently building, there are seven WhisperValue fans, each one ducted directly to the outside using insulated flex duct. They are all the same base model, but the add-ons vary depending on where the fan is located.

The most basic fan is in the laundry room. This room has two light fixtures, so we installed a base model WhisperValue: fan only—no light—controlled by a simple wall switch.

Next up is a basement storage room. This room has plenty of lighting too, but we were concerned that it might experience elevated humidity levels. So we installed the fan model with a condensation sensor but no lights.

The powder room on the main living level has a unit with a fan, night light, and light, but no condensation sensor. With no shower or bath in it, this room has no significant source of humidity.

There are three full bathrooms, including a master bath. Each of these bathrooms received the full range of options: fan, night light, light, and condensation sensor. The master bath also has an adjoining water closet; for that room, we selected the unit with a fan, night light, and light, but no condensation sensor.

The wiring becomes complicated when you order the whole menu of options. You need separate switching for the fan, the night light, and the regular light, plus an unswitched continuous power supply for the condensation sensor. You have to plan for the boxes and circuits for all that. You'll want to make sure your electrician goes over the wiring specs for the fan carefully and understands what he's getting into.

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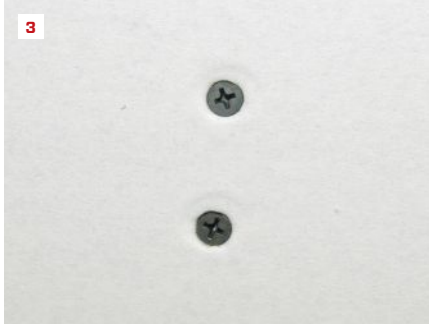
BY MYRON FERGUSON



This **(1)** is the goal for drywall painted with flat paint: a Level 4 finish—tape coat followed by two finish coats lightly sanded with 220-grit paper. For a glossy or eggshell finish, go with Level 5, which adds a skim coat of compound over the entire surface. Screw pops **(2)** are the most common callback in the industry and often result from poorly driven screws. The top screw **(3)** is driven properly, but the bottom screw has broken the paper around the screw head.

Avoiding Drywall Callbacks

JLC contacted long-time JLC contributor and JLC Live presenter, Myron Ferguson, to plumb his expertise on what can go wrong with drywall and how problems can be prevented. Myron started us off with an overview, before we dove in with specific questions.

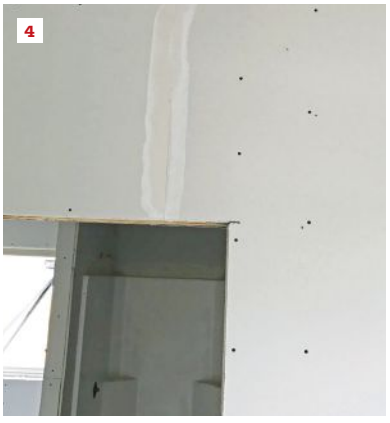
MF: Someone joked to me recently, "It's only drywall—anyone can screw it up!" The truth is, it's easy to do a lousy job with drywall. There are a lot of good, basic rules to follow, and it all starts with the quality of the hanging job: Use longer sheets to minimize butted seams, run the boards perpendicular to the framing, use screws instead of nails, use drywall adhesive on the framing in the most visible areas, don't use too many screws, and use the proper length screws. Most importantly, don't depend on the tapers to fix problems that were created by the hangers.

It's not just the drywall. Homeowners usually have high expectations for completed drywall work. People expect a perfectly smooth, blemish-free surface, and they expect it to look that way years after the project is completed. Part of my job is managing those expectations. I can do a Level 5 finishing job in a room, but a bad paint job can make the walls and ceiling look terrible. If a builder is investing time and money into a high-level drywall finish, they should also hire a first-rate painter.

Takes two parties. Both drywall contractor and general contractor play a role in achieving a high-quality finish. The drywall contractor needs to take the time to do high-quality work and should always use the best tools and materials. Getting in and out as quickly as possible, scraping by with minimal tools, and low-balling the materials are not compatible with doing first-rate work.

The general contractor needs to give the drywall crew enough time on the schedule to do their best work and needs to create the best working conditions possible. The work site should be clean and wide open so that the drywall crew can work quickly and efficiently. Conditions for the materials are important, as well. Controlling temperature, humidity, and airflow before, during, and after drywall work is a huge factor and one of the best ways to ensure the lasting quality of finished drywall. Keep in mind that

Photos by Myron Ferguson



This butt joint **(4)** over an opening is OK, but just barely. The joint should be at least 7 or 8 inches from the corner. Overcuts **(5)** and blow-outs **(6)** are common with sloppy hanging. The taper can fix these, but it takes considerably more time.

quality in drywall is not only about what the job looks like when you leave but also about how well it endures.

JLC: Every contractor has seen screw pops; what causes them?
MF: A screw pop happens when a screw head pushes out from the drywall surface and pushes the compound coating out along with it. A common cause is setting a screw to proper depth, but without pulling the drywall tight to the framing. If the drywall ever is pushed tight to the framing, the screw head will pop. Any fastener that misses or is not securely anchored into a framing member may work loose over time. If you miss, don't leave the screw in place.

The opposite is also possible; if not enough compound is used over a screw indentation, a slight depression will show in the drywall surface. It's also possible for the framing or drywall to expand after taping is finished, which can pull the screw in slightly and cause an indentation. One of the most common causes for this is hanging drywall when the framing is too wet. As the wood dries, the framing shrinks and pulls away from the drywall. Misaligned and twisted framing can also contribute to fastener failure.

JLC: What's the best way to prevent fastener pops?
MF: From a contractor's standpoint, the most important thing is controlling the temperature, humidity, and airflow in the rooms where the drywall is being installed. Wet framing is one of the biggest culprits.

The moisture content should be tested (no more than 12% moisture content), but it rarely is. Using common sense can go a long way here. If the building has never been heated and has never had time to dry out after being framed in wet conditions, then the contractor should build time into the schedule for the framing to dry out before insulating or installing any vapor retarders.

If I am concerned that framing is wet, I will test and record the results in case future problems should arise, or if I feel like the job is being rushed. I generally like to see a moisture content of 10% or less. By the time the electric, plumbing, and heating are roughed in, enough time has usually gone by to dry out most buildings unless the conditions for drying are poor; high humidity, rain, and propane space heaters being used will all delay drying.

The drywall contractor needs to fasten the drywall correctly. I make certain that the panel is tight against the framing. The nose of a screw gun helps to push the panel tight to the framing, which is another advantage of screws over nails.

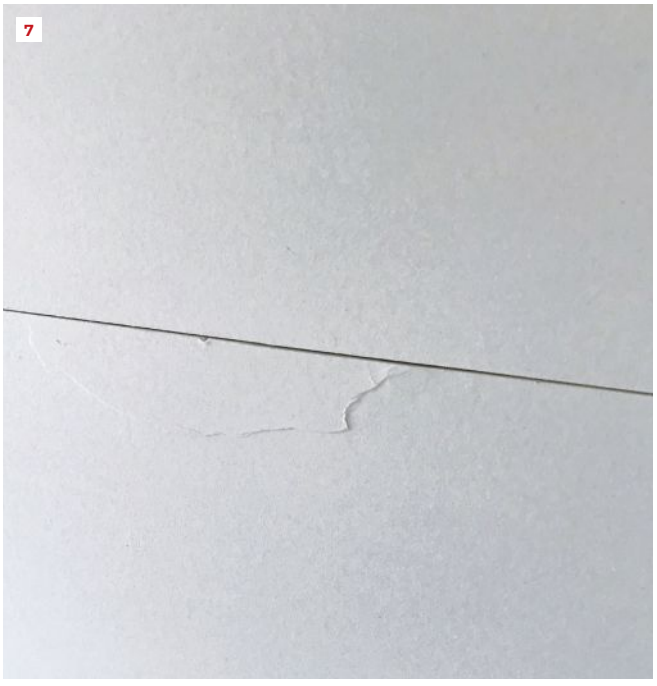
Screws should penetrate into the wood framing 5/8 inch; longer is not necessarily better. (Nails, if used, need to penetrate the framing at least 7/8 inch.) I typically use 1 1/4-inch (32mm), coarse-thread screws for both 1/2-inch- and 5/8-inch-thick drywall, and 1-inch (25mm), fine-thread screws when fastening drywall to steel studs or resilient channel.

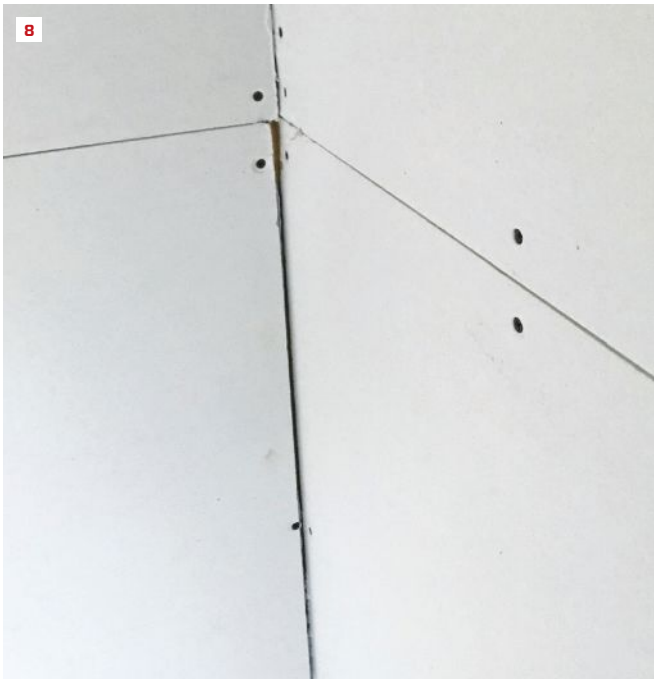
Don't use too many screws. For walls framed 16 inches on-center, place screws every 16 inches along studs, no more; for 24-inch-o.c. framing, every 12 inches. For ceilings, space fasteners every 12 inches along joists for both 16- and 24-inch-o.c. framing.

When properly set, a screw should not damage the drywall core or even tear the paper face. The screw head should be set about 1mm below the drywall face. If a screw is set too deep, the panel is more likely to pop loose.

Underdriven screws are obvious and easy to detect. Just run a taping knife over the screw before applying compound. If you hear the knife click when it hits the screw head, then the fastener has to be set deeper. If you try to hide an underdriven screw by coating it with more compound, you'll end up with an unattractive bump of compound.

With an overdriven screw, the fastener breaks through the paper face of the drywall, creating a much weaker connection than an





Broken edges need to be repaired (the broken area cut out and the void prefilled with a setting compound) before taping and finishing the seam **(7)**. Any large gap (wider than 1/4 inch) needs to be prefilled with a setting compound before taping **(8)**.

underdriven screw. Often, an overdriven screw shows up right away because a panel is loose. Overdriven fasteners typically are corrected by tapers when they do their pre-taping inspection (see "Prep Work Before Taping," Aug/19). A worse case is having this weak connection pop when subject to even minimal structural movement or expansion and contraction of the building materials.

