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On the cover: Kyle Davis of Pioneer Builders in Port Orchard, Wash., uses a DeWalt Flexvolt in-line saw to cut outlookers on a gable end. For more on the cordless revolution in framing tools, see the story on page 33. Photo by Tim Uhler.

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DEPARTMENTS

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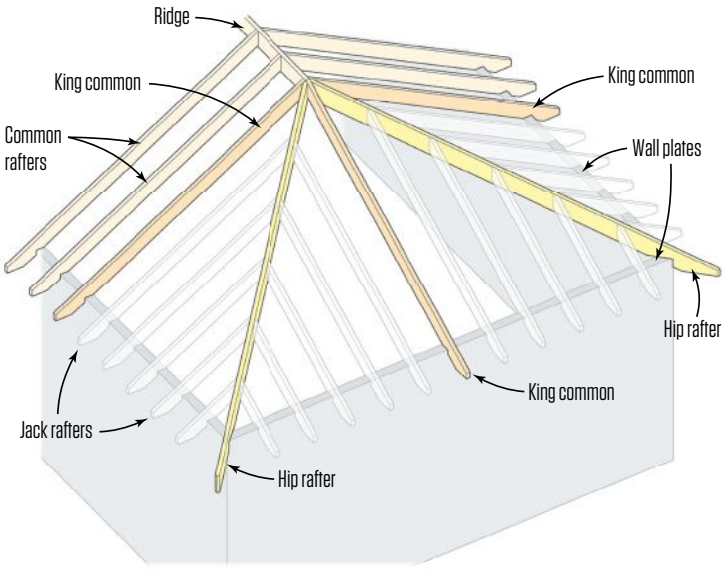
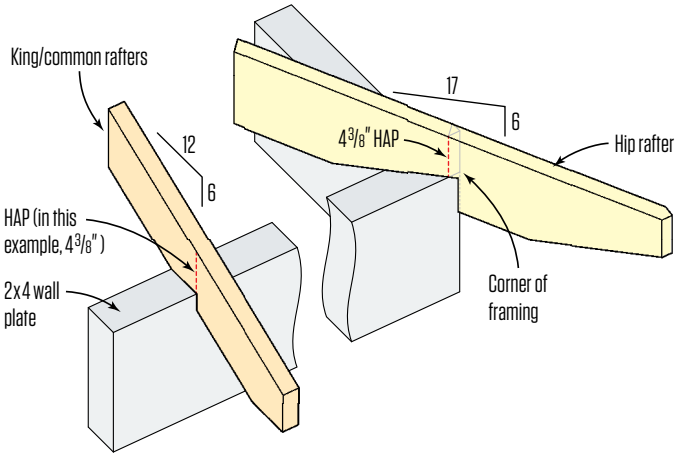
BY DALE DIAMOND



Height Above Plate (HAP)



Hip rafters support the two sloping planes that make up a hip roof. Depending on the size of the roof, hips can be doubled or made out of different material, such as LVL. To keep the hip roof sections in plane with the main roof, the hip roof rafter must have the same height above plate (HAP) as the regular rafters. Measured at the common rafters, HAP is the vertical distance from the tops of the rafters to the plate at the edge of the wall framing.

Illustrations by Tim Healey

Laying Out a Hip Rafter

One of the strongest ways to frame a roof is using a hip-roof design. The planes of the roof slope up from every side, so the framing braces the roof from all sides. If the building is square and the sides are of equal length, the roof planes will meet at a point, as in a pyramid. On a rectangular-shaped building with a hip roof, the roof planes on the two longer sides meet at a ridge, as shown in the illustration at left.

The key structural member is the hip rafter, which spans from the building corner to the peak or the ridge. Before we explain hip rafters, you need to understand how to lay out and cut common roof rafters; this is covered in "Cutting Common Rafters" (Mar/17). There are many variations on hip roofs and hip-roof construction, but for the purpose of this article, let's assume that the roof planes are all the same slope (6:12) and that they meet at a ridge. For simplicity, we will make all of the framing out of 2-by stock.

King commons and ridge. Start by framing the common rafters along the ridge. The last common rafters that support the ridge are called *king commons* (see illustration, left). An additional common rafter that extends from the end of the ridge down to the plate at the end of the building is also called a king common. The king common at the end of the ridge and the king common on the side of the ridge intersect at a 90° angle. The hip rafter intersects this 90° angle at a 45° angle and runs diagonally down to the building corner.

The king commons at the ends of the ridge are the same length as those at the sides. Each common, including the kings, has an "adjusted run" that equals the run shortened by half the thickness of the ridge (in this case, using 2-by stock, the run is shortened by 3/4 inch). If both ends of the building end with a hip, the length of the ridge is the total length of the building minus two times the adjusted run of the common rafters. (For details on calculating ridge length, see "Framing a Hip Roof," Sep/13.)

Height above plate (HAP). Before we lay out the hip rafter, we must first figure out the *height above plate* (HAP), or the vertical distance from the seat cut of the birdsmouth (or the top of the wall plates) at the edge of the wall to the top of the rafter. This measurement is taken off the common rafters (see illustration, left). Using the same HAP on the hip rafter and the common rafter

ensures that they will be in the same plane. This measurement is crucial for laying out the hip rafter.

Hip rafter length. The conventional way to determine the length of a hip rafter is by using the "Length of Hip per Foot of Run" table on a framing square or by using a construction calculator. But rather than depending on the math, I find it easier on small roofs to physically measure the length as shown on the illustration at right. I start by making a short pattern of the ridge cut for the hip. For this, I need the plumb angle for the hip, which is calculated as the rise-per-foot/17. So for this 6:12 roof, the plumb angle on the hip is based on a 6:17 slope.

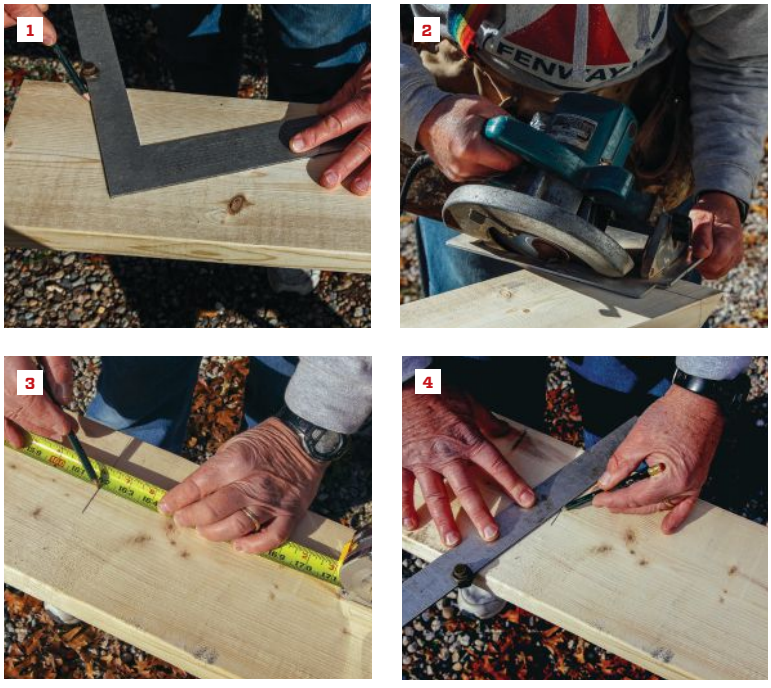
The easiest way to lay out the angle is with stair gauges attached to a framing square. These little hexagonal devices clamp on the edge of the square—one at the 6-inch mark and one at 17. When you slide the square to the edge of the board, the gauges "stop" the square at the proper angle for the hip slope.

Using this angle, I make a *double 45° cheek* cut on my pattern. I then place the pattern in the corner between the two king commons and mark where the shoulder of the cheek cut meets the kings.

Next, I move to the building corner and on the plates, I draw a 45° angle that bisects the corner. I then measure over half the width of the hip rafter—3/4 inch for 2-by stock—and draw a parallel 45° line.

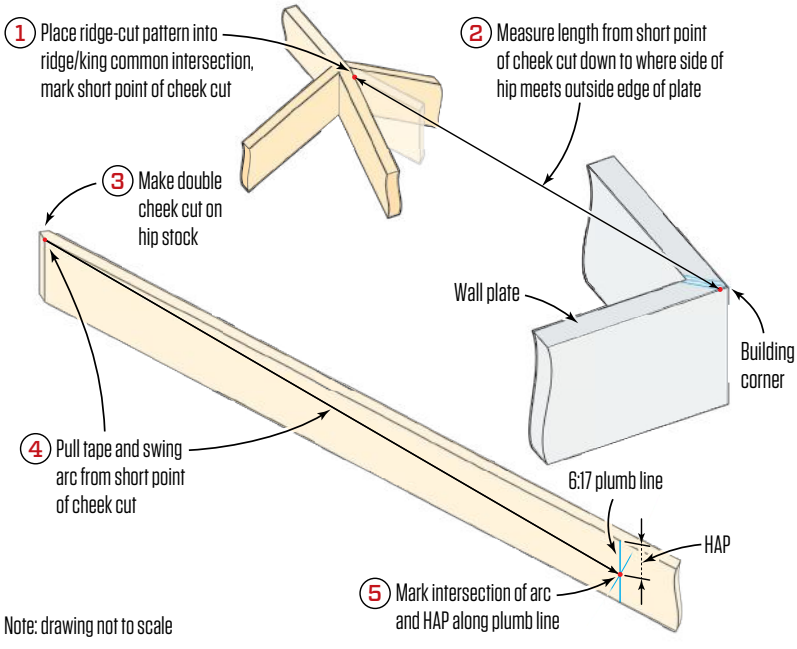
Holding the tape on the shoulder mark that I made on the king common using my ridge-cut pattern, I measure down to where the line for the side of the hip meets the outside edge of the plate, and I record that measurement. (Note: This is *not* the same length as the hip rafter "line length," which is the figure you would find using a calculator or the table on a rafter square to determine the hip rafter length.)

Hip rafter layout. For the hip rafter, I choose a lumber dimension one increment up from the size of the common rafters. In this case, I used 2x6 stock for the commons, so I went with 2x8 stock for the hip. (If the commons were 2x10, I would have used 2x12 stock for the hip). Be sure to mark the direction of the crown on the hip board and keep this as the top edge of your hip rafter.



Lay out plumb cuts for the top of the hip rafter **(1)**, and make the cuts with the saw blade set at 45° **(2)**. Swing an arc at the measured length of the rafter **(3)**, and then mark the HAP along an intersecting plumb line **(4)**. Using the ruler on the framing square, the 4 3/8-inch HAP is marked at 10 3/8 inches. These steps are also shown in the illustration below.

Measuring Hip Rafter Length



Photos: 1–4, Rae Osborn; 5–7, Kyle Diamond

To install the hip rafter, set the top end into the corner between the two king commons and tap it down until the shoulders are flush with the tops of the adjacent rafters **(5)**. Align the edge of the seat cut with the layout line on the plates and toenail it from both sides **(6)**. Fasten the top through the king commons if accessible or directly through the top **(7)**.

For a more detailed discussion on hip rafters, go to **www.jlconline.com/training-the-trades/laying-out-a-hip-rafter**

On one end of the stock, I cut a double 45° cheek cut along a plumb line for a 6:17 roof. To lay out this double cheek cut, I draw a plumb line on one side **(1)**, square this line across the edge, flip the board over, and draw another plumb line on the opposite side. These define the short points of each cheek cut. After setting the blade angle on the saw to 45°, I cut all the way through the board from one side. (Because I am cutting the short point line, I keep the saw blade angled towards my offcut.) Then I flip the board over and cut from the other side **(2)**. The cheek cuts should meet in the middle of the hip stock.

Next, a crew member holds the end of the tape on the short point of the cheek cut (at the top edge of the hip rafter) while I hold a pencil at my length measurement and trace a shallow arc across the width of the board **(3)**. With the framing square set at the 6:17 angle, I slide the square up to the arc and mark the point where the HAP distance along the plumb side of the square intersects with the arc **(4)**. That point is where the seat cut of the hip rafter starts, so I slide the square down and draw a level line to the edge of hip stock, using the "level" side of the square. (Note: The plumb cut for the birdsmouth has to be moved out to clear the plates and sheathing.)

Install the hip rafter. To put the hip rafter in, I have a crew member hold the top end of the hip rafter so that the shoulders of the cheek cuts are flush with the tops of the king commons **(5)**. When the top is set, I align the seat cut on the line that I drew for the side of the hip and drive toenails to secure the hip to the plates on both sides **(6)**. To secure the top of the hip in place, I drive nails through the king commons. If that isn't possible, I drive a nail through the top of the hip and into the ridge **(7)**.

Next, I cut and install the jacks (see "Fast Jack Rafter Layout and Cutting," Sep/17). When the jacks are in place, I extend a line from the tails out to the hip rafter from both directions and make plumb cuts at a 45° angle. I then project a line from the bottoms of the jack rafter tails to the hip and make a level cut to catch the corner of the soffit.

Dale Diamond is a partner with his son, Kyle, in New Dimension Construction, in Millbrook, N.Y.