I prefer to use adhesive, as well. It's not a must, but it improves the job and limits the number of problems common to fastening drywall. I also use it to reduce the number of fasteners. With adhesive on each stud or joist, the number of fasteners needed can be reduced by up to 75%. An added benefit is that the adhesive strengthens the structure by increasing the panel's tensile strength by up to 100%, and its shear strength by up to 50%.

When using adhesive, apply a 3/8-inch-wide bead to each framing member to within 6 inches of the edge of the drywall. Install fasteners on 16-inch centers along the perimeter of each panel immediately after hanging it.

JLC: You began by saying we can't depend on the taper to fix what the hanger has done. Besides fastening, what are the other mistakes that can result in drywall blemishes or callbacks?

MF: One of the most common is installing panels so the butt end aligns with the edge of a window or door opening. This is a rookie mistake; it seems plausible for layout, but the butt joint will crack the tape if there is shrinkage in the header. Wood shrinks more across its width, so the wider the header, the more likely this will happen. The crack can appear below a window, too. Butt joints are very vulnerable to cracking. The way to prevent this is to not place seams close to the edge of an opening. Place the sheet so the panel covers the corner, and the butt joint falls somewhere in the middle of the opening, then cut out drywall in the opening. The joint should be no closer than 7 or 8 inches from the corner.

Butt joints anywhere on the wall are often problems because they don't start out as a recessed seam. They basically start as a bump that needs to be blended in properly. The best way to handle them is by "floating" butt joints between joists or studs and securing them to beveled backing boards that create recessed seams (for more on this technique, see "Hanging Drywall Smart," Mar/15).

On finishing jobs, I don't always hang the drywall and sometimes have to deal with butt joints that land on studs and joists. In those cases, I will prefill butted seams, using a setting compound. Prefilling is also needed for any large gaps and for any repairs.

Overcuts and blowouts at electrical boxes are common problems. The cover plates don't cover much more than a 1/4-inch gap. The tapers will usually catch these while taping, but to help them notice, I circle the box and point out the area that needs to be patched. Fixing a blowout requires tape embedded in compound and a couple of finish coats to conceal it. I always encourage people to take their time and be careful cutting out with the drywall router. Each mistake will cost the finisher at least four minutes.

Water seeping through a basement slab is a good recipe for drywall problems, which will appear once all the materials dry out **(9)**. This joint **(10)** cracked because the first coat hadn't cured before the second was applied. The building was not heated, which delayed curing.

JLC: What are the most common taping problems?
MF: There's a lot of detail to know about taping drywall. Inexperience is often the problem. For example, rookie tapers often don't bed the tape in enough mud. This is the kind of thing we covered in the article "Taping Drywall Seams" (Jul/17).

But even experienced tapers run into problems. The failures I see when I am called in to consult are often climate related. When drywall seams are taped, the air, surface, and compound temperature should be at least 55°F, with 65°F to 70°F being ideal. It's a good idea to establish the ideal temperature at least a few days before the drywall hanging starts. Once the hanging and taping are underway, maintain a constant temperature—don't work in 80°F weather during the day, then let the temperature drop to 45°F at night. The drywall phase is an important part of the job, so don't try to save a few dollars on heat. In addition, provide adequate ventilation and airflow to help remove excess moisture.

Cold and damp weather will adversely affect the taping job, delaying drying times and possibly softening the panels. Hot and dry weather can cause problems, too. Heat can affect the joint tape bond. Hot, dry weather hastens drying, which can result in poor bonding of the tape, edge cracking, and excessive shrinkage of compound. So take some precautions in hot and dry conditions. Eliminate drafts, work shorter joint lengths, use faster setting compounds, and don't weaken the compound by adding excess water.

JLC: How about sanding? We often see ridges telegraphing through the paint where it looks like the mud wasn't sanded enough.
MF: Undersanding is common over screws in the face of the drywall. Just the indentation has to be filled and then sanded flat so that there is no buildup of compound around the screw head. There is a smear of mud between fasteners that occurs on the second and third coats, but not a buildup.

Oversanding can certainly happen, too; it creates concave seams or exposes the tape, which is especially common on inside corners when not enough mud was applied in the first place. Because lightweight compounds are preferred for the finish coats nowadays (these compounds are softer than the traditional heavyweight compounds), you should never use coarser than a 220 sandpaper grit. A 220 grit will minimize scratches in the compounds and won't rough up the paper face.

JLC: What should a contractor look for before calling the painter?
MF: I often ask about how different parts of a job will be painted before I even bid on a drywall job. If ceilings will be painted with anything but a flat paint, I will usually recommend a level 5 finish. Large, well-lit walls will often need a level 5 finish, as well.

Don't rush the paint. Do not allow painters to begin work before all taped joints are thoroughly dry; painting over wet joints is a major cause of joint discoloration. Differences in suction between the paper facing and the joint compound may cause the paint color to appear lighter or darker, making the joint conspicuous.

A coat of primer is necessary to help equalize the porosity and texture of the taped drywall surface. I recommend using a good-quality latex primer, such as USG's First Coat, that's formulated with a high solids content, and applying it undiluted. However, even a good primer coat may not be enough when glossy paint will be used. In that situation, I recommend applying a skim-coat of compound to the entire wall surface first to equalize the surface reaction.

I know some painters damp-sponge surfaces after sanding to remove dust and knock down any raised fibers of the paper. Brushing with a very fine broom also helps. But I have found that sanding with 220 grit after the primer is dry works best and is less likely to do damage compared with sponging or brooming.

Myron Ferguson is a drywall contractor in Middle Grove, N.Y. Follow him on Instagram: @thatdrywallguy.

Roughing-In Kitchens

Careful layout and smart sequencing avoids a tangle of trades

BY IAN SCHWANDT

Today's kitchens are a marriage of modern-day mechanicals and storage methods with colonial and Victorian roots. Iceboxes, Hoosier cabinets, larders, and sculleries join with wall ovens, cooktops, plumbed coffee makers, refrigerators, dishwashers, range hoods that need makeup air, and countless other countertop appliances to create a space that is an expression of the cook's workflow methods. For a homeowner entering a beautifully designed and well-appointed kitchen, it is easy to view the cabinets and their smoothly operating accessories as the heart and soul of the space, but any carpenter who has had to alter existing wall framing without damaging the wall finish on the opposing side to duct a range hood knows otherwise. The success of a kitchen remodel or install depends on perfectly laid-out mechanicals. Whether you are a jack of all trades who executes every step of a kitchen remodel or the lead carpenter overseeing a whole-house remodel, knowing the design and equipment specifications is critical to setting yourself or your team up for success.

STEP ZERO: GET THE SPECS

The majority of kitchens have specs that are relatively simple—same modular cabinets, same brand-name appliance package, and layouts that oscillate between the standard work triangle–based layouts of gallery, in-line, and U- and L-shaped. Custom-designed kitchens or those designed with the workflow methods of

a professional chef in mind can contain an array of appliances with additional mechanical needs. Often, the design and specs are completed before the start of a kitchen remodel, and the lead carpenter would have time to review the details before starting work. However, a small remodeling company or a design builder can be the one who works with the homeowner to design the space and specify equipment. Either situation presents challenges that can be overcome by proper planning and by knowing the specs inside and out.

A carpenter who is involved in the design and specification of a kitchen has a slight starting advantage in a remodel because of their ability to steer design through their understanding of the existing conditions.

When the design is set long before the work begins, the lead carpenter is at the mercy of the design professional who provides the required drawings and specs, which, in my experience, focus on the aesthetic qualities of the kitchen first and the mechanical operation second. Quickly determining the accuracy of these drawings is a skill that is built over the course of one's career.

My crew and I recently installed a remodel kitchen with furniture-style cabinets. Upon reviewing the drawings, which arrived only days before the cabinets, we found that to give the side-by-side refrigerator the room needed to open fully, the sink cabinet would need to be off-center from the window. When we contacted a field rep from the kitchen design company, we were told "our kitchen layouts always start by centering the sink cabinet on the window and making everything else fit." Needless to say, the freezer door on that project opens only to 80 degrees. No matter where you are on the design-to-production chain, there is no substitution for getting your design specs early.

ORGANIZING THE WORK

On top of building codes requiring things like outlets, each stationary appliance in the kitchen has mechanical needs of its own. And those needs must be met within the confines of the cabinet layout. Large-scale commercial and institutional projects will have mechanical-electrical-plumbing (MEP) drawings done by an engineer that lay out all the mechanicals and how they interact and share space. While that doesn't typically happen on residential jobs, the information is no less important.

My go-to method for communicating this on a residential jobsite is to use a 12-inch-wide rip of cardboard floor-protection material cut to the length of each kitchen wall as a story pole on which I mark the layout for each cabinet box, appliances and their associated mechanicals, and tile (if necessary). This horizontal story pole is stapled level across the wall above the highest mechanical, and each trade plumbs their layout down from the story pole. Each wall also gets a vertical story pole cut from a rip of plywood to show the layouts from the floor up—top of base cabinet, top of counter, range hood, bottom of upper cabinet, undercabinet light wiring, and the like. I color-code the different items using markers or colored pencil. The cardboard story poles can be taken down, rolled up, and stored as they become living documents that guide the work from rough framing through to install. The horizontal story pole is created pre-drywall, so each end has the thickness of the drywall marked on it. Once the drywall is installed, this section is cut off the story pole. Finish floor is dealt with the same way on the vertical plywood story pole.

The story poles can have as much information as the lead carpenter and the mechanical trades deem necessary. I use this method for bathroom layout, as well, and have had plumbers comment that seeing the tile layout marked out is helpful in fine-tuning placement of showerheads and mixing valves. Wall-mounted faucets, outlets, and lights can be given the same center-of-tile or center-of-grout-joint layout on the kitchen story pole (see Roughing-In With "Story Poles," page 36). Executing layout in this detail early on, though a time-consuming task, can save the lead carpenter time throughout the job when the mechanical trades buy in to the method and understand that they can rely on the story pole in the same way they rely on MEP drawings.