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Fortify Homes Against Storms with Sealed Roof Decks

When General Contractor John Price moved to Gulfport, Mississippi, and began work with premier residential and commercial developer Sapphire Homes, he noticed significant rainfall was a crucial jobsite variable year-round. According to Price, even outside of the June to November hurricane season, rain is an almost-daily reality on build sites in the coastal city, and that can spell trouble for roofs.

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

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

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

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

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

Sapphire Homes follows FORTIFIED Homes™ guidelines to make each of their projects as strong and weather resistant as possible. The FORTIFIED Homes program was created by the Insurance Institute for Business and Home Safety (IBHS) to help offer disaster protection for homes in areas susceptible to natural disaster. Formulated after over 20 years of research, FORTIFIED Homes offers a set of design and construction standards that goes above building code requirements to help homes resist damage from natural hazards. Homes are inspected by FORTIFIED Homes professionals and certified, which can enable homeowners to receive insurance benefits. The bronze, silver and gold categories build upon each other, but the main focus of the first level — bronze — is fortifying the roof.

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

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

Introduced in 2006 for exterior wall and roof applications, ZIP System sheathing and tape is changing how professionals achieve tight building envelopes.

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

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Q The article “Sealing a Chimney Chase” (Oct/17) pertains to a brick chimney. How would I seal the chase for an existing double-wall metal chimney?

A Matt Damon, owner of Penobscot Home Performance, a weatherization company based in Bucksport, Maine, responds: The procedure for sealing around an existing cylindrical double-wall metal chimney is similar to that for sealing around a brick chimney. Be aware that metal-chimney companies make materials to air-seal *new* chimneys, but using them would require dismantling an existing chimney.

Start with a rectangular piece of 26-gauge sheet metal large enough to cover the framed chase. On the sheet, locate and draw a circle that has the same diameter as the outside of the pipe and cut it out.

As with a masonry chimney, take care to seal any gaps in the chase that are more than 2 inches away from the pipe, using rigid foam and one-part foam sealant. Note that double-wall pipe manufacturers may rate their products for zero clearance to combustibles, but I would try to maintain a gap of at least 2 inches to be on the safe side.

Cut the sheet metal in half and slip it around the pipe, as shown below. Screw the metal to the framing, sealing it with high-temperature caulk at the framing and where the metal contacts the pipe. To seal the edge of the metal where it was cut in half, bridge the caulked seam with a small strip of the same sheet metal.

Even if the pipe is rated for zero clearance, I would recommend wrapping it with 2-inch Roxul batts. Blown-in cellulose treated with borate is fire-resistant, but the fireproof Roxul would provide some additional peace of mind.

Air-Sealing Retrofit for a Double-Wall Metal Chimney

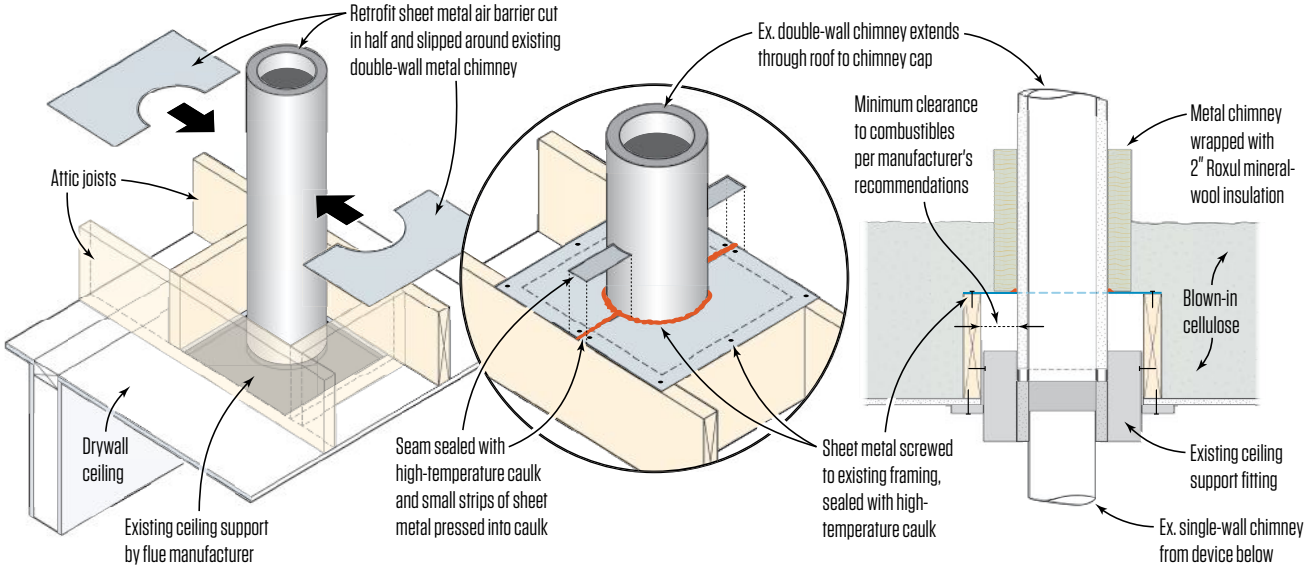

Illustration by Tim Healey

Q What are the pros and cons of a block foundation vs. a poured foundation?

A Nate Eldon, owner of Eldon Builders, a custom home-building and remodeling company in Cape May, N.J., responds: A lot depends on your region. In southern New Jersey, I've built both block foundations and poured foundations, but the most common foundation in this area is of concrete block (CMU). Concrete block is readily available and doesn't take much of an investment on the part of the foundation contractor—a mixer for the mortar, some shovels, trowels, and levels seem to be all that's needed.

Block foundations have good load-bearing strength, but their lateral strength is limited unless the block is fully grouted with rebar (which is rarely done). Because of high water tables and flood zones, most of our foundations are crawlspaces with short walls, although certain lots in some flood zones require taller walls. In these flood zones, local building codes do not allow much of a change in elevation from the inside of a foundation to the surrounding grade, so fully excavated basements are not possible.

Outside of flood zones, I have done a few poured-concrete basement foundations. Poured walls in this area are typically 10 inches thick with rebar 2 feet on-center, so they have much more lateral strength than a typical block foundation. When walls are tall, pouring is much faster than using block. Block is more labor intensive—especially as the height of the wall increases. For a poured wall, extra height just means taller forms and more materials. Also, the porosity of CMUs makes waterproofing more difficult in a full foundation.

Costs vary from region to region, but in this area, poured stemwall foundations cost about 20% less than block foundations of the same height. In my most recent experience, an 8x16 CMU foundation went for about $6.25 per square foot of wall compared with about $5 per square foot for 10-inch-thick poured walls. Tall CMU walls would likely require grout and rebar, so any cost comparison for them would go out the window.

Although poured concrete makes for a superior foundation wall, in my area, few foundation contractors have invested in the forms. A poured-wall contractor based nearby told me that he had $200,000 invested in forms; it's not an easy business to get into without financing. Also, the complex foundations in flood zones require flood and air venting, pre-formed beam pockets, and penetrations that are more easily executed in a block foundation; a poured foundation would call for more diligent layout and installation management.


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Photos by Dave Holbrook and Matt Quigley

Low-Slope Copper-Look PVC Roofing

BY JIM BENNETTE

As a certified installer of just about any type of roofing you can think of, my company enjoys a competitive advantage when working with products whose manufacturers restrict the number of installers per geographic region; to get the material, a homeowner typically has to go through a certified installer. This year, my crew and I spent several days on a full-house remodel in Cohasset, Mass., replacing existing EPDM roofing with Sentinel Copper Art (soprema.us), a European-made 60-mil, polyester-reinforced PVC membrane. It has actual powdered copper metal incorporated into its chemical mix **(1)**, resulting in a single-ply waterproofing membrane that weathers, or oxidizes, over time to a classic copper patina.

This PVC material has a number of benefits. Its reinforcing scrim provides high puncture resistance, which is an important feature around here because seagulls drop clams on the roofs, and the shells make sharp shards when they break. Unlike EPDM, ponding conditions don't void the warranty, so a no-slope roof is actually a go with PVC. That's because once you weld the seams, they'll never separate again, period. Another plus is that while EPDM can leach nasty solvents into the runoff, PVC sheds clean water, making it a great choice for cisterns and agricultural water capture.

The windows on the second floor of this house looked out over a couple of low-slope roof areas, and the owners wanted to see something more attractive there than black EPDM, or even white PVC or TPO. (A white roof has about 88% reflectivity, forcing us to wear shades during installation.) When I showed them a sample of the copper membrane, they were sold on the look. We sell Copper Art roofing starting at an installed cost of about $10 per square foot. Compared with solid copper, that's maybe one-third the cost, and it's probably three times faster to install, too.

UNDERLAYMENTS

After stripping the old roofing and fiberboard underlayment, we installed new, 1/2-inch-thick polystyrene underlayment **(2)** as a smooth base for the membrane. Unlike fiberboard, polystyrene underlayment

doesn't absorb water, ensuring a dry base in the event we have to leave it temporarily exposed. Also, once fiberboard gets wet, it pretty much stays wet and can even promote rotten plywood sheathing—it's the cheap stuff and we never use it.

Raised perimeter trim around one of the areas of the roof called for additional build-up, so we installed 1-inch-thick R-Max Thermasheath-3 as underlayment there **(3)**. For both the 1/2-inch and the 1-inch thicknesses, we fasten the underlayment using common screw-down plate fasteners on nominal 2-foot centers.

MECHANICAL FASTENING PREFERRED

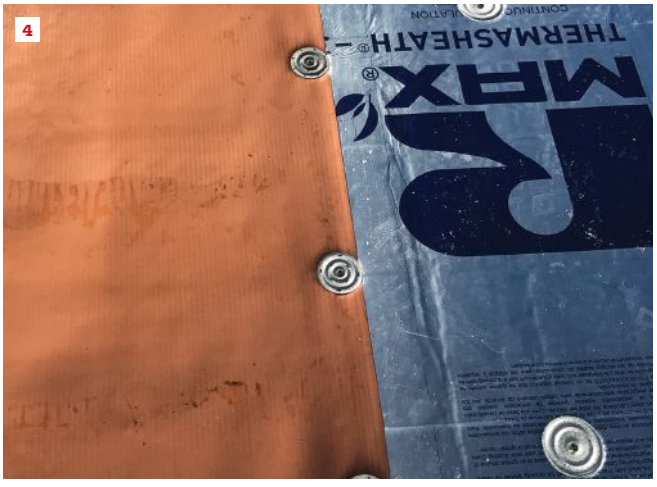
PVC membrane can be installed fully adhered using a flocking-backed membrane and approved adhesives, or it can be mechanically fastened, which is the method we typically use. Certain applications or specifications do require adhesive bonding, but it's overkill in most residential situations.

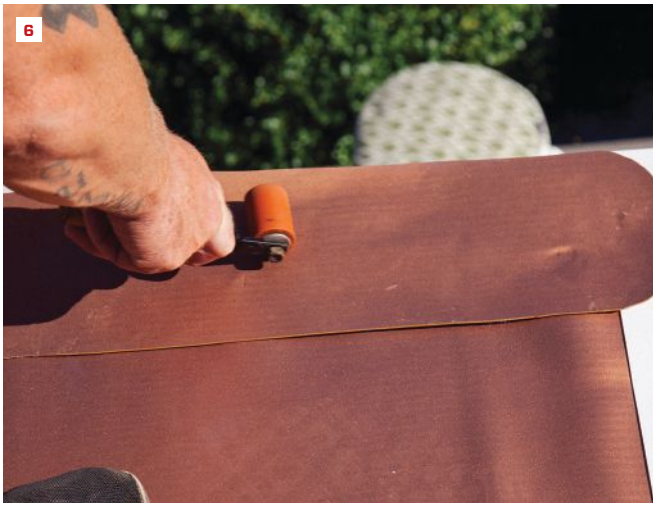
Mechanical fastening avoids the prep, the volatile goo, and the 50°F low-temperature limitation that go with the fully adhered method. Mechanical fastening also satisfies high-wind code requirements, a real concern on an oceanfront property like this one. We use proprietary, 2.4-inch "membrane stress plates"—we call them "seam plates"—along the upper edge of each 6-foot-wide course, on 12-inch centers **(4)**. These plate fasteners have barbs and ribs on the underside to better resist membrane uplift. The 6-inch overlap of the next membrane course covers the fasteners.

Over the starter membrane course along the roof's perimeter, we install PVC-clad stainless drip edge with a bonded, weldable PVC coating **(5)**. The drip edge is nailed with common roofing nails, replacing seam plates along this edge. To finish it off, we then seal it under a weld-down cover strip. Because there's a tendency during welding for the membrane to deform at any sharp corners, we round all the cover-strip terminations **(6)**.

MEMBRANE

We cut both cover strips and terminal flashing from the roll, according to need. To terminate the membrane against a wall or





parapet, we cut the sheet to the junction and fasten the edge with stress plates. Then we fold a cover strip up the wall, using a full bead of caulk along the upper edge and nailing it in place **(7)**. A few tack-welds hold the strip in place pending full seam-welding. Measuring 6 inches out along the roof plane, we then snap a line and trim the cover strip to it. Pre-formed inside and outside corner flashing is available from the manufacturer, and is the way to go for these junctures **(8)**.

Welding PVC is straightforward, though it takes some practice. We heat the seams briefly by slipping a torch nozzle under the membrane edge, and then immediately press the pieces together using a seam roller. You should see a little bit of white smoke wafting out of the seam as you work **(9)**.

We use a hand-held, 1,500W torch, with power adjustable from 80W to 1,500W, and a temperature scope from 100°F to about 1,300°F **(10)**. (On smaller jobs like this one, the hand-held torch is sufficient, but on large, commercial-scale work, we break out the "robot," which semi-automates seam welding and can crank along at up to 10 feet per minute.) While cold weather doesn't delay installation (you can even weld PVC in the rain), you do have to adjust the welding temperature upward to compensate. Likewise, in hot weather, you need to lower the welding temperature accordingly.

What you're looking for is a characteristic "bleed" at the seam edge, where molten material is squeezed out ahead of the seam roller **(11)**. That tells you that you have a fully welded bond. We use a pointed probe to check for any loose spots that would void the manufacturer's warranty.

When mechanically fastened membrane is first installed, it's common to see slight waves in the surface where the material hasn't fully relaxed onto the substrate. Over time, as the material responds to temperature cycling, the material settles to a flat, smooth appearance.

Jim Bennette owns and operates J Bennette Roofing Inc., in Sagamore Beach, Mass.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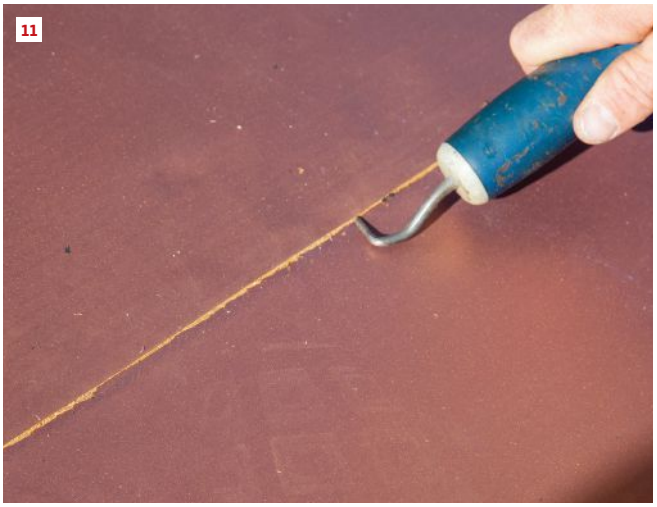
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Cubby Cabinets For a Mudroom

BY GARY STRIEGLER

I've never heard anyone complain about having too much storage in a house, and one place I try to provide plenty of storage in both remodeling and new-home projects is in the transitional space between the garage or entry door and the main house. I've heard these rooms referred to as mudrooms or launching pads. The cabinets I build for these spaces have cubbies where people can hang up their jackets, take off their shoes, and drop their things before entering the house.

In every bank of cubby cabinets I build, I try to include a partitioned space for each member of the family, with a place to sit for putting on shoes, a place to store shoes, hooks to hang coats and backpacks on, and at least one shelf or cubby to store things that don't hang. When asked, I've also included drawers and upper storage cabinets with doors in mudroom projects.

For the mudroom shown here, I built a fairly basic cabinet, with enough room for three cubbies, each 28 inches wide (I never make cubbies less than 24 inches wide). Because the room had 9-foot ceilings, I could make the cabinet 7 1/2 feet tall; for 8-foot ceilings, I keep the height of the cabinets to 7 feet or less.

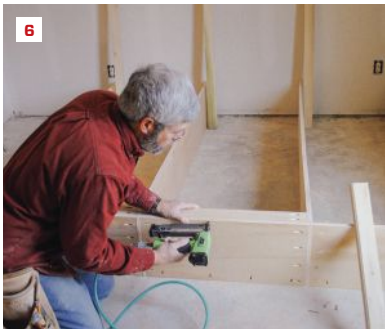
I usually build the cabinet in two parts: a base section and an upper section that sits on top of the base. (The whole cabinet for this project would not have fit through the door in one piece). I make the base cabinet much like a window seat—usually 18 to 20 inches tall for a comfortable seat height, and 16 to 24 inches deep, as space allows. When I include drawers, I try to make the base cabinet 24 inches deep. I made this base cabinet 20 inches deep, and the upper section 12 inches deep.

Because I build the cabinets from scratch, I can match them to the decor of the house or give them a unique design. This particular cabinet was paint-grade, so I made the face frames out of poplar and the boxes out of 3/4-inch birch plywood. The backs of the cabinets were 1/4-inch plywood, but I've often used paneling instead to dress things up.

These cabinets usually get a lot of use, so I assemble them using glue and pocket-hole joinery to make them strong and durable. I rabbet the boxes together for alignment and to help conceal the joints, and I also use pocket screws to attach the face frames.

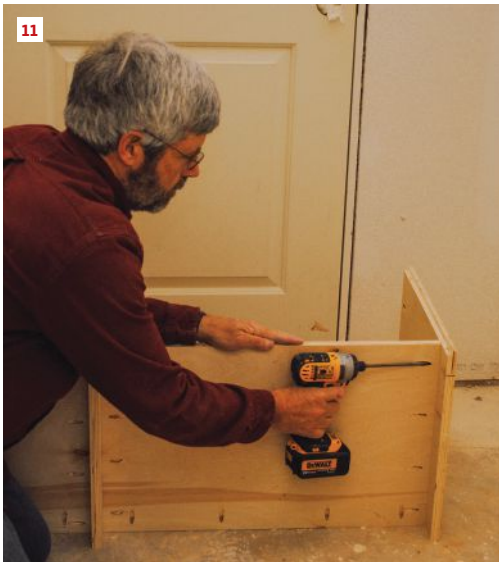
Gary Striegler owns Craftsman Builders, in Fayetteville, Ark., and teaches workshops at the Marc Adams School of Woodworking. His website is craftsmanbuildersnwa.com.

Upper section pieces. Construction begins with rabbeting the vertical pieces for the upper cabinet, using a router **(1)**. A jig positions holes along the edges for adjustable shelf brackets **(2)**. The author drills pocket holes along the front edge of the vertical components for attaching the face frame **(3)**.



Build the upper section. Working in a large, flat area, the author drives pocket screws to assemble the face frame for the upper section **(4)**. He screws the box together, fitting the top pieces into the rabbets he cut into the top edges of the verticals **(5)**. Then, at the top of each section, he glues and screws one-by cleats for attaching the unit to the wall **(6)**. The cleats also add stiffness to the assembly. A second set of cleats act as spreaders and blocking to catch the bottom edge of the plywood back **(7)**. To account for the plywood, the two inboard verticals were cut 3/8 inch narrower than the outboard ones and the outboard verticals received 3/8-inch-deep rabbets along the inside edges. The extra depth gives the plywood back plenty of room.

The back. Because the upper cabinet is more than 4 feet tall, the back consists of two pieces. The author glues and nails the 1/4-inch plywood back to the cleats and to the verticals **(8)**. Next is the bottom of the upper section. It's also the seat for the cubbies, so it's wider. The author glues and screws it to the verticals **(9)**. The last piece of the upper section to go on is the face frame **(10)**, which attaches with pocket screws, drilled earlier. The upper section can now be moved so the base cabinet can be built.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The base section assembles much like the upper section except that it is shorter and deeper. The author attaches the bottom shelf 4 inches from the bottom of the box to create a kick space **(11)**. A spreader cleat along the top of the cabinet provides attachment for the plywood back, as well as support for the upper section when it is installed. The face frame attaches to the box with glue and pocket screws **(12)**, and the plywood back completes the assembly.


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Combined unit. The base section is set in place first, then the upper section sits on top. Screws driven through the upper cleat and into the wall framing secure the upper cabinet in place **(13)**. The base also screws to the wall, and then pocket screws join the two sections together **(14)**. A large back-band molding with a rabbeted edge fits around the edge of the seat; a bullnose softens the edge **(15)**. The author uses a cove-and-bead bit to make a two-step trim detail on the top of the upper cabinet **(16)**. Short pieces of molding finish the back edge of the seat, and the cabinets are ready to be sanded and painted.

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BY STEVEN BACZEK

The 'Buy-In'

The architect and the building crew met to question and review the details of a challenging project to make sure everyone was on the same page before the project began.

One of the greatest takeaways from the four years I spent in the Marine Corps was the understanding of a ladder of leadership and responsibility. The bottom of that ladder—where the boots hit the road—is the "fire team," a small, organized group of four Marines. When you're building a house, the leadership ladder is similar, with the building crew as the fire team on the jobsite, responsible for carrying out the construction details at the most basic level.

Recently, I began work on a high-performance home, and while my familiarity with the performance details in the home were solid, I needed a way to convey those details to the crew. Having worked many times with the project's builder, Shoreline Builders of Scituate, Mass., I knew that I could count on their commitment to success at every level. But this new project had higher performance standards than our past collaborations, so I was looking for a way to get everyone to buy into the process.

With the new challenges of this project, Shoreline's owner, Jim Wolffer, asked me to meet with him and his crew to develop a deeper understanding of the construction details. A week before the meeting, Wolffer gave preliminary drawings to the entire crew, asking them to bring their questions and comments. As in a Marine Corps fire team, it was crucial that each member of the crew understood the details and scope of the project—their mission—along with the paths, the goals, and the duties of the other crew members around them.

Taking the crew out of the field for an entire afternoon carried a big price tag for Wolffer. But he saw the meeting as an investment rather than a cost. He figured that one mistake on the project

Photos courtesy Shoreline Builders

could cost more time and money than a meeting ever would. More important than the cost, this meeting would help us deliver the best project possible.

Wolffer and I divided the meeting into three parts. First, I presented an overview of a high-performance house and its components, which gave the crew an understanding of the complete trajectory of the project.

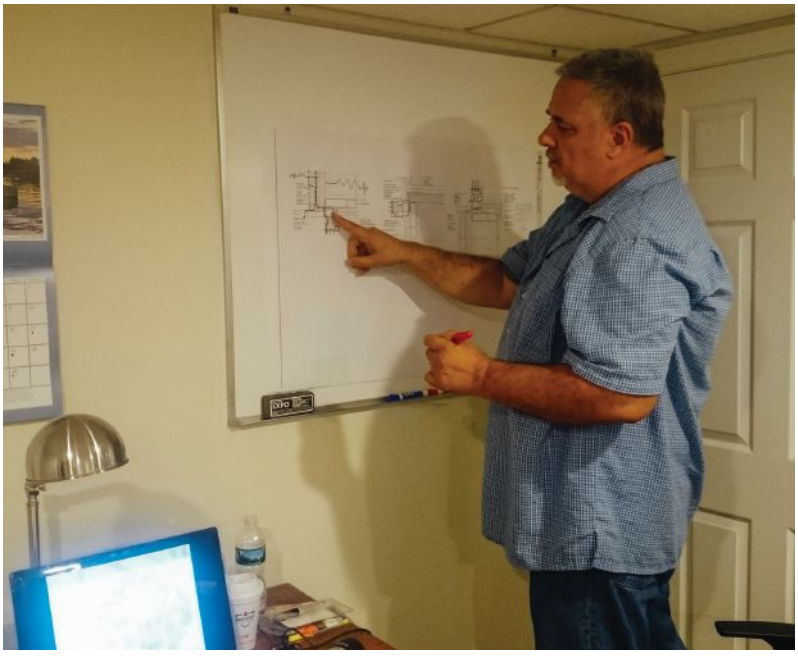
In the second part, I showed the crew some past case studies. The photos brought to life all the concepts that I'd presented in the first part of the meeting. The photos also legitimized the details by showing that they had already been successfully implemented on other projects—this proved key to getting the crew's buy-in.

What followed was a very involved—and welcome—conversation. The entire team had become closely engaged with the details that go into building a high-performance home. The team had done their homework and came in with questions, suggestions, and a desire to think through and grasp every step in the building process.

For the last part, we reviewed the details of the actual project we'd be building together. Here, I leaned on a mantra of the Corps: "We run as fast as the slowest man, and no one gets left behind." The entire crew needed to understand the project details with nothing left in question, and no one in the dark—this was mission critical. We talked though how each detail would be built, discussing airtightness, water management, vapor control, and the thermal barrier at length. We broke down each of these items into its key components and discussed how they related to each other. This way, we identified the most important pieces of the project, as well as areas of less concern.

As a result of this meeting, Wolffer and his guys are now efficiently working on the project with a clear understanding of where to focus their efforts and where not to. I left with a better grasp of how the crew dealt with my drawings. We gained respect for each other and the jobs we have to do to accomplish a unified mission.

Steven Baczek, of Reading, Mass., is an architect specializing in energy-efficient design and certified passive homes. stevenbaczekarchitect.com



The crew looked at drawings and photos of how certain high-performance details had been executed on previous projects (top). They not only asked questions about the details, but also offered suggestions for how they might improve on how the details were built. The architect and the crew then broke down the details of this particular project (above), underscoring the most critical areas for accomplishing the high level of performance.