EXECUTION: UNDERSTANDING FLEXIBILITY

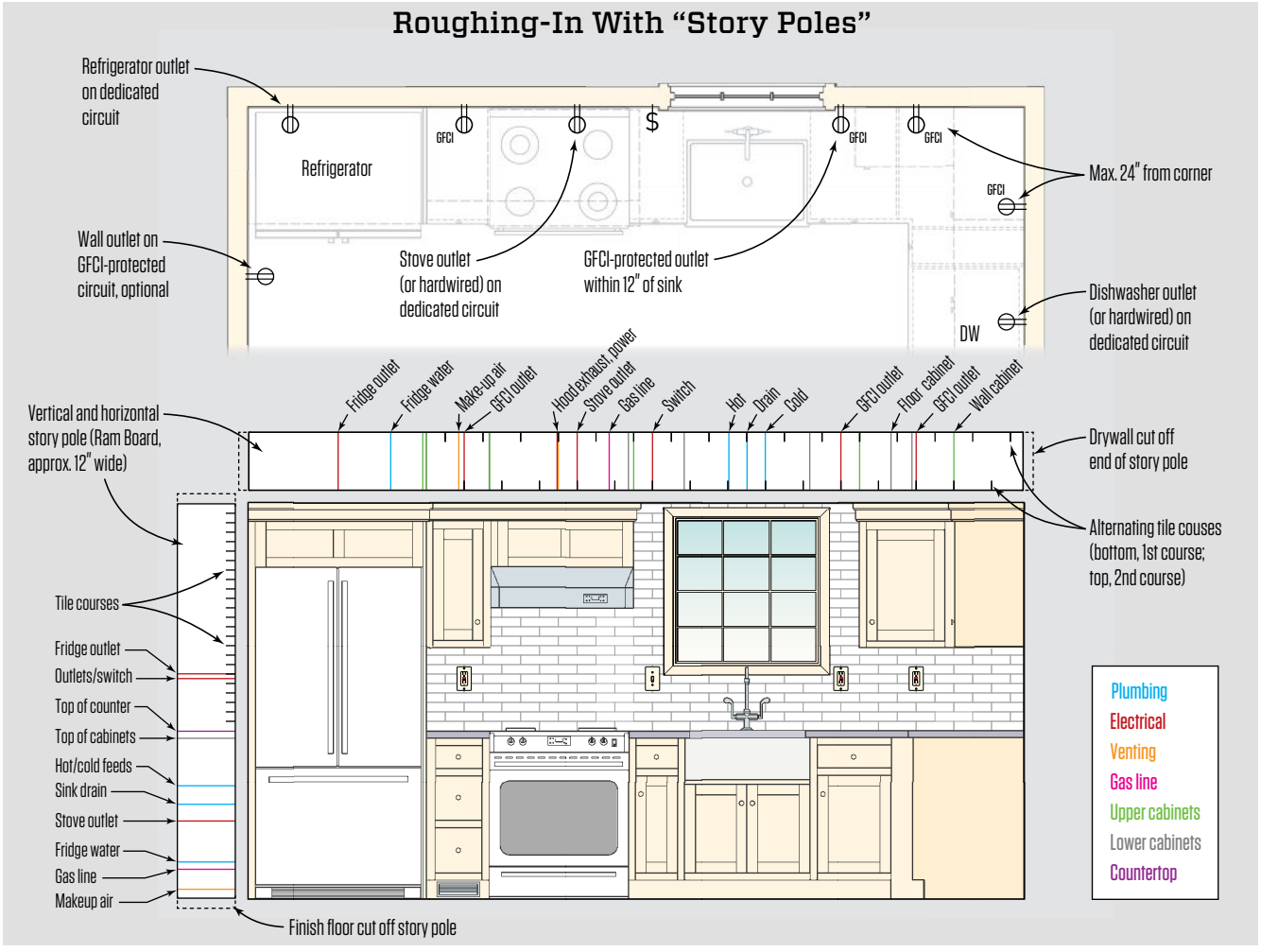
The execution of a large-scale kitchen remodel often takes place over multiple months and can be at the mercy of the schedules of many different contractors. It is important for the lead carpenter to set mechanical service priorities early and give each trade the space they need to execute their work. My preferred sequencing is ventilation, HVAC, plumbing, electrical. While I separate ventilation from HVAC in my sequencing (for reasons that I'll tackle later), I place these two scopes at the front of the line because of the lack of design flexibility of their behind-the-wall installs. The ventilation ductwork for a range hood or a pop-up downdraft vent typically must go where it goes. Plumbing drains and supplies have a bit more design flexibility if the framing has been laid out thoughtfully. Electrical work has the highest degree of flexibility once you achieve the minimum requirements of building code.

Ventilation hoods. On many of my larger kitchen projects, I am responsible for the range-hood ducting. For this type of work, I think it is important that the exhaust duct for the range hood and any associated makeup-air inlets get priority over the other mechanical installs.

The range-hood specs will give you the manufacturer's recommended exhaust-duct size. Running the exhaust ducting through the over-the-stove cabinet and out the roof is often the easiest approach. A bit of flex duct may be needed to avoid a joist, but that's usually the extent of the problems.

Owners or designers often prefer going straight out a wall because it doesn't take up cabinet space, but it's not always easy. Make sure the wall outlet on the exterior is farther than 3 feet from an operable window; this is typically required by code. Also, check and double-check the layout before cutting through the exterior. There's seldom enough wall thickness to use flex duct if the inside and outside openings are offset; they need to line up perfectly.

Makeup air is required for any range hood that exhausts more than 400 cfm. On some jobs, we've felt lucky to have makeup air supplied to the kitchen or an adjacent space via an ERV that lets in tempered air. The HVAC contractor takes the exhaust hood into

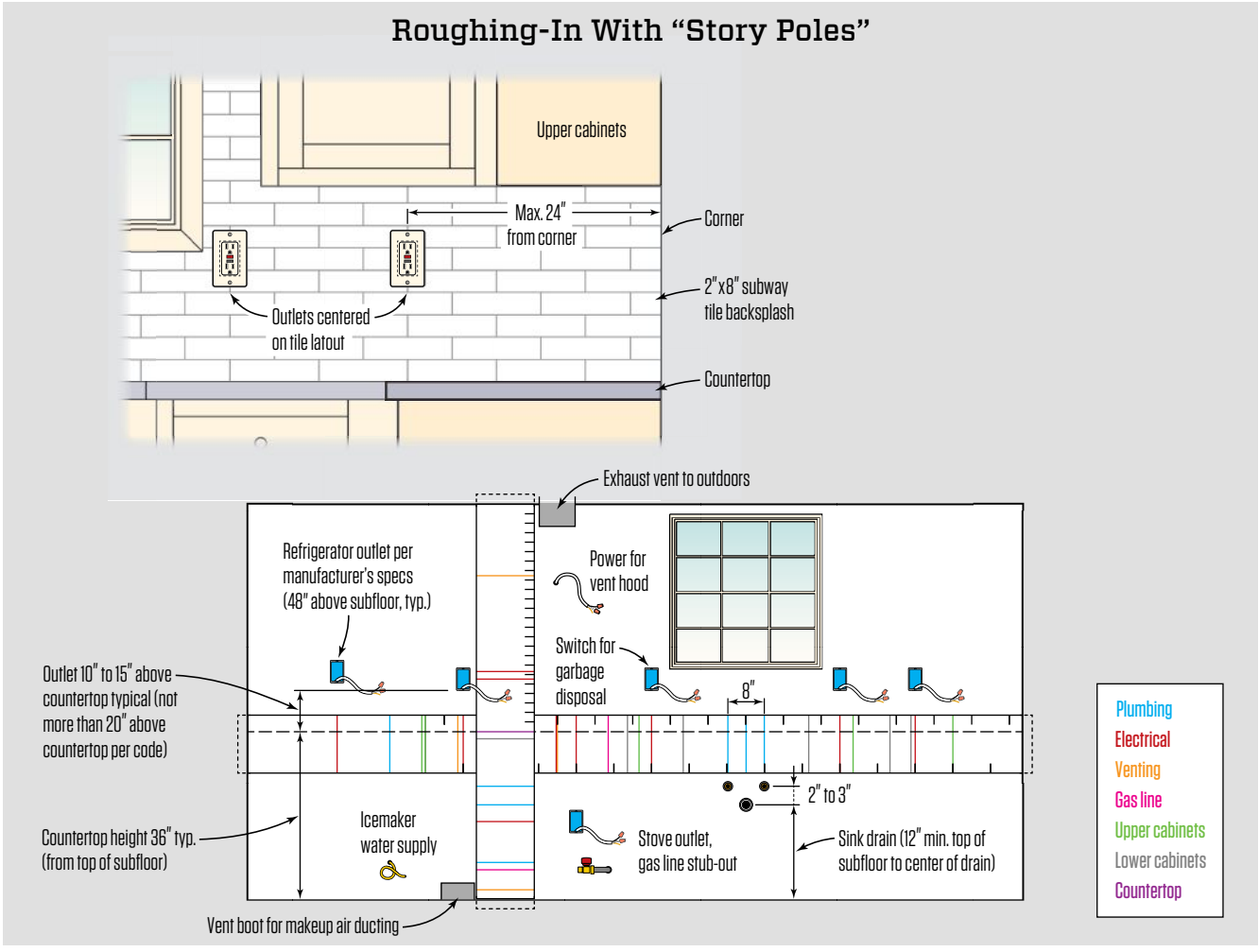


Residential kitchen design plans typically consist of only plan and elevation views like these; they seldom have a separate mechanical-electrical-plumbing (MEP) plan, though kitchens often have a convergence of MEP components that must be precisely integrated with cabinets, appliances, tile, and trim. The author uses color-coded story poles, cut from heavy floor

consideration when sizing the ERV, but otherwise, the kitchen plan is not impacted. On many jobs, however, the energy-efficiency afforded by an ERV, which tempers the incoming fresh air with heat from the outgoing exhaust, is not always as high on the priority list as the kitchen finishes. We often end up having to bring in unconditioned makeup air, and the placement of this inlet needs careful attention to avoid a stream of cold air blasting the cook when the range hood is turned on.

Typically, we locate the register for the makeup air near the floor on the wall behind the range, or in the floor under the range towards the back. This keeps the air stream away from the cook, and as it is pulled upwards by the exhaust fan and passes the cooktop, the airflow picks up air off the cooking surface—an effect called "entrainment"—that helps exhaust pollutants and moisture generated by the stove and cooking activity. The makeup-air inlet should include an electric damper that opens and closes to keep unconditioned air from leaking into the house when the range hood is not in use (see Makeup Air for Range Hood, page 38). Typically, this damper is wired to the switch that controls power for the range hood.

HVAC. Kitchens, being the gathering place they are for many homeowners and their families, can be complex microenvironments to heat and cool. Radiant heat, whether designed by a floor-panel supplier or by a technician on site using a modular product, will take into account the cabinet layout to provide an evenly heated floor surface. No matter how heating and cooling is delivered, involving the homeowner early on in the layout by ask-



protection paper, that can be taken down, rolled up, and stored as they become living documents that guide the work from rough framing through appliance install. The author takes the time to develop these story poles so he is able to keep track of fine-grained detail like the tile layout at the framing and electrical rough-in stages.

ing the right questions—Do you use the sink to hand wash dishes? Do you favor one side of the stovetop for prep work? Is a portion of an island counter used for dining or as a kitchen office? Will hot or cold air blowing on you while you work bother you?—can provide a goldmine of information that can make or break the job in the mind of the client when they start using the space.

All of the questions above are ones that I, or a designer I have worked with, have neglected to ask. There is no feeling worse than putting a toekick supply vent in a sink cabinet and being told by the client during the final walk-through that, despite the $3,000 German dishwasher you installed, she hand washes most of the dishes and hates the feeling of air blowing across her feet. Had I asked the right questions early on, that toekick vent could have been easily moved down the line of cabinets to a less intrusive spot.

Plumbing. Cataloging the manufacturer's specs for each appliance on site is an important first step in developing a scope-of-work checklist for each trade's responsibility to each appliance.

From wall ovens with steam functions to plumbed coffee makers, many higher-end appliances now require plumbing where they once only needed power.