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BY CLAYTON DEKORNE

Review: Buildings Don't Lie

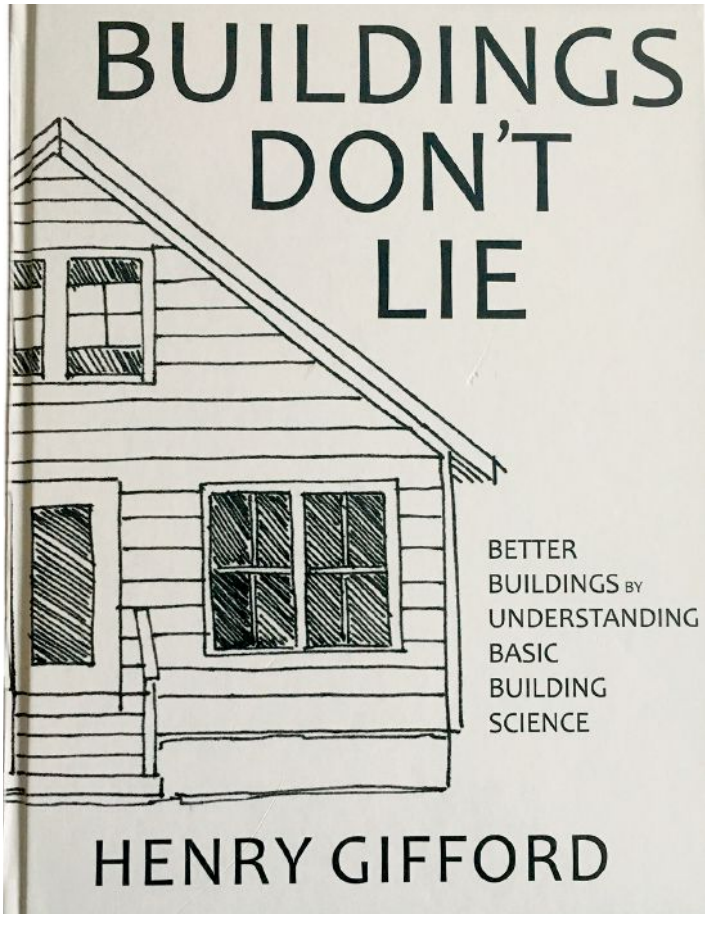
Anyone working in any capacity on residential or commercial buildings of any size should read *Buildings Don't Lie*. It's not the easiest read, to be sure. It's dense in the sense that it is packed solid with information and takes a diligent effort on the part of the reader. But Henry Gifford does an admirable job of presenting concepts precisely and then walking the reader through concrete examples. As we follow the path Gifford has laid out, our understanding gradually unfolds in breadth and depth around each topic. Reading this book for an extended period, I felt a little like I do after visiting a museum or gallery, learning how an artist sees the world and then walking out on the street seeing the world in a slightly different way.

Reading Gifford's work, I find myself adopting his methodical way of articulating ideas. More importantly, I begin looking at buildings in a new way. Evidence of how they might be performing in the presence of heat, air, and water appears. I recognize how these elements combine as weather and indoor environments to transform and move through a building. I see how light and sound respond, and imagine how fire and deadly smoke might spread.

The book is packed with photos of existing buildings showing telltale signs of how all those forces have manifested on building materials, and that is where this book proves most valuable. Anyone with an interest in sleuthing out building-performance problems will benefit from taking the long journey through this book's 564 pages, and later using its detailed and innovative "glindex"—a combined glossary and index. In it, Gifford provides definitions of terms along with page citations; this proves useful as a learning tool and as a resource for those of us still learning the terms and wanting to surf back to the graphics that show how these terms apply to building performance.

The bulk of the book is organized into twin chapters addressing theory first, followed by practice: One chapter frames key scientific principles (of heat, air, water, light, sound, fire, and pests), followed by a chapter that explores in photos and drawings specific applications of those principles at work. The knowledge conveyed in these twin chapters is combined in later chapters to address building enclosures, indoor air quality, and heating and

Buildings Don't Lie (Energy Saving Press, 2017) is available for $75 from buildingsdontlie.com.



Water details in masonry buildings. Caulk alone **(1)**? Nope. This end dam **(2)** is better, but water can leak behind it. On this end dam **(3)**, the stucco covering it will wick water. The last option **(4)** is the best but is still not perfect. See why?

cooling systems (three key chapters for the majority of readers). This organization provides an effective way to build knowledge. *Buildings Don't Lie* would likely make an effective textbook for many introductory building design courses, but it also has a place as a resource for those of us not pursuing an academic path to building knowledge.

TRANSFORMATIVE INFORMATION

Henry Gifford is no stranger to building science, but he has always been solidly rooted in hands-on work. He's been a mainstay of the New York City plumbing and heating world longer than *JLC* has been in existence. (*JLC* started as *New England Builder* in 1983; Gifford started work as the *East Side Energy Company* in 1982.) During his professional career, he's made significant technical contributions, including a formula that simplifies the sizing of pipes and pumps for hydronic heating systems.

Each year since its inception, he's participated in the Building Science Symposium (an event hosted by Joe Lstiburek in which building-science movers and shakers the world over gather for "summer camp" to explore new ideas and debate old ones). One year, he and architect Chris Benedict enacted a skit to demonstrate the "Perfect Energy Code," a proposed energy code that requires just three numbers—the square footage of the building, the heating equipment size, and the cooling equipment size—to show compliance. At the 2008 Building Science Symposium, Gifford gave a scathing critique of green building rating systems, a report that centered on USGBC's LEED system. Gifford eventually filed a class-action lawsuit against the USGBC, demonstrating that the energy performance of LEED-certified buildings tends to be worse than the majority of non-certified buildings. No one ever successfully disputed his claim, but the suit was thrown out of court because Gifford wasn't advocating a competing rating system and the court could find no basis for damages.

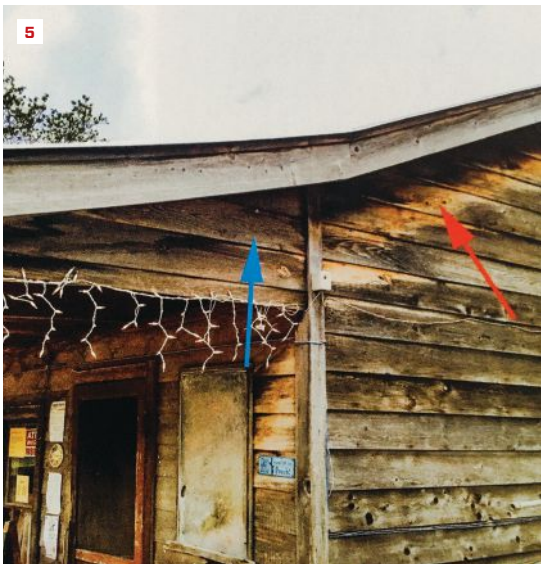
As you can gather from these examples, Gifford comes up with bold, transformative ideas, and he is not at all shy about presenting them. *Buildings Don't Lie* is infused with the same revolutionary spirit. For example, in "Heat: Basic Science," we learn how heat moves. In most building-science texts, we are introduced to the ways sensible heat moves—by conduction, convection, and radiation. Gifford is not afraid to turn up the flame on our understanding of the basics: He adds latent heat to this discussion and (stickler that he is for scientific precision) is clear to point out that convection is not a flow of energy from molecule to molecule, but a movement of heat-carrying fluids. Fortunately, he is also quick to not get too bogged down in minutiae, adding, "Whatever the count, all are important ..."

There are other new practical ideas in this book. Gifford shows us how to use a laser pointer to check if windows have a low-e coating, and how to determine exactly which glazing surfaces are coated. And in the final chapter, he offers developers of large multifamily and office buildings radical advice on eliminating ventilation served through forced-air heating systems, and instead installing separate ERVs on each floor. It's a way not only to provide more-efficient ventilation, but also to gain one extra floor from the space normally taken up by ventilation for three floors. Urban developers ought to be thrilled about gaining more rentable space.

Gifford is a product of New York City and he is best at describing urban masonry buildings. Some of his descriptions will be frustrating for folks who work in single-family detached homes. For example, in describing how to air-seal drywall, he completely ignores that most homes framed with precut studs leave enough space along the bottom edge of the drywall so you can lift the second panel with a kicker. The idea of caulking the bottom edge of drywall panels to the floor would be impossible for most drywall crews. Gifford, in his ultra-principled manner, also avoids any mention whatsoever of product names in the book and the word acrobatics he performs to describe, for example, Zip System, adds to the confusion that a reader might already experience grappling with new concepts.

I don't think such limitations should dissuade anyone from taking time to study this book. Martin Holladay, writing in *Green Building Advisor*, provides a detailed listing of discrepancies, and I imagine many of those points will be addressed in a second edition. But you shouldn't expect any edition of this book to be a field guide of building details and reference data. That is not its point. This book requires study. If you are willing to immerse yourself in its pages, it will change the way you think about buildings. Then you won't need a book; you can apply your own insights to solve real-world, ever-present problems in buildings of all sizes.

Clayton DeKorne is editor of JLC.



Buildings Don't Lie is peppered with picture quizzes. This one **(5)** points to the siding under the eaves of the porch (blue arrow) and asks why it is more weathered than the siding on the main house (red arrow). No spoilers here; you'll have to buy the book.

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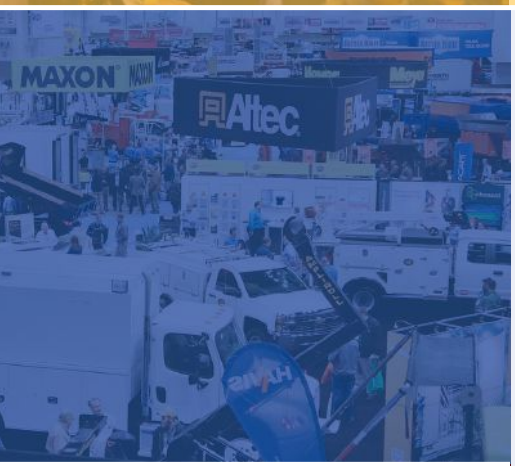

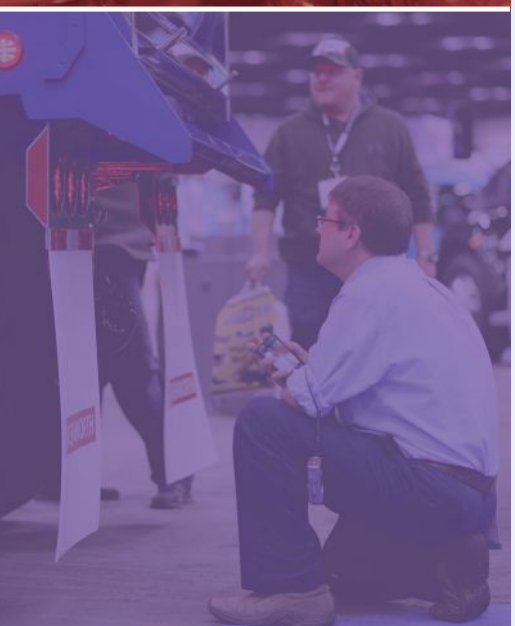

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Photos by Tim Uhler

The Cordless Framing Site

Power tools have evolved to the point that it no longer makes sense to trip over extension cords

BY TIM UHLER

In 2006, we had five guys framing on my crew. On site, we usually had a power cord rolled out for each guy, as well as three hoses for air guns. When the HVAC subs and plumbers were on site too, as many as 10 power cords plus air hoses could be rolled out all over the job. After the market dropped out in 2008, we dropped down to a two-man crew for framing, siding, and foundation work. Still, we needed two or three power cords and three air hoses—two high-pressure hoses and one regular-pressure hose for guns like our positive-placement nailer.

Then, several years ago, cordless technology reached a critical point. Battery voltage had been creeping up for many years, but toolmakers started to offer bigger packs, better battery chemistry, and improved electronics in the chargers and the tools, resulting in a significant boost in cordless power on the jobsite.

FRAMING SAWS

We first had an inkling that an all-cordless framing site might be possible when we got a Milwaukee M18 Fuel cordless saw (see photo, above). This is a 6 1/2-inch, blade-left circular saw. It isn't super-powerful, but it does a decent job for many smaller

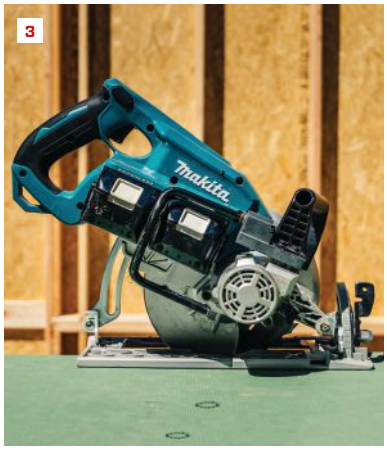
sheathing cuts. Using it meant we needed to drag one less cord around the site during pick-up work.

That was not our first cordless Milwaukee saw. We had already shelved our corded Makita recip saw for an M18 Fuel Sawzall **(1)**. This cordless tool cuts faster and provides better control over the cut than any other recip saw I've ever used. It has all the power I need, without the inconvenience of a cord to drag around. It also has a built-in ladder hook, which is handy when I'm doing work up high. One thing I especially like about this tool is its low vibration, because that translates to less fatigue.

We have also used a DeWalt Flexvolt recip saw **(2)**. This saw doesn't cut as fast as the Milwaukee through everyday 2-by stock, but surprisingly, it does cut faster through thicker, 4-by stock. That isn't enough incentive for me to use it instead of the Milwaukee. If, however, I were already heavily invested in the Flexvolt ecosystem, the DeWalt would work perfectly fine as our only recip saw for framing.

For us, the turning point to an all-cordless framing job came last spring when Makita released its XSR01PT cordless rear-handle circular saw **(3, 4)**. This saw looks a lot like the Skilsaw worm drives many of us in the West grew up using, and it packs as much power. So far, we haven't found any situation in which the Makita made us wish we had a corded saw rolled out. I've ripped 3-foot pieces of 1¾-inch LVL to try and overheat it, to no avail. Ripping three layers of 7/16-inch OSB for roof sheathing didn't present any problems either. I can get the saw to stop if the material starts binding, but I can also do that to every corded saw I've ever reviewed.

This Makita saw runs off two 18-volt, 5.0-Ah batteries that are stored directly behind the brushless motor and under the top handle. The batteries are located roughly in the center, keeping the weight right in front of the handle. This layout allows the handle to be placed behind the motor as on the saws we love here in the West. In fact, the layout is nearly identical to that of all the other blade-left in-line and hypoid saws we've reviewed over the years. Its rear-handle design is more comfortable than a top-handle



The Milwaukee M18 recip saw **(1)** performs better than any corded model the author has tried. And the DeWalt Flexvolt **(2)** actually cuts a little faster in thick material, but it's heavier. The Makita XSR01PT is powerful enough to compete with corded in-line saws. It has a large rafter hook, which tucks out of the way **(3)**, and a table that tilts up to 53 degrees **(4)**.

Only recently introduced, DeWalt's in-line saw **(5)** is well-balanced and cuts faster than, though not as deep as, the Makita. The last surviving corded saw on Uhler's site is the 10-inch Big Foot saw **(6)**. It's only used these days for finish beam cuts. Rough cuts on large beams are easily handled by a cordless chain saw, such as this 36V (dual 18V) Makita **(7)**.

configuration because you push the saw; top-handle saws involve pulling at an odd angle and have less reach when you're cutting rafter tails and sheet goods.

The Makita saw bevels to 53 degrees with positive stops at 22.5, 45, and 53 degrees. With a 7¼-inch blade, it has a cutting depth of 2 9/16 inches (3/16 inch more than my Skilsaw 77). That means we can use the Makita to cut 2½-inch flanged I-joists, instead of our Big Foot, which is harder on the arm. On some jobs, the engineer requires us to use 3-by mudsill or 3-by blocking for straps; with the Makita, we don't need to roll out another tool to make the cuts.

One feature we've come to love is the electronic brake and the relatively soft start, for safety. Unlike a wormdrive saw that will twist when the trigger is pulled, this saw doesn't move. I've gotten used to the "kick" on my Skilsaw. The lack of kick, though, on the Makita means I can use it one-handed when I need to trim a rafter tail or even a wall plate. The electric brake and lack of kick on startup also make this a safe saw to train new framers with.

We loved this saw so much that we immediately bought a second kit. We have six batteries (we had two more for a drill/driver kit) and we have not yet had both saws down charging. The dual-port chargers claim to charge 5.0-Ah batteries in 45 minutes or less, and that seems about right; we charge these saws at lunch whether they need it or not. There is nothing about this saw that makes me want to reach for a corded saw. It has all the power and runtime we need.

DeWalt recently introduced its own in-line saw **(5)**, which we've used for about a month. The jury is still out for me, but I'm leaning slightly towards the DeWalt over the Makita, though both are great saws. The DeWalt is much more powerful and is faster. It doesn't get bogged down but powers through LVL, and it has a great sight line when I'm making cheek cuts. Granted, the balance isn't as good as the Makita's, it takes longer to charge, and I don't think the runtime is quite as good. But the DeWalt is a beast of a saw and because we cut so much 2x12, I think that gives it an edge for us. Still, the Makita can cut 2½-inch I-joists in one pass, so I'm fortunate to have both on site.

There is one corded saw we occasionally use that I think should be in every framer's kit—the Big Foot saw **(6)**. We don't use this 10-inch beast as much as we used to, because we are often able to cut large beams with a cordless chain saw **(7)**, but we do still use the Big Foot occasionally for finish cuts on exposed beams.

DRILLS AND DRIVERS

We used to use a heavy-duty, corded 1/2-inch DeWalt drill, but we've started using a cordless Makita 18V XPH07T instead **(8)**. This is a hammer drill, though we don't often use the hammer mode. The main advantage is power (both torque and runtime). This was the first cordless drill/driver we used that packed enough power to let us put the corded DeWalt away.

For a lot of smaller (5/8 inch or less) drilling work and for hanging doors, we use a DeWalt 20V Max drill/driver **(9)**. With this tool, we typically use DeWalt's smaller, compact battery packs. Whenever we can, we strive to reduce weight.

The last few years, we've increased our use of structural screws. We have used FastenMaster LedgerLoks and TimberLoks for more than a decade and also use Simpson SDWS Timber screws. I like to use the screws to pull walls tight to the floor and to fasten deck ledgers, stair stringers to walls, and headers. The quality of wood we now get has gone down, but with these fasteners we are able to get the framing tight. Additionally, I like to fasten temporary bracing with screws because they are easy to adjust and remove. It wasn't long before we decided we needed a heavier-duty impact wrench.

Because at the time we had Milwaukee batteries, I bought an M18 High Torque Impact Wrench **(10)**. We were using the small Milwaukee saw, so I bought the bare tool. I was looking for something with a lot of torque to easily drive screws. I didn't care about weight at the time. This is a big tool, but it has loads of power. I do wish it had a belt hook, though.

A note on runtime: When I evaluate a cordless saw or drill, my concern is not how many 2x4s I can cut, or how many holes I can drill or fasteners I can drive on a single charge. For me, those numbers are useless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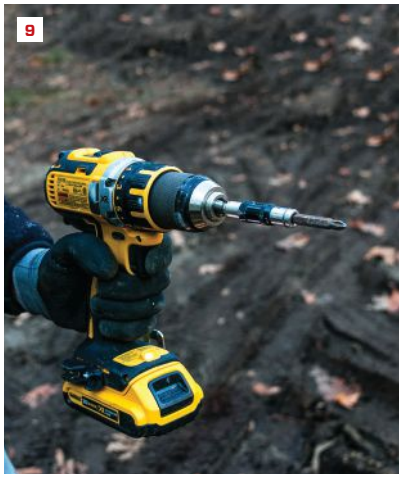
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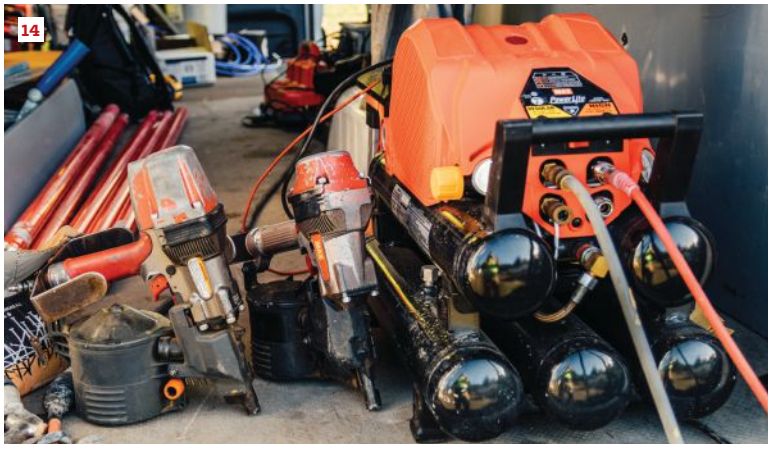
The high torque and long runtime of the Makita XPH07T **(8)** have allowed it to replace all the author's corded drills for all drilling and hole-cutting tasks. For driving many fasteners, DeWalt's 20V Max drill/driver **(9)** serves well, but for long structural fasteners, the author needs the extra power of an impact driver, such as the Milwaukee M18 **(10)**.



The Paslode XP **(11)**, the DeWalt DCN690 **(12)** and the Hitachi NR1890DR **(13)** all work well for pick-up and roof framing—work where dragging a hose is a liability. But for the production nailing work of most wall and floor framing, cordless guns can't compete with the author's Max high-pressure coil nailers and compressor **(14)**.

because they depend on the blade or bit, the temperature outside, the material we're working with, and other variables; one test with one set of variables doesn't tell the whole story—every job is different.

Instead, I judge a tool on how it performs in the course of a job. I listen to the guys on my crew and pay attention to how the tool feels, what features prove useful, and how well it gets the job done. If I don't hear complaints about performance, I know the runtime is good enough. We are careful not to outwork a battery, changing it out before it dies. Swapping out batteries on a regular basis just becomes part of the work flow with a cordless tool. Going completely cordless, however, meant learning one new habit: Now I always put every battery on a charger during lunch, regardless of charge.

NAIL GUNS

I've been working with fuel-power framing nailers for a while, hoping they would eventually work for production framing. The early attempts from Paslode and Bostitch were not convincing.

Then we reviewed the Paslode XP **(11)**, the DeWalt DCN690 **(12)**, and most recently, Hitachi's battery-powered, brushless nailer **(13)**. We like all three of these guns. None of them are suited to production work, because they carry only one clip of nails at a time, but we use them regularly for pick-up work and even for roof framing. While I can't yet give up my Max high-pressure coil framing nailers **(14)** (they carry around 300 nails per coil), the new-generation cordless guns are impressive enough that we find ourselves reaching for them more and more often. They are the go-to guns for punch-list work or for any work up high where maneuverability is an asset.

GOING COMPLETELY CORDLESS

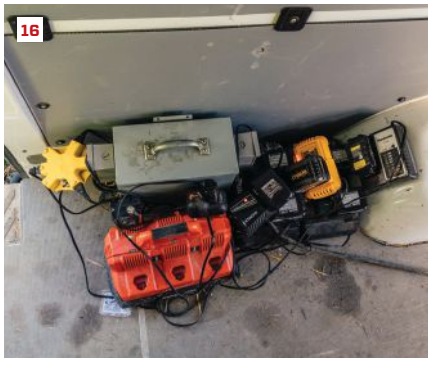
Last June, we decided to try going cordless to frame an entire floor system. It was a 1,800-square-foot floor framed out of 2x10 Doug fir on 4x10 girders to 4x4 posts over a 24-inch-deep crawlspace. We had just received a DeWalt Flexvolt chain saw **(15)** to review, and we used that for cutting the girders, gang-cutting the joists, and even cutting the posts. We did all the drilling

with the Makita cordless drill and all the nailing with the Paslode and DeWalt guns. We did not roll out any cords except from the power pole to the Sprinter van where we keep our chargers **(16)**. For lighting our pick-up work, we used Milwaukee's cordless tower light **(17)**.

In our experience, the jobsite is safer without cords and hoses around. While I wouldn't recommend that a production framing crew go completely cordless, I would recommend that they invest in cordless tools because of convenience and safety. These tools now directly compete against corded models, and battery runtime is no longer a factor. One other important advantage is that with less load on the temporary power pole, we're not having to walk out to the pole to flip breakers back on. This is especially nice when it gets wet—when we had cords out in the mud, we would frequently trip circuits; now we never do.

If you're a remodeling contractor, I see no reason to invest in cords, compressors, and hoses. The electrical contractor and plumber we use have gone completely cordless, as well. When we are all on site, we have one cord for the chargers, one of which is also a radio. Of course, we still have two Max high-pressure hoses to run our coil nailers, and we run a router to cut out sheathing in window openings off that one extension cord. But that's it.

Tim Uhler is the lead carpenter for Pioneer Builders in Port Orchard, Wash., and a contributing editor to JLC *and* Tools of the Trade. *Follow him on Instagram @awesomeframer.*



As the author began running entire framing jobs without corded power tools, he relied more and more on the fast-cutting Flexvolt chain saw for gang-cutting joists and cutting posts **(15)**. Typically, only one power cord is rolled out to the author's Sprinter van for all the chargers **(16)**. Even interior lighting is cordless, with a Milwaukee M18 Rocket **(17)**.

FRAMING TOOLS

Here are the power tools that we roll out almost every day:

2 Max HN90 high-pressure framing guns
1 Milwaukee high-torque impact wrench
1 Milwaukee M18 Fuel recip saw
1 Milwaukee radio/charger
2 Makita XSR01PT saws (beginning to use the DeWalt)
1 Makita 36-volt cordless blower
1 Makita 3¼-hp router (corded)
1 cordless chain saw (Makita or DeWalt)

And as needed, we roll out these other cordless models:

1 Makita cordless drill/driver
1 cordless framing gun for pick-up work (Paslode, DeWalt, or Hitachi)
1 DeWalt 15-gauge cordless finish gun
1 Milwaukee M18 Rocket LED tower light/charger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Custom Concrete Windowsills

Shop-fabricated concrete adds a custom touch

BY DAVID KELLY

Some of the most valuable real estate in a high-performance home is the 6-inch- to 18-inch-deep alcove created between a window and the interior space. In a home with fat walls, the depth of the window opening makes the sill more than just a trim piece and offers the chance to treat that wide, flat, well-lit surface as a usable space.