In kitchens located on exterior walls, these plumbing lines can be run up through the floor and the backs of the cabinets to keep the lines inside the conditioned space.

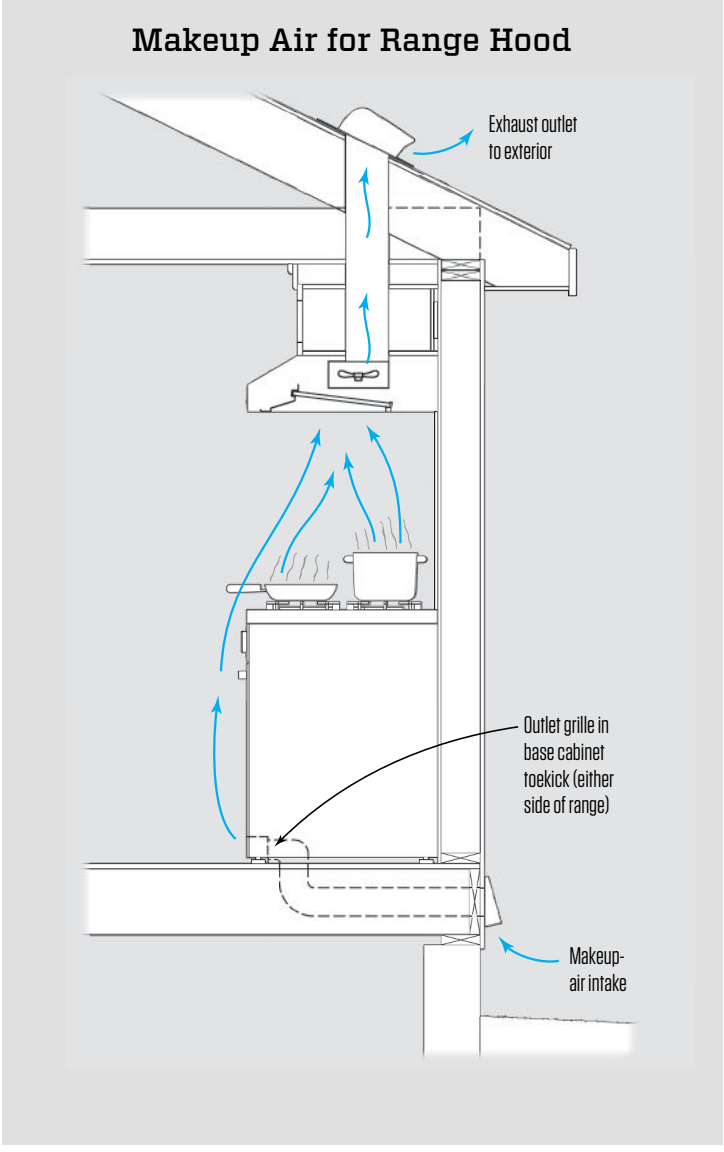
For the laying out of plumbing lines that will travel through cabinets, it is important to know if the cabinet houses any accessories that will compete for space with the mechanicals and their shut

offs. Sink cabinets are excellent spots for pullout trashcans when the sink plumbing install accounts for them.

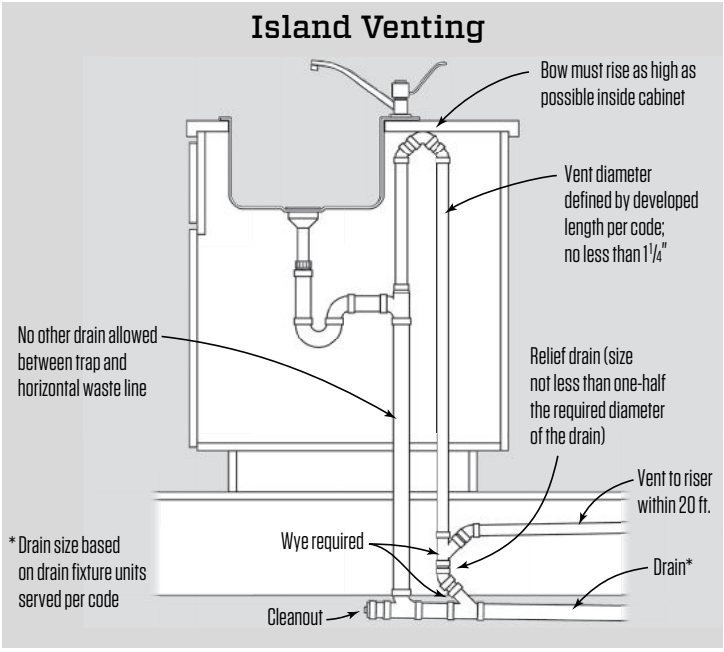
Drain plumbing often takes precedent over supply lines to guarantee adequate pitch and venting. The widespread use of PEX for plumbing supply lines has both made the work of the plumber easier and simplified the work of the lead carpenter or designer tasked with making an increased quantity of mechanicals fit without compromising in-cabinet accessories.

Kitchen drain lines must be low enough to fit a disposal. Most codes will limit the height to 12 inches minimum off the floor. The vents for sinks in islands can be challenging in a very large kitchen. Most codes require that a sink be no farther than 8 feet from a vent, so there may be only a small wall area through which to run the vent stack that intersects within an 8-foot radius from the sink drain. Automatic undercabinet vents or oversized drain lines typically are not allowed by code as vents. Bow vents are often the only option for large kitchens in which a vent stack needs to more than 8 feet away from the sink. I recommend that you work with your plumber early on to find out exactly how much cabinet space the vent will take up. Also, the plumber may need to get prior approval from the inspector. The inspector will be looking for two key features with a bow vent—a tie-in to the vent stack in the wall that is higher than the sink overflow height (usually 36 inches on a standard-height island) and a relief drain on the vent running through the floor. If a blocked sink drain ever fills the bow vent with water, the relief drain will drain away the water so the vent stays operational.

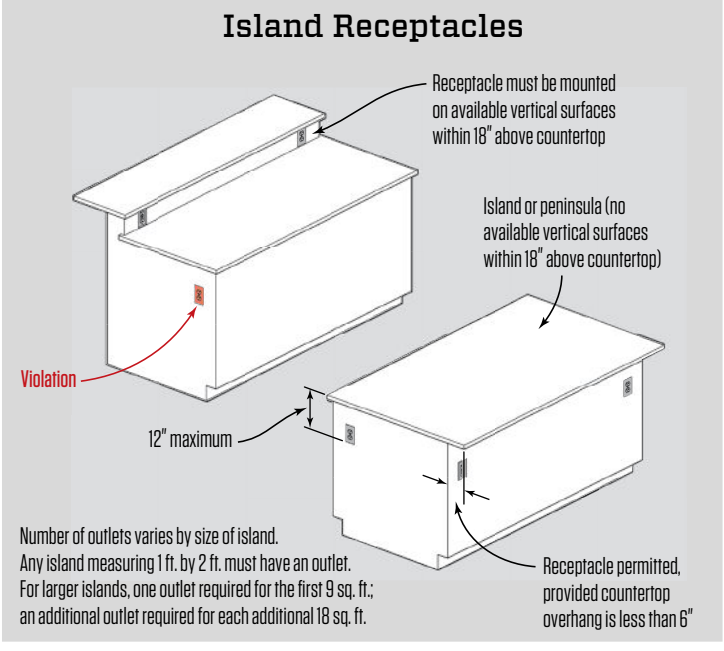
Electrical. Selecting appliances early in the process eliminates assumptions made by all the trades. In terms of the project budget, assuming that the electrical service of a house built in the 18th century has been updated so that it can handle modern appliances can lead to an unwelcome change order at a point when most budgets have been maxed out. Partnering with an electrician early in the design phase is helpful not only for evaluating panel capacity but also with reviewing requirements of the building code. Section E3901.2 through E3901.5 of the IRC can be used as a guide by a lead carpenter for laying out other mechanicals and even wall tile. E3901.4.5 states "outlets shall be located not more than 20 inches above the countertop," giving a lead carpenter room to coordinate the tile selection with the outlet location. This finish detail, and the client who demanded visual perfection, was the genesis for the story-pole method I described above. E3901.4.1 "Wall Countertop Space" states: "A receptacle outlet shall be installed at each wall countertop and work surface that is 12 inches or wider. Receptacle outlets shall be installed so that no point along the wall line is more



When makeup air is required for a kitchen range, the author prefers to bring fresh air in near the base of the stove. As fresh air is pulled up the exhaust fan, it creates a negative pressure zone on the cooktop that helps pull pollutants into the exhaust stream.



In most code jurisdictions, the only venting option for an island sink is often referred to as a bow vent. The length of the vent "foot" (horizontal section in the floor) is typically limited to 20 feet.



The number of outlets on an island counter depends on the countertop area served. If a vertical surface exists above the countertop, the outlets must be placed there, and are not then allowed on the cabinet.

than 24 inches, measured horizontally, from a receptacle outlet in the space" (see kitchen plan, page 36).

There are exceptions to this, outlined further on in the code, that include drawings in the explanation. Receptacle requirements for kitchen islands have changed to accommodate the ever-increasing size of island work surfaces. The code now calls for one outlet for the first 9 square feet, or fraction thereof, with an additional outlet required for each additional 18 square feet, or fraction thereof. At first glance, this may not sound like much, but many large islands and peninsulas will now require three outlets to satisfy code (see Island Receptacles, below left).

COMMISSIONING AND COMPLETION

After the cabinets are installed, the lead carpenter again relies on the mechanical contractors to take part in the install and commissioning of the appliance package. If the appliances have been on site, the lead carpenter has the opportunity to visually inspect the units and their mechanical connections for damage or missing parts in advance of install day.

On high-end projects with expensive appliances, I have had good luck communicating with the manufacturer's customer-service reps via phone and online chat (it is as much in the manufacturer's interest as in the contractor's that a $10,000 refrigerator operate flawlessly). It is important to save all manuals and warranty info for the client as well as any auxiliary mechanical parts like LP/NG conversion kits. Many companies that I have worked with catalog the operation manuals into a binder for easy access by the client. Once the appliances have been installed and commissioned by the mechanical contractors, it is important for lead carpenters to familiarize themselves with each appliance's operation and to run a test cycle on each appliance. This is an important final step in the lead carpenter's confidently turning over a finished product to the client and providing instruction on its use.

For many homeowners, the kitchen is deeply personal place within the home, and renovating that space from design through to completion is at best disruptive—and at worst, can cause high levels of anxiety. The lead carpenter who is tasked with bringing the abstract design to functioning reality travels a path that can be full of twists and turns or a path that can be straight and smooth if the lead carpenter understands their place as the conductor of an orchestra of tradespeople and the head coach of a dynamic jobsite team.

Ian Schwandt is a lead carpenter and construction estimator based in Iron Ridge, Wis., with experience leading commercial and residential projects in the Midwest and Northeast.

Photos by Glenn Mathewson

Strategies for Safe, Affordable Decks

Six ways to trim costs and still meet code

BY GLENN MATHEWSON

"To produce safe buildings for the greatest economy and good of the public." Echoes of this sentence (from the 1927 Uniform Building Code) still ring true in today's International Residential Code (IRC), which states, "... to establish minimum requirements to safeguard the public safety, health, and general welfare through affordability, structural strength ..." (2018 IRC, Section R101.3). Everyone knows the code is the minimum standard and probably understands that its goal is to keep construction affordable. However, code has somehow taken on a negative connotation, as if a structure built to code is cheap or unsafe, or that a contractor known as building "to code" is a hack.

But I think that's the wrong way to look at the IRC, especially when it comes to decks. Its provisions aren't a best practices guide to building the "best" deck, but they are a terrific guide that can be used to build affordable, sufficiently safe decks.

As a code professional, I believe in safety, but I recognize that safety needs to be available to everyone, and minimum standards provide for maximum deck ownership. For builders looking to tap into the huge budget-deck market, here are some safe, respectable, and sensible strategies for building code-compliant decks that will maximize the client's dollars.

Glenn Mathewson is a frequent presenter at JLC Live and a consultant and educator with BuildingCodeCollege.com.

CANTILEVERING THE JOISTS

The IRC provides tables for sizing joists (see Table R507.6, below) and beams (see Table R507.5, facing page), which are based on the span of deck joists. The longer the joist span, the more load the beam carries and the shorter its span. Note that beams are being sized for the maximum allowable cantilever of the joists beyond the beam, whether they cantilever or not. If you are not cantilevering joists, you are probably oversizing both your joists and your beam.

Lesson: Design joists to cantilever past the beams and you shorten the joist span. A shorter joist span allows you to use a different column in the table when sizing the beam—which in turn results in a smaller beam size. For example, instead of using 2x8s hung from a flush beam to build a 10-foot-by-16-foot deck, you can install 2x6 joists—which can span 8 feet 8 inches with an additional 1-foot-4-inch cantilever—over a dropped beam to build the same-size deck. This option saves on lumber and metal-connector costs.

TABLE R507.6
DECK JOIST SPANS FOR COMMON LUMBER SPECIES (ft. - in.)

SPECIES[a]	SIZE	ALLOWABLE JOIST SPAN[b] SPACING OF DECK JOISTS (inches)			MAXIMUM CANTILEVER[c, f] SPACING OF DECK JOISTS WITH CANTILEVERS[c] (inches)		
		12	16	24	12	16	24
Southern pine	2 × 6	9-11	9-0	7-7	1-3	1-4	1-6
	2 × 8	13-1	11-10	9-8	2-1	2-3	2-5
	2 × 10	16-2	14-0	11-5	3-4	3-6	2-10
	2 × 12	18-0	16-6	13-6	4-6	4-2	3-4
Douglas fir-larch[d], hem-fir[d]	2 × 6	9-6	8-8	7-2			1-5
	2 × 8	12-6	11-1	9-1			2-3

For a 10-foot-wide deck framed with southern pine, 2x8 joists at 16" on center are "oversized"

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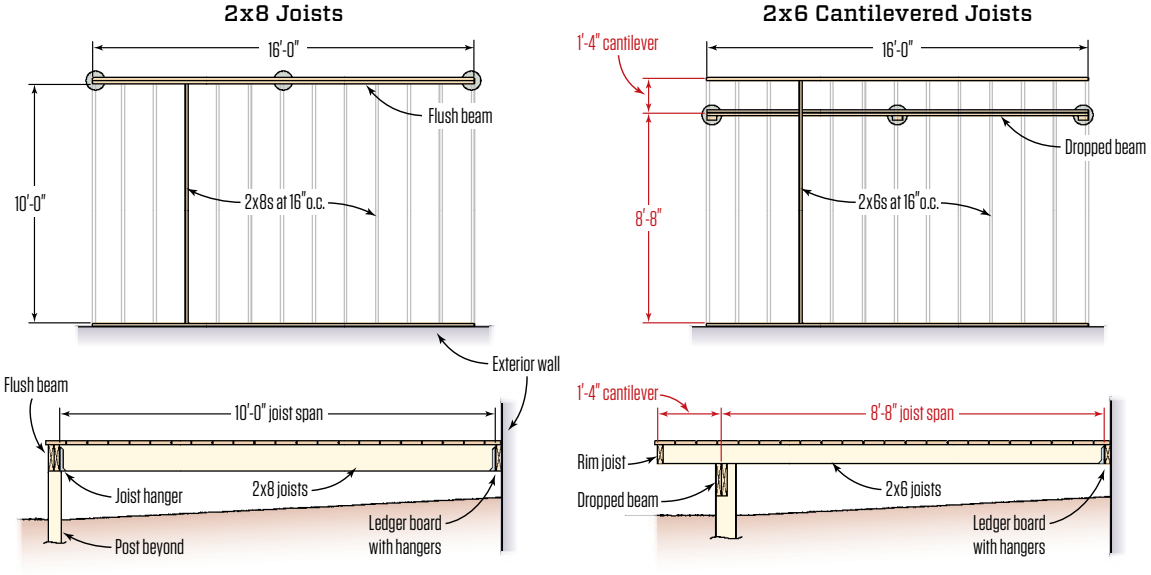
Note: rows and footnotes are omitted from the bottom of the table to highlight example.



Joist spans for a 10-foot-wide-by-16-foot-long deck. For the 10-foot-by-16-foot deck shown in the plan and section views above, 2x8 southern-pine joists at 16 inches on-center are "oversized" per IRC Table R507.6 (top). Using a dropped beam (above right) instead of a flush beam (above left) reduces the 10-foot joist span to 8 feet 8 inches with a 1-foot-4-inch cantilever, allowing the joists to be downsized to 2x6s at 16 inches on-center.

CANTILEVERING THE BEAMS

Per Table R507.5 (below), the IRC beam design provisions allow beams to cantilever an additional one-fourth the span beyond the last post. Utilizing this allowable cantilever is a wise way to have more deck supported on the same beam, without additional support posts. Additional posts not only drive up costs, but they also inhibit views from beneath an upper-level deck.

Lesson: One way to support a 10-foot-by-16-foot deck is with a double 2x10 beam bearing on three posts. By upsizing to a double 2x12 beam, dropping the beam, and taking advantage of the IRC's L/4 beam cantilever provision, as shown below, only two posts would be required to support the deck framing. Making use of beam cantilevers allows you to size smaller and less costly beams, as well as minimizing the number of posts.

TABLE R507.5
DECK BEAM SPAN LENGTHS[a, b, g] (feet - inches)

SPECIES[c]	SIZE[d]	DECK JOIST SPAN LESS THAN OR EQUAL TO: (feet)						
		6	8	10	12	14	16	18
Southern pine	1 – 2 × 6	4-11	4-0	3-7	3-3	3-0	2-10	2-8
	1 – 2 × 8	5-11	5-1	4-7	4-2	2-10	3-7	3-5
	1 – 2 × 10	7-0	6-0	5-5	4-11	4-7	4-3	4-0
	1 – 2 × 12	8-3	7-1	6-4	5-10	5-5	5-0	4-9
	2 – 2 × 6	6-11	5-11	5-4	4-10	4-6	4-3	4-0
	2 – 2 × 8	8-9	7-7	6-9	6-2	5-9	5-4	5-0
	2 – 2 × 10	10-4	9-0	8-0	7-4	6-9	6-4	6-0
	2 – 2 × 12	12-2	10-7	9-5	8-7	8-0	7-6	7-0
	3 – 2 × 6	8-2	7-5	6-8	6-1	5-8	5-3	5-0
	3 – 2 × 8	10-10	9-6	8-6	7-9	7-2	6-8	6-4
	3 – 2 × 10	13-0	11-3	10-0				
	3 – 2 × 12	15-3	13-3	11-10				
	3 × 6 or 2 – 2 x 6	5-5	4-8	4-2				

The example's 8'-8" joist span falls between the 8-foot and 10-foot Deck Joist Span columns. Interpolate "adjusted" span as shown below.

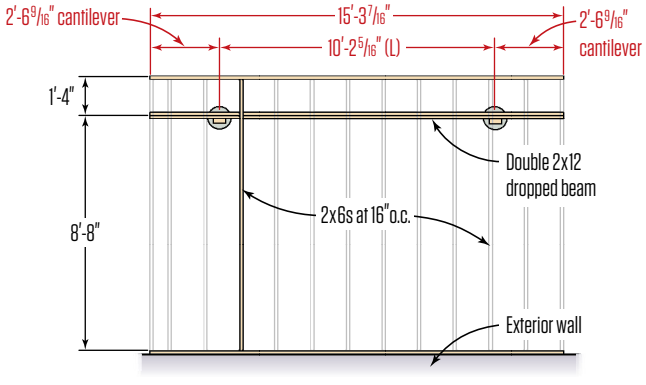
Beam Span Interpolation

1. **Determine "adjusted" beam span (L).** The beam span for 10x16 deck example (8'-8") falls 8" into the range between the 8-ft. and 10-ft. columns shown in Table R507.5. Cross-multiplying the ratio of this 8" distance and the difference between the 8-ft. and 10-ft. columns (24") with the ratio of the range between the resulting beam spans 10'-7" and 9'-5" (14") will yield a 4.66" adjustment—the adjustment is a decrease in span length. Subtract the 4.66" adjustment from 8-ft. column span (10'-7"), which results in a 10'-2 5/16" "adjusted" span (L).

$$\frac{8''}{24''} = \frac{X}{14''} = X = 4.66'' \qquad 10'\text{-}7'' \text{ (from 8-ft. column)} - 4.66'' = 10'\text{-}2\,5/16'' \text{ (L)}$$

2. **Determine beam cantilever.** Divide the beam length (L) by 4 to determine the cantilever length.
10'-2 5/16" beam length (L) ÷ 4 = 2'-6 9/16" cantilever length

Double 2x12 Cantilevered Beam



Determining beam span. Table R507.5 (top) includes a footnote (g) that provides for an additional cantilever equal to the beam's listed span divided by 4. On a 10-foot-by-16-foot deck, upsizing to a double 2x12 dropped southern-pine beam and using this cantilever provision reduces the number of posts needed from three to two (though the deck's length will be slightly reduced). To interpolate spans not shown in the table, use the ratio shown above to find the "adjusted" span.

USING SINGLE-PLY BEAMS

The 2018 IRC expanded the deck-beam span table to include single-ply beams. Table R507.5 "Deck Beam Span Lengths" has five new rows for 2x6 through 2x12 single-ply beams. The spans aren't huge, but they help the IRC be what it is supposed to be—a minimum standard. In many designs with short beam spans or short joist spans, a single ply is sufficient as a beam. A stronger beam can carry more load, but the load it carries comes from the joists. Unless the joists are also oversized, they become the load limit. There is no benefit to blindly building beams that are twice as large and expensive. As shown in the table below, a single 2x10 beam can span 6 feet while carrying 2x8s spanning 8 feet and cantilevering another 2 feet.

Lesson: When beam spans are less than 8 feet, you may be able to use a single-ply beam. A single-ply beam will have much better decay resistance, as there is no space between members to trap moisture. A single-ply beam also allows for the connection of a 4x4 support post with a notch and bolts in place of a post cap connector. In addition, a single-ply beam allows for outside mounted guard posts to connect back into the deck frame with fewer intermediate members inside the connection. Single-ply beams can provide a design advantage, while also reducing costs.