We've used maple and other hardwoods for the deep windowsills in our high-performance homes, and that does look great. But I've come to believe that stone or concrete sills are better suited for the microclimate of the windowsill location. Like a concrete slab, a concrete windowsill acts as a thermal battery, absorbing the heat of sunshine during the day and releasing it at night. Plants love a masonry sill, and so do cats. And of course, concrete is far more durable than wood. It handles abuse and standing water well, so homeowners can feed and water their windowsill fig trees or kitchen herbs without worry. Properly made concrete windowsills will probably outlive the house.

A concrete windowsill doesn't have to be a work of art; I suppose you could buy a bag of Quikrete, set up plywood forms, add water, and get a pretty good product. But with a few specialty admixtures and some attention to detail, you can create a beautiful finish that looks like slate, quartz, or leather—or, as I prefer, just concrete. We

Photos by Ted Cushman/JLC

The author uses a cardboard template made at the jobsite to guide his placement of 1x4 forms, screwing the wood down to the melamine surface of his worktable **(1, 2)**. Where necessary, he sands the wood with a belt sander to even up any inconsistencies in the thickness of the lumber **(3)**.

get most of our admixtures and surface coatings from Buddy Rhodes Concrete Products (buddyrhodes.com), also a good source of education and training.

The best thing is, custom-crafted concrete gives you durability and visual versatility at a cost that is much more affordable than that of stone. Most of the cost of the job I'm showing here was for my own labor. As for equipment, you can do good work with just the basics. Our company casts only about a dozen sills and a couple of countertops a year, and we find we can mix efficiently enough for our purposes with a concrete hoe, a wheelbarrow, lots of 5-gallon buckets, a few basic carpentry tools, and a scale. For higher volumes of work, you could invest in specialized gear, but it's not at all necessary.

Windowsills involve pretty much the same steps as casting anything else in concrete: You build forms, cast your product, smooth it, strip forms, finish, and seal. The same technique works for many other finish elements in a house, such as vanity tops and countertops—or, for that matter, just about any surface in a kitchen or bath where you want durability combined with good looks.

TEMPLATING AND FORMING

Rather than cast sills in place, we "face cast" in the shop. This allows us to precisely regulate our cure and control our mess. It also allows other work to progress on site.

Unlike wood, a cast concrete sill can't easily be sanded or planed, so it has to be built with precision. A good template taken from each rough opening is critical. I use thick cardboard, such as an appliance box, and I use a very sharp box cutter to fit the cardboard to the rough sill. I keep working the piece until it fits just right.

You can cast sills with typical rabbit ears as shown here, although this can make for tight or weak corners in your form, and

The author coats the edges of his wood form strips with paste wax **(4)**, then applies a generous bead of black silicone caulk where the edge forms meet the worktable **(5)**. Tooling the caulk with a stainless steel ball used by cake decorators **(6)** creates a consistent, smooth eased edge on what will be the upper face of the windowsill. Excess caulk peels away nicely **(7)**.

more fussy corners to fiddle with. A simpler option, if it fits the aesthetic, is forming a simple rectangle. If you have many openings of the same size, that makes formwork a breeze.

You can size the template to fit your rough opening, leave a spacer on site to guide your drywall crew or finish carpenters, and just slide the sill right under the finish when it's made. Installing the sills is easier, however, if you cast and install them before you install drywall and casing. But for this job, unfortunately, I wasn't able to template the sills until after drywall, and I didn't leave a spacer either. This made things tricky for accurate templating, and also for fitting the sills to the openings when it came time to install them.

FORMWORK

If all goes well, most of your time is spent at this stage. Begin with a perfectly level surface (preferably large enough to easily support a 4x8 sheet). A stainless steel assembly table with adjustable legs is ideal, but a set of sawhorses with a 2x4 strongback frame faced with plywood works fine. Shim up the table and check level with a 6-foot level (or better yet, a rotary laser). Check across too, so you don't get a twist. The stiffer your mix, the less critical leveling is—but with a fluid, self-leveling concrete, "pretty level" won't work.

If you're casting with the finished surface facing up, and either grinding the top or hand-troweling, a smooth plywood base is sufficient for your forms. But in this example, we're using the "face cast" method, where the top, finished surface of the sill is the face that's touching the form. That means we need smooth forms. I've played around with barn wood, OSB, and plexiglass, but I find that a sheet of melamine yields a nice surface.

Fasten the melamine down to your assembly table and lay out

Traditional Mix Design Example

Material	Parts	Weight (lb.)
Aggregate - 3/8" crushed stone	3	50.00
Playground Sand	3	50.00
Cement Total	2	33.33
Pozzolan - VCAS	0.2	3.33
Portland Cement	1.8	30.00
Water	1	16.67
TOTAL	9	150
*Water Reducer - 205 - 3 grams/lb water		50.00

GFRC Mix Design Example

Material	Parts	Weight (lb.)
Playground Sand	8	49.52
Cement Total	10	61.90
Pozzolan - VCAS	1	6.19
Portland Cement	9	55.71
Liquid Total	3	18.57
Water	2.55	15.79
Acrylic Fortifier	0.45	2.79
TOTAL	21	130.00
*Water Reducer - 205 -3 grams/lb water		185.71
**Fiber Reinforcement @ about 50% volume of sand		

Traditional Mix Weight Totals

Lb./Cubic Ft	Cu Ft	Total Weight	Lb./Part
150	1	150	16.67

GFRC Mix Weight Totals

Lb./Cubic Ft	Cu Ft	Total Weight	Lb./Part
130	1	130	6.19

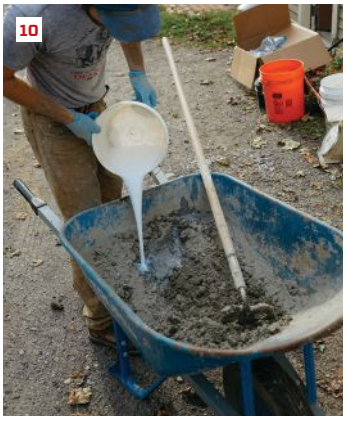
Shown above are the ingredient proportions for the author's traditional mix for heavy components such as countertops (left), which requires steel reinforcing ladder wire, and for his glass-fiber reinforced mix (right), which uses fiberglass filaments instead of steel and is suitable for very thin castings. Working from the ratios in his formulas, the author breaks the total quantities into small batch sizes for easy mixing. The table shows a sample calculation of the ingredient ratios for 1 cubic foot of each type of mix. If your project requires more than one cubic foot of concrete, the same ratios can be applied to much larger batches by simply changing the overall volume, which carries through in the calculations to result in a revised total weight and weight per part. The author has put all of this into an Excel spreadsheet for quick recalculation from one job to the next.

your templates. Carefully transfer the templates with a pencil, or just build around them. (By the way, don't forget that since we're casting face-down, the top side of the template has to face down and touch the melamine.) For anything thicker than 3/4 inch (such as a typical countertop), I rip strips of melamine and use a Kreg jig and pocket screws to set the strips on edge alongside my templates. I add mini strongbacks along the perimeter to prevent bowing. For these 3/4-inch-thick windowsills, however, I just screwed down 1x4 pine, remembering to fill my screw holes with plumber's putty for easy removal.

At this point, I caulk the corners of the form to give a nice relief to the visible, touchable edge of the finished product. I like to use black 100% silicone because I can see its shape better than white or clear caulking. For a crisp bevel, I tool the caulk bead with a tooling ball (I bought mine from Buddy Rhodes, but it's actually a baker's tool). I wipe paste wax around the perimeter, so the excess caulk will release. After the caulk cures, the waste peels up, leaving a perfect radius that will form your sill's eased edge.

CHOOSING A MIX

There are two basic mix designs: "traditional" and glass-fiber reinforced concrete (see tables, above). My traditional formula is pretty much like any ordinary concrete mix: It's mostly coarse playground sand, small coarse aggregate, Portland cement, and water. But it also has some important admixtures. I add a pozzolan called VCAS (vitrominerals.com), as well as a superplasticizing water reducer that increases the fluidity of the wet mix while limiting the amount of water, thus improving cure strength while maintaining workability. For colored concrete, I add a small amount of dye.



The author weighs out his ingredients using 5-gallon buckets **(8)**. He pre-mixes the cement and dry admixtures **(9)**, places them in the wheelbarrow in small batch amounts, and adds pre-mixed water and acrylic fortifier until the material is well wetted **(10)**. He adds a water-reducing admixture to make the mix more workable, then mixes in fiberglass reinforcing filaments **(11)**.

Without reinforcement, this traditional mix would be prone to cracking, so I add a layer of ladder wire for reinforcement (or, if the piece is thick enough, two layers of wire). I use this traditional mix for anything thicker than 1 1/4 inches. Anything much thinner than that just isn't thick enough for me to be sure it won't crack.

Glass fiber reinforced concrete (GFRC), the variety I used for these windowsills, is a whole different animal. The aggregate is omitted, in favor of higher cement and sand proportions. Acrylic fortifier is added to the water to improve bond strength. But most notably, the ladder wire is replaced by thousands of alkali-resistant fiberglass filaments. These are mixed right in. So rather then crumble, the concrete behaves more like wood, with lots of overlapping fibers. This leads to impressive flexural strength. I've gone as thin as 1/2 inch with GFRC, and I wouldn't be surprised if it could be pushed further. The sills shown here were fabricated at 3/4 inch thick.

POURING DAY

Particularly if I'm pouring alone, I make sure to measure out all the proportions I need beforehand. I use 5-gallon buckets and a good scale to weigh out each of the ingredients into smaller, manageable "batch" proportions that I can mix up by hand in a wheelbarrow. For bulky materials like sand and cement, I measure my weight once, and then mark the level on the inside of a bucket with a crayon marker. That way I don't need to weigh every time.

Like a baker, I measure my dry ingredients first. For GFRC, that's VCAS, cement, and sand. Then I start adding water and fortifier. This mix is thirsty; it will suck up a lot of water. Be patient, and don't add too much. Once the batch is well "wetted," the trick is to add some water reducer a little at a time and watch for the alchemy—all of a sudden, your mix will get significantly more fluid. Then

The author packs the stiff concrete into the forms by hand **(12)**, then strikes the material off with a 2x4 screed **(13)**. After allowing the concrete to set under a tarp for a few hours, he trowels the surface **(14)**, then covers the sills again to let them cure. After a few days, he strips the forms and finishes the surface, starting by rubbing off rough spots with a grinding disk **(15)**.

add the rest of your water, until the batch has a thick, stiff pudding consistency. Finally, sprinkle in and incorporate the fiberglass a bit at a time, making sure you don't have any mats or clumps.

Now you're ready to add the concrete to your forms. I scoop the material into the forms with my hands, working in layers rather than sections. Make sure to work it into the corners; otherwise, you'll end up with more air holes on your corners, because air has the hardest time escaping from those areas.

Once the forms are filled, take a screed (I use a straight chunk of 2x4) and ride it along the top of your forms, using sort of a walking and sawing motion. Hold the screed at an angle—I've found that if I hold the screed square to the forms, it tends to pull glass fibers out for some reason. I make sure to reserve some excess concrete to add to low points; you want to see the screed push out concrete the whole way.

Cover your form tables with a tarp and a blanket for a couple of hours, to hold in heat and moisture and help the concrete cure. Timing is key here—the concrete needs to be wet enough so that you can still manipulate it, but set hard enough so the back doesn't slice up or "pull." When you can barely make a mark on the surface with a finger, it's time to trowel the backs, removing any junk along the edges and making sure it's fairly smooth—this will help your windowsills slide easily into place and sit nice and flat. Then cover everything up again and wait for the cure to finish. I usually give sills at least two days in the forms, and more time doesn't hurt.

SURFACE FINISHING

In a few days, you can strip forms and do some finishing. I ease the bottom edge of the sill with an old grinding wheel (by hand, not in a grinder), so it's smooth to the touch. Fill any pinholes

The author fills pinholes using a paste of cement, pozzolan, and acrylic fortifier **(16)** and applies ICT PS1 Reactive Sealer to the surfaces of the windowsills **(17)**. On site, the installers apply a setting bed of silicone caulk to the rough framing **(18)**, then set the concrete windowsills into place **(19)**.

with a paste mix of cement, VCAS, and acrylic fortifier (I work the paste in with my fingers, sometimes with the help of a razor blade used trowel-fashion). Give it a few days to cure, if you can, before you apply the paste; otherwise, I have found that the surrounding concrete will steal moisture from the paste, so that the patches don't adhere as well. (Another option that works is to seal the concrete before you fill the pinholes and voids.)

When you're happy with the surface, it's time to seal the sills to prevent staining and degradation. I allow at least a week of curing time before doing this; otherwise, coating adhesion is poor because the concrete is still releasing moisture.

I've tried the whole spectrum of sealer choices and hadn't found the right one until recently. There are drawbacks to most options: Epoxy sealers can look wet and artificial; acrylic sealers are prone to hazing and streaking; and waxes (such as Feed-N-Wax, for example) give a great finish but need maintenance and don't actually seal anything. Recently, however, I started using ICT PS1 Reactive Sealer from Buddy Rhodes Concrete, a hybrid between penetrating and micro-coating systems. This coating provides excellent protection without sacrificing the look or feel of concrete. The Buddy Rhodes website provides good instructions, and the sealer is easy to apply without drips or runs. If time allows, let the sealer really harden up before you manhandle the sills into place.