TABLE R507.5
DECK BEAM SPAN LENGTHS[a, b, g] (feet - inches)

SPECIES[c]	SIZE[d]	DECK JOIST SPAN LESS THAN OR EQUAL TO: (feet)						
		6	8	10	12	14	16	18
Southern pine	1 – 2 × 6	4-11	4-0	3-7	3-3	3-0	2-10	2-8
	1 – 2 × 8	5-11	5-1	4-7	4-2	2-10	3-7	3-5
	1 – 2 × 10	7-0	6-0	5-5	4-11	4-7	4-3	4-0
	1 – 2 × 12	8-3	7-1	6-4	5-10	5-5	5-0	4-9
	2 – 2 × 6	6-11	5-11	5-4	4-10	4-6	4-3	4-0
	2 – 2 × 8	8-9	7-7	6-9	6-2	5-9	5-4	5-0
	2 – 2 × 10	10-4	9-0	8-0	7-4	6-9	6-4	6-0
	2 – 2 × 12	12-2	10-7	9-5				
	3 – 2 × 6	8-2	7-5	6-8				

The example's 8'-8" joist span falls between the 8-foot and 10-foot Deck Joist Span columns. Interpolate "adjusted" span as shown below.

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Note: rows and footnotes are omitted from the bottom of the table to highlight example.

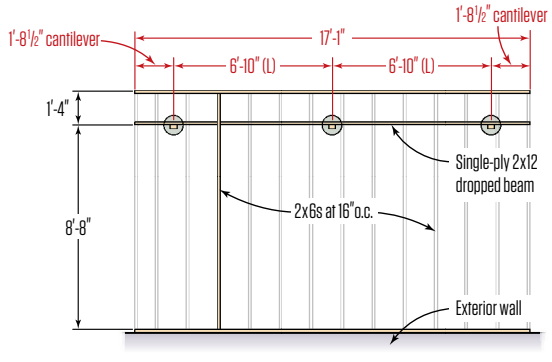
Beam Span Interpolation

1. **Determine "adjusted" beam span (L).** Similiar to previous example; cross-multiply the ratio of this 8" difference and the difference between the 8-ft. and 10-ft. columns (24") with the ratio of the range between the resulting beam spans 7'-1" and 6'-5" (9"). This yields a 3" adjustment. Subtract the 3" adjustment from 8-ft. column span (7'-1") for a 6'-10" "adjusted" span (L).

$$\frac{8"}{24"} = \frac{X}{9"} = X = 3" \qquad 7'\text{-}1" \text{ (from 8-ft. column)} - 3" = 6'\text{-}10" \text{ (L)}$$

2. **Determine beam cantilever.** Divide the beam length (L) by 4 to determine the cantilever length.
6'-10" beam length (L) ÷ 4 = 1'-8½" cantilever length

Single-Ply 2x12 Cantilevered Beam



Single-ply beam. The IRC's beam span table includes sizing for single-ply beams, showing that a single 2x12 beam can be used to support a 10-by-16-foot deck (top). Although the beam will require three support posts, the single-ply beam can cantilever, allowing the deck to be widened to 17 feet, as shown in the plan view above. To interpolate the spans shown in Table R507.5 to determine the "adjusted" span of the single-ply 2x12 dropped beam, use the ratio shown above.

DROPPING THE DECK

The past decade of deck building has seen an increasing focus on the ledger connection, and rightfully so. Many decks insufficiently attached to wood framing or attached to decayed material have been collapsing. However, if you examine this subject closer, you find that all the failures are due to a connection to wood framing.

On a first-floor deck, an advantageous design is to drop the deck below the wood framing and attach it directly to the foundation. This changes things—big time. All the concerns that drive the misunderstanding of the IRC's lateral-load-anchor details disappear. Take away the connection to the band joist and you eliminate the weakest link in the chain. In structurally sound concrete, common 1/2-inch-diameter mechanical or adhesive bolt connections of the ledger to a concrete foundation are more than sufficient for most common deck designs.

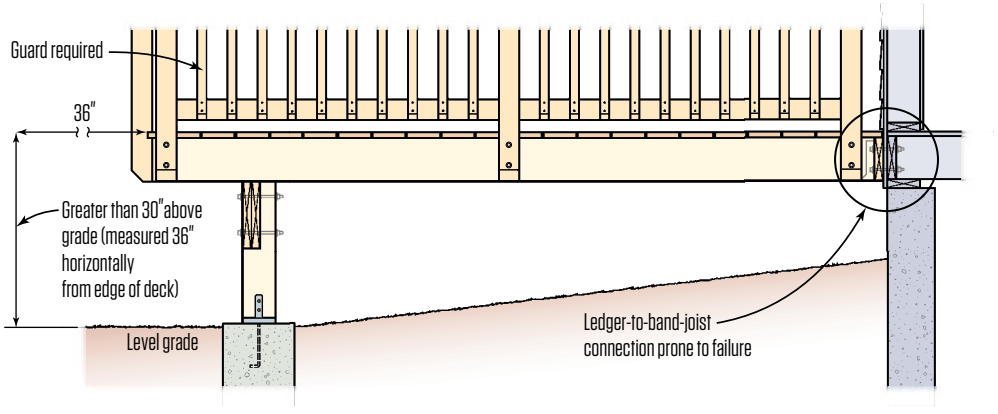
The lateral-load anchor isn't the only thing to disappear, as flashing is no longer required. The IRC requires deck ledgers to be preservative treated, and flashing is required only when attaching to wood framing. Ledger flashing is primarily meant to protect the house framing, not the ledger. With a connection to the foundation, the exterior cladding and water-resistive barrier is not penetrated (another benefit to dropping the deck), and thus there is no counterflashing to place ledger flashing behind.

Though not directed by code, it may be useful to run a bead of sealant down the top of the ledger at the foundation, or better yet, space the ledger 1/2 inch off the foundation for drainage and drying behind.

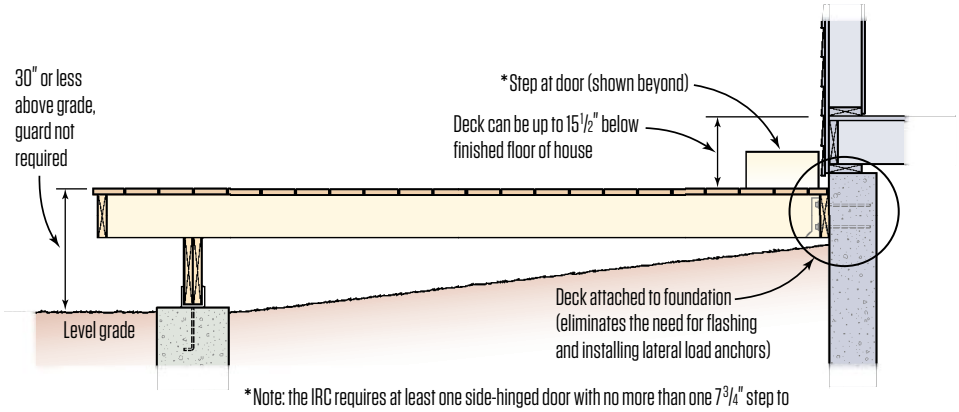
Lesson: For first-floor decks, drop the deck below the framing and attach it instead to the foundation. This eliminates damage to the cladding, as well as the need to install flashing and lateral-load anchors. Unless there is a side-hinged door, the deck can be up to 15 1/2 inches below the house framing, with the construction of a single step. Otherwise, a small landing can be built outside of the door. First-floor decks are also often close enough (30 inches or less) to ground level that guards may not be required.

A deck that is hung from a ledger fastened to the rim joist requires ledger flashing to protect the house framing and often requires lateral-load hardware. In addition, decks that are more than 30 inches above grade around the perimeter of the deck require guards, adding to the cost of the deck.

Deck Attached to Wood Framing



Deck Attached to Foundation



*Note: the IRC requires at least one side-hinged door with no more than one 7 3/4" step to a landing. All the other exterior doors of the house can be up to 15 1/2" down to a landing.

Anchoring the deck to a sound concrete foundation eliminates the need for ledger flashing and lateral-load anchors. This approach also allows the deck to be dropped closer to grade, eliminating the need for guards.

TAKING ADVANTAGE OF FOUNDATION EXCEPTIONS

For ground-level decks, the IRC offers a few options for relief from robust foundation systems. The simplest is allowing joists to bear directly on the ground (see IRC R507.3, exception). In this construction, they aren't really joists, in the sense that they don't span between bearing points. If the joists are preservative treated for ground contact and fully supported along their bottom edge on grade, then I don't expect to see any concrete delivered. For decks up to 20 inches above grade, the joists can be independently supported by pier blocks bearing on grade, rather than by beams and ledgers. Neither of these construction methods would be suitable for supporting guards around the deck, but their limited height above grade is meant to avoid that necessity.

Lesson: When a deck is built at ground level, there's nothing wrong with it structurally functioning as flagstone or patio pavers would function. There is little hazard in the structure of wood sitting directly on the ground.

A grade-level deck doesn't need to be supported by a concrete foundation, as long as the deck is not connected to the house framing.

USING LESS CONCRETE

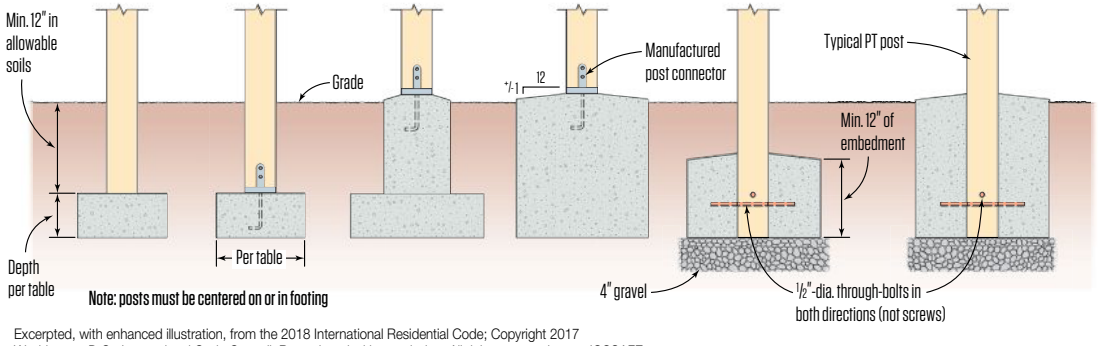
There are two ways to use less concrete in your deck footings: Leave it all at the bottom or bring it all up to the top. When preservative-treated posts rated for ground contact are used, the IRC allows deck support posts to be sunk into the ground. For areas with a frost depth and thus deep footings, there is no requirement that the concrete come up to the surface. A minimum 6-inch-thick concrete footing can in most cases be poured at the bottom of the hole and the post placed directly on top without a post base.

However, this is permitted only when the soil type is sufficient for lateral restraint and the post is embedded at least 12 inches into the earth. This is not acceptable for conditions where uplift design is required or when posts support a roof above the deck. In regions with a 3-foot frost depth, this strategy can result in huge savings in concrete and labor, not to mention the cost for post-base hardware.

The other option is frost-protection exceptions. If a deck is not supported by another frost-protected structure (like a ledger connection to a house), then the footings are not required to be frost protected. Freestanding decks can save in concrete and excavation expenses in exchange for no frost protection. Bear in mind that some regions have soil and groundwater sufficient to create problems with frost heave that may make this code-compliant choice a poor consumer choice. However, in other freezing regions, the soil is not conducive to frost heave and using this exception will likely make no difference in performance.

Lesson: The only concrete that matters in a deck footing is the concrete in contact with the soil. The IRC provides many options to consider for minimizing the amount of that concrete.

Use Less Concrete



IRC Figure R507.3 specifies connection details between deck posts and deck footings. It also provides for different deck foundation options, including posts that are buried in the ground to reduce the amount of concrete needed for the footing.

remodeling

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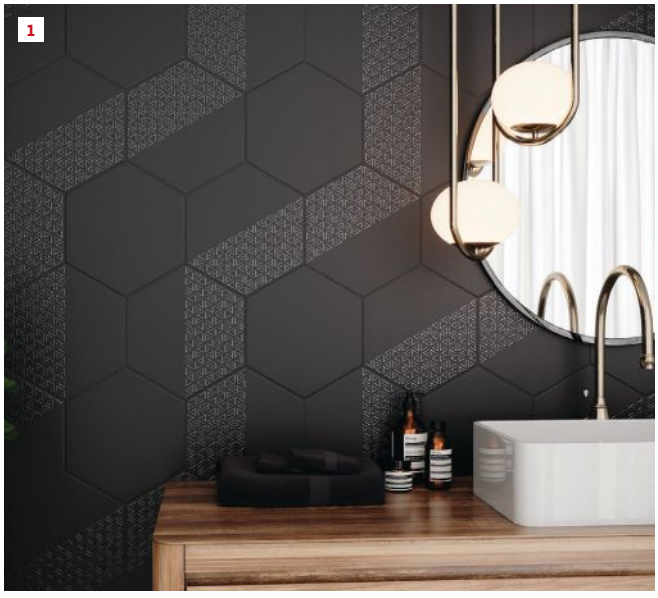
BY SYMONE GARVETT



1. Statement Tile Collections

In response to consumer trends, Emser Tile unveiled several new collections of porcelain, stone, ceramic, and mosaic products for 2020. Among them are bold-patterned "statement piece" collections, including Rhythm, a black glazed porcelain hexagon tile (pictured, left); Link, a chevron stone groutless mosaic; and Splash, a blue glass mosaic. The manufacturer also debuted collections of textured tiles and of porcelain tiles that mimic natural surfaces. Contact a local distributor for pricing. emser.com

2. Light, Thin Solar Panels

Designed to nestle between the seams of standing seam metal roofs, Sunflare's PowerFit 20 solar panels allow homeowners to harvest solar energy with a more streamlined appearance. According to the manufacturer, the light, thin, and flexible 60-watt panels can be seamlessly connected to cover whatever length the roof demands, and their butyl adhesive backing can withstand gale-force winds, so no roof penetrations are needed for installation. Pricing starts at $90 per panel. sunflaresolar.com

3. Thermal Imaging Inspection System

The Flir Systems MR277, a thermal-enabled moisture meter with hygrometer, helps users understand problem areas by enhancing Infrared Guided Measurement thermal images with visual details to quickly identify moisture, air leaks, and insulation voids. When an issue is located, the pinless sensor enables quick, non-invasive moisture detection. Inspectors can streamline diagnosis and documentation by connecting to the mobile app. Pricing starts at $1,400. flir.com

4. Self-Adhered Flashing

Benjamin Obdyke's HydroFlash GP self-adhered flashing can be installed in temperatures as cold as 25°F and without use of a primer, according to the manufacturer. The flashing has a maximum UV exposure of 120 days and features a polypropylene film facer that provides tear and abrasion resistance. HydroFlash GP is available in 2 1/2-, 4-, 6-, or 9-inch widths; 6- and 9-inch sizes have a plastic split-release liner for quick and easy installation. Contact a local distributor for pricing. benjaminobdyke.com

5. Compact Air Quality Monitor

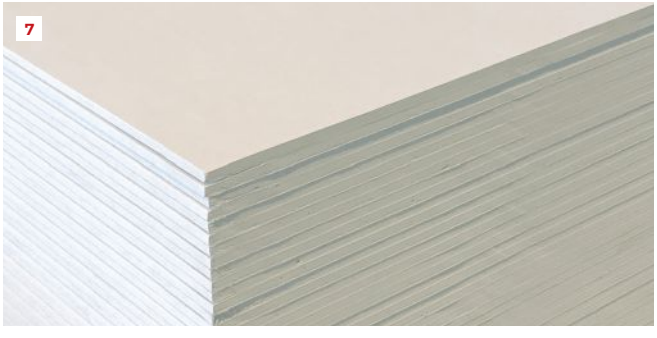
Unobtrusive in size, the Wave Mini, from indoor-air-quality-product manufacturer Airthings, provides a simple overview of a room's air quality with insights into three critical, non-radon air components: total volatile organic compounds, temperature, and humidity. By offering detailed air quality insights, customized alerts, and personalized trend analysis, Wave Mini can be used to help mitigate the health and wellness risks of poor air quality within homes. Pricing starts at $80. airthings.com

6. Antimicrobial Hardware Coating

Inox has a new powder-coat finish for its stainless steel door levers, pulls, deadbolts, push/pull plates, and panic devices. The Inox MicroArmor Antimicrobial Coating is infused with silver ions, which attach to microbes' cellular enzymes to inhibit growth. This reduces the spread of bacteria, fungi, or mold on the hardware. The coating and silver ions are applied and integrated during the manufacturing process, which Inox says ensures that the coating will not wear away or lose effectiveness. Pricing ranges from $28 to $108 for residential hardware. inoxproducts.com

7. Glass-Faced Gypsum Panel

Pabco Gypsum's new glass-faced gypsum panel is designed for use in non-fire-rated residential interior applications, particularly where moisture is a concern, such as in bathrooms and kitchens. The interior gypsum panels measure 1/2 inch thick and include a mold- and water-resistant gypsum core reinforced with glass fibers for increased core strength. The panels can withstand up to one year of exposure to normal weather conditions during construction, which allows for their use in pre-rock construction practices. Contact a local distributor for pricing. pabcogypsum.com



8. Universal Linear Drain

Infinity Drain says its Universal Infinity linear drain is compatible with every type of traditional or modern waterproofing method. The kit includes a pitched channel and clamping collar. Traditional membranes can be mechanically fastened to the drain channel, and more modern installation methods that incorporate bonded waterproofing will bond to the 1-inch channel flange. Available lengths include 24, 30, 32, 42, 48, 54, and 60 inches. Pricing starts at $200 for a complete 24-inch drain kit. infinitydrain.com

9. Composite Stone Panels
Atlas Stone Composite Stone Panels from Royal Building Products have the appearance of stacked stone without the weight. Protected with a Kynar coating for enhanced durability, the 18-inch-by-38-inch panels install easily and quickly, in any weather, with no special tools and without mortar, according to the manufacturer. Available in five neutral to bold shades, panels have a fine grit texture. Accessories include two kinds of ledge corner-L, shorter strip-L, stone ledge-L, stone wall-L, and stone corner-L. Contact a local distributor for pricing. royalbuildingproducts.com

10. Heavy-Duty Garage Rail
Designed to lift the tallest and heaviest residential garage doors, the Overhead Door Heavy Duty double-reinforced, C-channel garage-door rail can support more than 500 pounds, according to the manufacturer. It works with any existing Overhead Door opener, is compatible with any screw-, belt-, or chain-drive model, and serves to reinforce the motor rails and operating system. The rail is available preassembled in one or two pieces, depending on the job size. Contact a local distributor for pricing. overheaddoor.com

11. Paperless Drywall Tape
Saint-Gobain Adfors' FibaFuse Max reinforced paperless drywall tape was engineered with a porous design to allow compound to flow through the tape for a stronger bond. A reinforcement layer features a patented tri-directional construction that provides crack resistance in multiple directions and helps prevent accidental tearing of the tape when it's used on inside corners. It can be applied with automatic taping tools or by hand on factory and butt-end joints, on inside corners, and for patch and repair. We found a 2 1/16-inch-by-250-foot roll online for $6. us.adfors.com

12. Fiberglass Exterior Doors
With up to 18% more glass area, Masonite's Vista-Grande fiberglass exterior doors aim to bring more light into each home. The door's insulated glass with warm-edge spacers provides seal durability and less heat transfer, reducing interior condensation, improving sound absorption, and resulting in energy savings, according to the manufacturer. Available in fir or smooth texture with various glass and grid options, this new collection is ideal for front and patio applications. Contact a local distributor for pricing. masonite.com

Compact Positive Placement Nailer

BY TIM UHLER

From joist hangers and strapping to A35 framing angles and other seismic connectors, a lot of metal hardware needs to be fastened on my company's jobsites, making positive placement nailers invaluable. Last fall, Max USA sent us its new SN438J SuperLocator positive placement nailer (which I had first seen at last year's International Builders' Show) to try out.

This is a lightweight, compact nail gun with a purposely short magazine to allow it to squeeze into small places. It comes with a plastic belt hook that swivels, and it has a fully adjustable exhaust cap, a useful feature when you're working in tight quarters. The gun shoots only 1 1/2-inch-long metal connector nails, but in 0.131-inch and 0.148-inch diameters. Instead of using a probe to locate the hole in hardware, this gun uses the tip of the nail to find the hole, which I find is more accurate.

The company says that it designed this gun for durability, with a driver blade that is 21% thicker (I don't know whether this is noteworthy, as I've never broken a driver blade in the 17 years that I've been using positive placement nailers). Max also says that it built the gun with a thicker contact arm to provide more protection from breakage due to nail jams or accidental drops. In our experience, Max has always produced high-quality tools, of which we own many. They have always been reliable and durable, so I don't doubt the company's claims.

Like other Max nailers, this one has a filter that self-cleans when the hose is disconnected. For safety, the gun cannot double-fire, and it has an anti-dry-fire mechanism that prevents operation when the magazine is empty. It has an operating pressure of 70 to 120 psi.

In short, this lightweight gun does exactly what it is designed to do: reliably and accurately shoot nails through the holes in metal hardware. At a retail price of about $280, it's more expensive than similar nailers but—at least for my crew—well worth the price. maxusacorp.com

Tim Uhler is a lead carpenter for Pioneer Builders in Port Orchard, Wash., and a long-time contributing editor to JLC. *Follow him on Instagram: @awesomeframers.*

The Max SN438J SuperLocator positive placement nailer has a compact magazine that holds 1 1/2-inch metal-connector nails and allows the gun to fit between joists; an air deflector cap that rotates 360 degrees so you can aim exhaust away from your face; and a swiveling belt hook. Instead of a probe, the tip of the nail is used to locate the hole in the hardware.