When it's time to install, begin by dry-fitting all your sills. When the fit looks good, we run a few beads of silicone on the rough opening, set the concrete sill down, and then slide it into place. When all your sills are in, you may need to apply some drywall compound and caulking to the wall for a clean joint.

David Kelly is a project manager for House Revivers, in Bangor, Maine.

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The Future of Framing

Some builders are not necessarily waiting for the next generation of carpenters to be trained

BY CHARLES WARDELL

Lumber and labor are perennial woes for most builders. Lumber price instability complicates revenue and profit forecasting, while the dearth of skilled workers has been blamed for everything from the inability to keep up with demand to rising warranty costs.

Responses to both issues should include rethinking how we frame houses. To start with, builders could dampen the effects of price fluctuations and protect their margins by better managing lumber use and by using more engineered components—neither of which actions asks them to alter how they build. Over the long-term, however, the better solution may be a transition to off-site building, a strategy that some progressive builders across the country are already employing.

OPTIMIZING MATERIALS

Lumber prices have gotten a lot of press lately. For instance, on September 19, *Bloomberg.com* reported that lumber futures had risen 16% since January, fueled by a U.S.–Canada trade dispute and wildfires that have been burning through Northwest timberlands. But how big a deal are these price trends?

Mike Wisnefski, a Chicago-based trader in lumber futures, believes that even if the current trade dispute resolves as a 20% tariff on Canadian lumber, retail prices won't rise more than 5%. That's because lumber markets are global. "If lumber goes to more than $450 per 1,000 board feet, as it did earlier this year, supply from other countries will prevent it from going higher," he says.

Other industry watchers point out that the impact of past price

increases on housing starts have been minimal. "The framing lumber for a $300,000 house might cost $15,000, so builders aren't calling off projects just because of lumber price increases," says Matt Layman, publisher of *Layman's Lumber Guide*, a pricing newsletter for material suppliers. He believes builders will pay as much as $100 more per 1,000 board feet for spruce 2x4s to avoid using southern yellow pine.

That's not to say the price of lumber isn't an issue. The builders who most easily absorb any price increases are the ones who use lumber the most efficiently. In fact, construction waste may be costing some builders more than they know. Clark Ellis, CEO and founder of Continuum Advisory Group, a management consultancy based in Raleigh, N.C, says his team analyzed hundreds of house plans from several divisions of the nation's top builders.

Ellis found that many builders were spending $2,000 to $4,000 more per home than necessary. "Material takeoffs are rounded up to the next highest number, then padded with generous waste factors. Inaccurate deliveries aren't identified as such and materials get used inefficiently, so the builder has to order more to make up the shortfall," he says. While these numbers include all materials, he sees the most waste in framing and siding. The causes include the following:

Sloppy takeoffs. "Most builders don't know exactly how much of what materials go into their homes," says Ellis. In particular, relying on suppliers for takeoffs often results in inaccurate shipments that have to be augmented later, making it difficult for the builder to get an accurate handle on costs.

Waste acceptance. Some trade contractors routinely add a 10% or 15% waste factor after rounding the takeoff up to the next highest number.

Stressed superintendents. With skilled job supervisors in short supply, those who are employed have more responsibilities than ever. They lack the time to verify deliveries or the experience to question field purchase orders from trade contractors who failed to do accurate takeoffs.

Lumber poaching. Framers who run short on sticks will often "borrow" from the next house in the development, leaving that one short. The practice can have a domino effect as the community is built out.

Poor tracking. "Many builders lack a system for ensuring that unused materials get returned and credited," Ellis says. Field supervisors may see this as an accounting issue, but the accountants can track down a missing credit only if someone notifies them of the return.

THE 'ADVANCED FRAMING' PROMISE

One of the most well known ways to build higher-quality homes for less money is through the use of advanced framing, also known as optimum value engineering (OVE). Developed in the 1970s by the NAHB Research Center (now Home Innovation Research Labs), OVE was conceived as a way to reduce the number of framing members used without compromising structural integrity. But since eliminating framing also somewhat reduces thermal bridging, advanced framing has become a tactic employed by builders to enhance energy efficiency, especially on homes with non-insulating sheathing.

Some builders have made advanced framing an important part of their business. "Our focus on energy efficiency has led us to a different framing approach than the typical builder by using advanced framing techniques," says Todd Usher, president of Addison Homes, a design-build company in Greenville, N.C. This approach requires a higher level of care. To make it work, Addison has all plans checked by a structural engineer and provides detailed instructions to the company's framing crews. Usher estimates a savings of about $1,500 per house in materials. That's thanks to a more efficient frame as well as to less waste. "When we let the framer figure out what to do, it wasn't uncommon to have full lengths of LVL left at the end of the job that we couldn't return because they had been lying outside in the dirt."

The approach isn't for every builder, says Massachusetts high-performance builder David Joyce, who has been building advanced-frame homes for years. But he believes builders can realize some cost savings and make their homes more energy efficient by adopting some advanced framing details, including two-stud corners, ladder-framed wall intersections, and 24-inch stud spacing.

That 24-inch spacing gets some builders worried about wavy drywall. That's why Austin, Texas-based builder Matt Risinger uses 5/8-inch sheets on 24-inch framed walls. "It's stiffer, makes for a straighter wall, and looks better when finished," he says. The extra mass also makes the finished house quieter.

Joyce contends that parts of the original advanced framing concept advocated by the NAHB are not practical. Cripple studs are usually cut from scrap anyway, so reducing the number of cripples at the end of the sills doesn't save much lumber. Switching from a double to a single top plate lowers the wall unless you stop using precut studs, which is even more impractical. And if you shorten the wall, you end up shaving narrow strips off the drywall, which may be even worse.

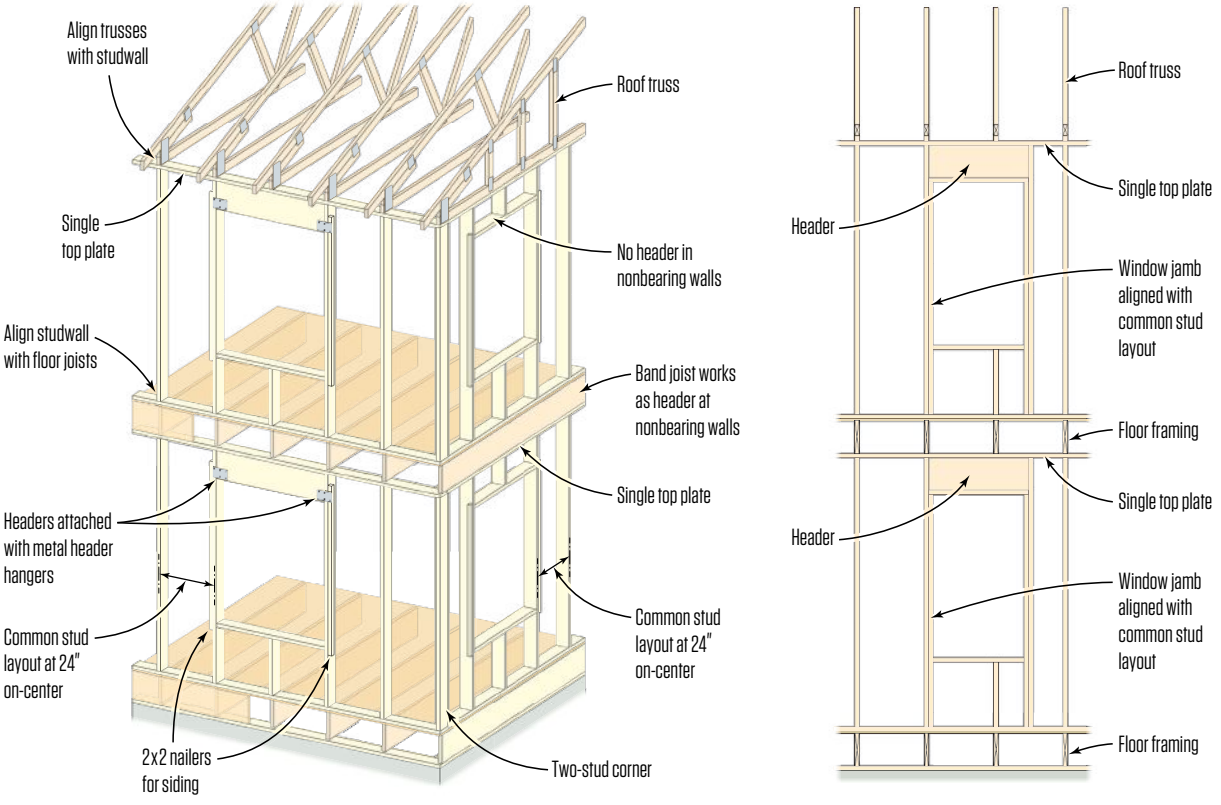
Perhaps the most impractical part of OVE is locating windows and doors on layout. Few window and door units require rough openings on perfect 24-inch increments, and placement is often dictated by other design concerns, such as alignment with interior spaces or with exterior building elements. The framer does not usually have discretion to shift an opening over several inches just to hit the layout.

For those new to advanced framing, Usher suggests spending a few hundred bucks to run a set of plans past a structural engineer. That could help you identify ways to save lumber and frame more efficiently on all your homes. "Look for ways to take complexity out," he says, "which could be as simple as using more engineered components."

THE RISE OF MANUFACTURED COMPONENTS

Ever since roof trusses were introduced to booming, post-WWII housing markets, the capacity to produce engineered framing assemblies has worked its way into the standard framing process,

Advanced Framing: Theory vs. Practice



The illustration on the left shows the lumber-saving elements afforded by advanced framing, as they are typically rendered by advocates of the technique. On the right is a much more practical interpretation of an advanced frame wall, by architect Steven Baczek. This method maximizes the stud spacing but also will accommodate windows of varying size and position.

component by component. After roofs came floor trusses, provided by building component manufacturers and distributed largely through lumberyards. Now even preframed walls are showing up on sites in a variety of forms.

BMC's ReadyFrame is one option. A builder hands a BMC supplier a set of framing plans and gets back an annotated set with letters and numbers added to each wall. The builder also gets a truckload of wall plates, jack studs (known by many framers as "trimmers"), cripples, and headers. "You now get everything precut, not just full-length studs," explains Matt Risinger.

The components for each ReadyFrame wall are banded together and labeled to match the letters and numbers on the plans. Wall plates have layouts premarked with an inkjet printer. All the framer has to do is break the banding on the wall sets and assemble the pieces, pulling full-length precuts off a separate pallet. Austin, Texas-based builder Luke Mezger, who completed a number of ReadyFrame houses in the past year, describes in visceral terms the transformation of the jobsite when using ReadyFrame: "It's an eerie sound on the jobsite when you're used to a lot of saws going on; all you hear is nail guns going off."

Not having to cut components increases the speed of assembling the frame (estimates range from 15% to as much as 40% faster, depending on the complexity of the wall). It's also safer and simpler, involves zero cutting waste, and requires less skill. Often, the most experienced person on the crew will mark-out the plate layout while other workers cut the headers, jacks, and cripples. All of the time and the skill required to complete those steps accurately is completely removed.

An increasing number of lumber retailers now work with component manufacturers to deliver preframed walls, along with roof

Illustration by Tim Healey

BMC's ReadyFrame provides lumber packages with precut plates, jack studs, headers, and cripples. Plates come printed with each wall layout **(1)**, so framers only have to grab precut studs from a pile and assemble the wall; no layout or cutting required. HomeTechnology is making inroads to North American housing markets with fully assembled floors, walls **(2)**, and roofs **(3)**.

and floor trusses. The trend is growing as more builders are using software to optimize their framing packages and interface directly with the supply chain.

Although most builders lack the labor needed to fully optimize their framing, Ellis believes that a BIM-enabled CAD program like Revit can help. "You can set it up so that when you draw a wall, it tells you exactly what's in the wall," he says. That data can then be integrated with the builder's estimating software.

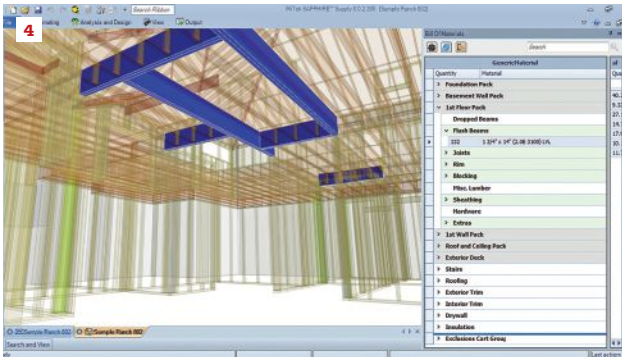
Another option is offered by MiTek's Sapphire suite, a BIM-based system for designing and optimizing wood frames. According to Brian McCormick, MiTek's director for residential supply chain, the software lays out all framing according to user-defined rules and produces a bill of materials as well as a cut list for the framer.

Ultimately, MiTek's goal is to move builders toward using more manufactured components. The company already makes the saws used by many truss and panelized-housing plants, as well as the software used to run those plants. The company recently added a framing module to Sapphire that will generate a BIM model from a 2D set of plans drawn in another program, optimize the framing, and make sure it meets local building codes. The builder can then transmit the BIM model directly to a truss or panel manufacturer.

REBOOTING THE FRAMING PROCESS

Some industry players believe that market forces and improved software will inevitably make manufactured housing the norm; as a result, they are putting design, engineering, and manufacturing under one roof.