Photos by Tim Uhler

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

A Hybrid-Powered Reciprocating Saw

One question I commonly hear about cordless tools is, "What happens when the battery dies?" My answer is to make sure that you always have batteries charged and ready to go. Metabo HPT has a different answer, though: It has a line of tools—called MultiVolt—that can be used either with the platform's 36-volt battery or with an adapter that plugs into a conventional AC power outlet. For the last year and a half, we've been using the Metabo HPT MultiVolt reciprocating saw on our framing jobsites, giving us a pretty good idea of the saw's characteristics.

In either cordless or corded mode, this saw does precisely what I need it to do: cut aggressively. The 1 1/4-inch stroke can be used in straight or orbital mode. Since we mostly cut wood, we keep it in orbital mode, but switch to straight mode when cutting metal.

The saw comes with a large rafter hook, which we find easily accommodates 2 1/2-inch-wide I-joists. It also has a variable-speed trigger, which allows for a "feathered" start when plunge cutting. Another feature on this saw that I like is what Metabo HPT calls User Vibration Protection. It does what the name sounds like: I don't have any numbing or tingling in my hands or arms during use. In a video that I recorded of my using the saw to cut through a 3 1/2-inch-by-14-inch LVL, very little vibration can be seen through my arm, even when the video is played back in slow motion (you can see the video in the online version of this article).

There is one feature on the saw that I'm not fond of: the tool-free blade change. It always seems to be stuck and never seems to want to lock in a blade. As a result, we don't change blades very often when using this saw, but—to be fair—the Diablo blades we use last a long time, so it doesn't end up being too much of an inconvenience overall. But if for some reason one of the crew needs to change a blade, we hear loud complaining.

Rated at 4.0 Ah at 36 volts, the MultiVolt batteries last plenty long and give this recip saw a lot of power. I've never run out of battery power using this saw, thanks in part to its handy fuel gauge. If I see the battery is at two bars (out of four) and I'm making a trip to the van or taking lunch, I put it on the charger; it takes less than an hour to charge. Even on a drained battery, the saw is still capable of cutting through an LVL.

The tool isn't cheap at $230 (tool only and battery). A battery costs about $120, but instead of buying a solo battery, buy a Metabo HPT MultiVolt Triple Hammer impact driver kit. Then you'll have my favorite impact driver, two batteries, and a charger. metabo-hpt.com —*T.U.*

The Metabo HPT MultiVolt reciprocating saw has a brushless motor that can be powered by plugging it into a 110-volt AC outlet or by attaching its 36-volt 4.0-Ah battery. The smooth-operating saw features a variable speed control, straight and orbital cutting modes, and a toolless blade lock mechanism.

Smart Work Lights

The Pacific Northwest's winter gloom lasts from November through February, so we rely on temporary lighting on our jobsites as soon as we get the roof sheathed. In the past, we used Wobble Lights, but a few years ago, we switched to Milwaukee's battery-powered LED lights (I've also tried clipping a headlamp to my hard hat). This winter, we added Milwaukee's M18 Radius site light (model 2150-20) and M18 Rocket tower light (model 2120-20). Spoiler alert: I love these lights. Our three-man crew framed all winter long using just the two lights in this review and an older (and smaller) battery-powered Milwaukee Flood light that has more than proven itself over the years.

M18 RADIUS LED SITE LIGHT

Similar in size and shape to our old wobble lights, this IP54-rated (for water and dust resistance) light has a two-battery bay that can sequentially charge M12 or M18 batteries. It also features Milwaukee's One-Key system, which allows the user to create profiles in the Milwaukee app, track the unit, set light schedules, or manage inventories.

The M18 Radius provides 360 or 180 degrees of light, with the option of turning off sections of the light in thirds. It provides 9,000 lumens at full power, 4,800 lumens at two-thirds power, and 2,500 lumens at one-third power. The company claims that a single battery charge can run the light for up to 14 hours; at full power, we've found that we can get about a full workday out of two 12-Ah batteries. Most of the time, we leave the unit plugged in to the one cord we have rolled out, so we can keep the batteries charged for the other cordless LED lights that I can't plug in.

I like being able to keep the light connected to power to charge batteries, and I like that up to six of these units can be daisy-chained together (even though I have only one unit). That means that other plug-in tools can be connected to the light, such as the wet/dry vac that we had to use on one job. At nearly 3 feet tall and almost 2 feet in diameter, the Radius Site Light is big, but it doesn't take up a lot of room, and it can easily be moved around to wherever illumination is needed. The bare tool is $600, so buy it when you can find a deal on batteries. This is a staple light to have.

M18 ROCKET LED TOWER LIGHT

Unlike other Milwaukee tower lights that I've used, the M18 Rocket folds down and packs away easily, which I think is a major advantage. This IP67-rated light doesn't have a built-in charger like the Radius light, but you can plug in two batteries and run it all day and night (or it can be plugged into an extension cord). To maximize runtime, I try to operate lights at the minimum brightness level that I feel is needed for the task at hand; at full power, the Rocket provides 5,400 lumens of light.

While this light can provide lighting for larger areas, I find it best suited for task lighting. The height is adjustable up to about 5 1/2 feet, and the head can be rotated to bounce light off the ceiling, which provides plenty of light for us in most cases. There are three leg positions and multiple ways the light can be deployed (think Transformers); I primarily use the light in a basic tripod position. This light also features One-Key compatibility. Like the Radius, the Rocket costs $600 (bare tool), so it isn't cheap, but it is powerful and versatile. milwaukeetools.com —*T.U.*

The Milwaukee M18 Radius site light **(1)** can be plugged into a standard 120V outlet, has a built-in dual battery charger, and can power additional lights or tools. Milwaukee's M18 Rocket tower light doesn't have a built-in charger, but it can run for up to 24 hours on a pair of batteries. The tower extends up to 5 1/2 feet tall **(2)** and can be folded down into a compact package **(3)**. Both lights feature variable output—up to 9,000 lumens for the Radius and 5,400 lumens for the Rocket **(4)**.

June Advertising Index

*Advertising appears in regional editions

Classifieds

BY TIM HEALEY

Termite HVAC (Passive Mound Ventilation)

Termites don't have many fans. Globally, they cause billions of dollars of property damage per year. Although only 28 out of 2,600 identified termite species worldwide are considered invasive pests, their destructive reputation precedes them.

Enter a cadre of termite-obsessed scientists who believe we have them all wrong and that termites just may be key to our future survival. In Lisa Margonelli's *Underbug: An Obsessive Tale of Termites and Technology* (Scientific American/Farrar, Straus & Giroux, 2018), she describes her eight-year trek around the world embedded with these multidisciplinary scientists—many of whom are as interesting and quirky as the insects they study.

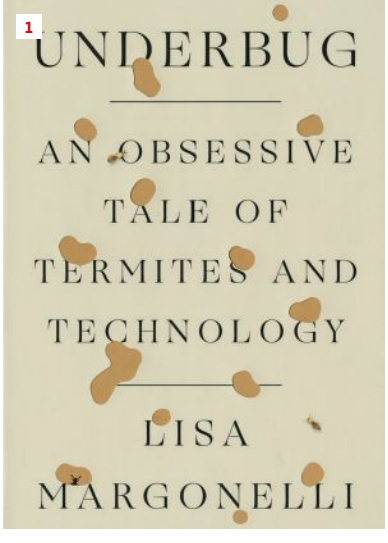
One such obsessed scientist is American physiologist J. Scott Turner, a foremost expert on mound-building termites, *Macrotermes michaelseni*, found widely distributed throughout sub-Saharan Africa. These termites cultivate a fungus that decomposes dead plant material within the colony (the fungus serves as a food source). For the past 30 years, Turner has searched for clues into why these tiny creatures build such spectacular structures.

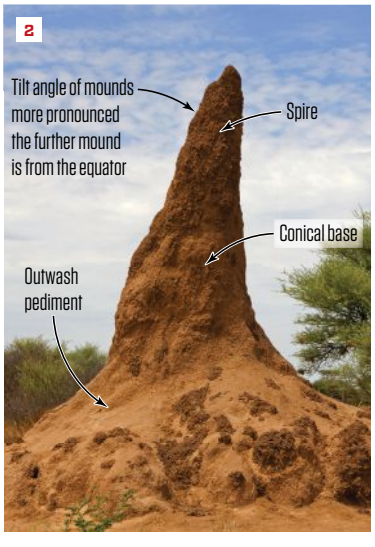
Thermosiphon vs. tidal ventilation. Conventional wisdom held that termites built mounds to promote bulk airflow via a thermosiphon model (in which colonial metabolism heats and humidifies the nest air, reducing its density and causing it to flow upward in a convective loop). Turner's research told him otherwise; that airflow was more a result of tidal ventilation, or "breathing."

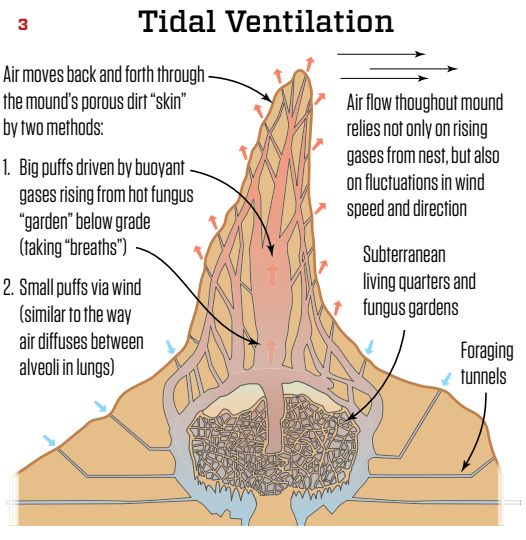
Turner surmised that the mounds function more as lungs (not merely as chimneys allowing hot air to escape, as with the thermosiphon model). After pumping propane gas down termite mounds, he found it behaved unpredictably—sloshing around sometimes, rising others, seemingly dependent on whether the wind was steady or gusty. According to Margonelli, this led Turner to believe that "the air moves back and forth through the porous dirt skin of the mound by two systems: in big puffs driven by buoyant gases rising from the hot fungus nest (like the sharp intake of breath from the diaphragm), and in small puffs (the way air wheezily diffuses between alveoli in your lungs)." Further, "Turner suspected that the termites themselves circulated air as they moved, like mobile alveoli. The mound was not a simple structure where air happened to move, but a continuously morphing complex contraption consisting of dirt and termites together manipulating airflow."

Engineers and architects hope to take this knowledge and apply it to the design of sustainable, self-regulating buildings, conserving energy while supplying ventilation.

Tim Healey is a senior editor at JLC.







Underbug by Lisa Margonelli **(1)**. Termite mounds in sub-Saharan Africa use the sun to thermoregulate. This *Macrotermes* mound in Namibia tilts north toward the sun in an effort to heat all sides equally **(2)**. The aboveground portion of the mound serves as a breathing and moisture-management apparatus, helping to promote airflow to subterranean living quarters **(3)**.

1: *Underbug* (Scientific American/Farrar, Straus & Giroux); 2: Adobe Stock/ AnnaReinert; 3: Tim Healey

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