Those market forces include builders' labor woes. "The industry's problem isn't a shortage of labor but a shortage of efficient processes," insists Gerry McCaughey, CEO of Entekra, a Ripon, Calif., startup that



Known as BIM to BOM, Mitek's Sapphire can generate a 3D "BIM" model **(4)** from a 2D set of plans drawn in another program; optimize the framing; make sure it meets local building codes; and spit out a bill of materials (BOM) to shop with suppliers. National Lumber is one of the many lumber retailers that can provide not only floor and roof trusses, but preframed wall assemblies, as well **(5)**.

serves the Bay Area, Sacramento, and Central Valley markets. "North America is the only place where people still build on site. It's as if the last 100 years didn't happen." McCaughey is the former head of Ireland's Century Homes, which he grew into one of Europe's largest home manufacturers. He believes the off-site model can revolutionize the U.S. housing market the way Amazon revolutionized retail.

He also insists that Entekra is not just a panelizer. "We're an engineering company. We don't exist to make components but to look for the fastest, most efficient way to get the building up." He says that his company's process allows a builder to erect a house in one-third the time and with half the workers that conventional framing requires. "Our approach is so efficient that the existing labor force can deliver everything required."

While Entekra employs human workers in its current plant, McCaughey refers to that as a pilot. He is raising capital for an automated operation with the type of robotic assembly lines used to make everything from pickup trucks to insulated glass units.

Entekra isn't the only building manufacturer banking on robotics. Other North American companies running automated panel plants include Blueprint Robotics in Baltimore and HomeTechnology in Toronto. Blueprint is a new company targeting the custom-home market. It will deliver panels with insulation and mechanicals already installed.

HomeTechnology, a subsidiary of Great Gulf, one of Toronto's largest developers, has an automated factory that CEO Tad Putyra says is "run by automotive people." It has been in operation since 2008. HomeTechnology will produce more than 3 million square feet of space this year, according to Putyra. One reason he thinks the time is ripe for this approach is that software has finally become sophisticated enough to address the manufacturing issues. That

includes the need to resolve all structural and mechanical conflicts at the planning stage and the need to send precise instructions to the robots and CNC machines.

The ultimate vision is a world where a buyer sits down with a designer, draws a house, and orders it over the internet. "As a model for what will likely happen to the building industry, go to Home Depot and order a kitchen," says Scott Hedges, the North American representative for Randek, a Swedish company that makes the automated machinery that HomeTechnology uses. "The designer draws the kitchen while the computer creates manufacturing instructions and transmits them to a cabinet company in another state."

The high-tech manufacturing approach also promises to attract a more educated workforce to the home-building industry. "The jobs we are creating are mostly in design and engineering," Putyra notes.

There remains the question of how to justify multimillion-dollar plant investments in an industry with such large swings in demand. One answer is the route taken by HomeTechnology, which manufactures a variety of structure types—single-family and multifamily homes as well as commercial structures—for its parent company as well as for other builders and developers. Another is what Freeport, Maine-based consultant George Casey, chair of the Home Innovation Alliance, describes as a step back in time. "If you only build for-sale homes, you ride a boom-and-bust roller coaster," he says. "But if you look back 50 years, you see builders doing for-sale and for-rent. That removed some of the fluctuation."

Of course, some builders already do a profitable single-family-for-rent business. "Last year, approximately 25,000 detached homes were built for rent," writes John Burns on realestateconsulting.com, his company's website. "We believe that number will increase significantly [and] expect detached homes for rent to become an important segmentation opportunity for the top master plans in the country."

WHERE IT ALL LEADS

Whether builders will continue to get on board with an increased use of manufactured components and off-site construction might largely hinge on how the labor issue plays out. What does seem clear is that some builders are not waiting for the next generation of workers to come up to speed and are seeking technological solutions using manufactured components and off-site construction. Both approaches promise to make it easier to meet code requirements and more cost-effective to build high-performance, green homes. The precision and quality control afforded can also reduce warranty costs, with the potential for the highest quality control coming from off-site methods.

The use of manufactured components is more likely to spread in rural and suburban markets where the high capital expenditure to ramp up a state-of-the-art off-site manufacturing facility will be harder to justify. Urban and high-growth markets, however, can certainly expect to see an influx of manufactured solutions and a dwindling reliance on stick-built methods.

Charles Wardell, a former senior editor of JLC, *is a freelance writer specializing in construction-related topics.*

Entekra has begun piloting "fully-integrated off-site solutions" in the U.S. that promise fully assembled, weathertight building shells within four to five days, on average **(6)**.

1. Color Variety for Vinyl Windows and Doors

Nine new exterior colors have been added to Pella's 250 Series and 350 Series vinyl windows and patio doors. DuraColor tan, poplar white, fossil, Hartford green, morning sky gray, black, brick red, and portobello are available in addition to the existing color options. Every color selection consists of a white interior and colored exterior, except white and almond, which are available for both interior and exterior surfaces. Pella says its paint process provides fade resistance in any climate. A double-hung window starts at $425. pella.com

2. An Innovative Fence-Post Solution

The PGT20Z Pipe Grip Tie by Simpson Strong-Tie is a metal bracket for attaching wood rails to metal fence posts. Interior embossing snaps the tie into position on a metal post, facilitating installation. The PGT20Z fits pipes with an outside diameter of 2 3/8 inches, and at 4 3/4 inches wide, can be easily hidden behind a 1-by wood box frame. The tie is ZMAX hot-dip galvanized and is installed with SDS heavy-duty connector screws (sold separately). The PGT20Z is available for $2. strongtie.com

3. High-Performance Gasket Technology

Dow Building Solutions' Great Stuff Pro Gasket is a water-based, low-VOC foam that forms a gasket between drywall and framing to improve air-sealing performance. The one-component foam is compressible when cured, allowing for a flat wall plane. The flexible foam beads applied to the face of framing lumber remain in place during drywall installation. It can be cleaned up with water. Pricing starts at $16 per can. dow-dupont.com

4. A Trowelable Air-Barrier Membrane

The StoGuard Gold Coat TA is the newest addition to Sto Corp.'s StoGuard air and moisture barrier product suite. The fluid-applied vapor-permeable membrane integrates with continuous insulation systems and can be troweled directly onto vertical, above-grade wall sheathing and concrete masonry. The company says the treatment minimizes the risk of water damage and condensation, eliminates the problem of air leakage between an air barrier and sheathing, and remains stable under air pressure or wind loads. StoGuard Gold Coat TA is low-VOC and safe for both interior and exterior use. Pricing varies. stocorp.com

BY KATHLEEN BROWN

5. Color-Adjustable Lighting

WAC Lighting's new Duo AC-LED Color Option Light Bar offers 100% to 10% smooth and continuous electronic low voltage or triac dimming. The 120VAC light bar features adjustable color temperature as well as an efficient reflector that creates evenly distributed LED output with minimal glare, the company says, making it a good choice for sensitive display spaces. The Energy Star–rated Light Bar is available in five sizes and three finishes at retail prices ranging from $81 to $153. waclighting.com

6. A Durable Countertop Surface

With the addition of the Eternal collection to its Silestone quartz countertop offerings, Cosentino launched Silestone N-Boost across its surface line earlier this year. The company says Silestone N-Boost modifies the material's surface at a molecular level, making it nonporous, more durable, and easier to clean and maintain, while enhancing the brightness and color intensity of the finish. The company also says the surface is water- and stain-repellent as well as resistant to scratches and impact. Pricing varies. silestoneusa.com

7. A Sleek 'Floating Handle' Faucet

California Faucets' newest addition to the Morro Bay series is a single-hole lavatory faucet with an ultra-thin handle that operates independently of the faucet body, appearing to hover just above it. The width of the "floating" handle matches that of the thin spout below for a balanced and streamlined look. The faucet is made of solid brass and is available in 5 5/16-inch and 11 9/16-inch heights. Prices range from $530 to about $1,100, depending on finish selection. calfaucets.com

8. An Ergonomic Kitchen Appliance Lift

Hardware Resources' Soft-Close Mixer/Appliance Lift not only allows bulky kitchen appliances like stand mixers, blenders, and food processors to be stored out of sight when they're not needed, it also provides mechanical assistance to raise them to counter height for use. The chrome-finished system is compatible with frameless or face-frame cabinetry and attaches to a shelf that is at least 3/4 inch thick and less than 20 1/2 inches long. The spring-loaded lift can support up to 45 pounds and locks in place just below counter level. It costs $150. hardwareresources.com

9. Custom Floor Heating Mats
WarmlyYours Radiant Heating recently updated its TempZone Custom Mat product line, making it more durable during installation. Heating elements, which used to be attached to a single layer of fabric, are now sandwiched between two layers. Designed for use under many commonly heated flooring types, including tile and marble, TempZone Custom Mats are now available in up to 20-foot lengths and in a minimum of 1-inch dimensional increments. Mats range from $15 to $20 per square foot. warmlyyours.com

10. Wood-Grain Finishes for Garage Doors
Overhead Door recently expanded its Thermacore Collection of insulated garage doors to include three new bi-directional wood-grain finishes—Mission oak, walnut, and golden oak. The embossed wood-grain textures offer a low-maintenance alternative to traditional stained wood and are available for Thermacore 494, 496, and 497 models. Vertical and horizontal window options, as well as decorative handles and hinges, are available. An 8x7 door costs between approximately $1,500 and $1,700, installed. overheaddoor.com

11. Composite Siding With a Wood Look
Featuring a natural texture molded from cedar planks, CertainTeed's new Icon siding panels are lighter and more flexible than fiber cement or wood, says the company. Engineered for moisture resistance, Icon's thermoset polyurethane composite (which includes fly ash, glass fiber, and quartz) minimally expands and contracts, so panels can be butted tightly together, CertainTeed says. The panels' "Stack Lock" design helps ensure they are aligned properly and hung securely. Icon siding comes in 12- and 16-foot lengths, primed and ready to paint, and is sold to contractors for approximately $230 per 100 square feet. certainteed.com

12. Cling Wrap for Your Boots
Pull-on booties have long been the go-to choice for protecting finished floor surfaces and keeping dirt out. Trimaco now has a hands-free version of wearable floor protection: When you step in and out of the E-Z Guard dispenser, a sheet of clear film is placed on the sole of your boot. The wearable film reportedly sticks to wet soles and is recyclable. A starter kit with dispenser and film for 250 pairs of shoe covers sells for about around $110; refill rolls run about $26 each. www.ezfloorguards.com

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December Advertising Index

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

Editors' Choice Awards

Within the past year, there have been hundreds of new tool releases from dozens of tool manufacturers. I and several contributing editors have been on the lookout all year for new tools and technologies that promise to help us work better, faster, and more easily. We attended tradeshows and media events, scanned social media and the web, and stayed in close contact with the people and companies that develop new tools. We put most of these tools to the test (with a few exceptions of new-to-market concepts soon to be released that we felt nevertheless deserved recognition).

While some manufacturers are focusing their efforts on adding more solutions to more trades, others are staying focused on the few trades they have been serving for decades. In the end, we all benefit because the innovations continue to move our industry forward.

One important development you'll notice is that only two of the 10 power tools featured here rely on a cord for power. Read between the lines (and Tim Uhler's article on page 33), and you'll see that it's probably a good time to be investing in battery cells, and maybe not the best time to invent a product for managing extension cords.

We can't include every tool or product that drew our attention this year, but here are 14 we felt were worth special recognition. As always, this list is unbiased and not sponsored by any manufacturer. If you're interested in learning more about these tools, visit toolsofthetrade.net.

Chris Ermides is the editor of Tools of the Trade. *Follow him on Instagram @toolmagazine.*

▸ Graco Ultra Paint Sprayer

The Graco Ultra puts professional-quality paint-spraying results in the hands of non-painters, in a cordless unit that's simple to use, easy to maintain, and powered by a readily available DeWalt 20V Max battery. The Ultra Cordless model 17M363 comes with a case, an RAC X FF LP 514 Tip, four liners, two DeWalt 20V Max batteries, and a charger. Cost: $500. *graco.com*

▸ Makita XSR01PT

It looks like, and has power to match, all the other blade-left in-line saws on the market, except this one's cordless. Instead of running on a worm- or hypoid-gear drive, this saw runs on a direct-drive brushless motor powered by two 18-volt batteries for a total of 36 volts. It features soft-start and an electronic brake, as well as thermal overload protection. As a kit, with a charger, two batteries, saw, and bag, the XSR01PT sells for about $360. *makitatools.com*

▸ Stabila LA180L Layout Station

As a general contractor, contributing editor Tim Uhler says that with this laser, he can lay out the location of a house on a lot quickly, easily, and perfectly, then square the foundation, even if the lot is stepped. The same holds true for framing and elevated decks. Tim Uhler notes that this laser can also shoot level, so you may not need to buy a rotary laser. Kit cost: $1,500. *stabila.com*

▸ Metabo WPB 36 LTX BL

This 9-inch cordless grinder has a brushless motor and runs off one of Metabo's new 36V LiHD batteries. Larger fuel cells allow for greater power output and runtimes for the large cutting wheel. The tool features a fast brake, a large grip and paddle switch, and a handle that swivels at multiple angles. The motor has a no-load speed of 6,600 rpm, and the tool weighs a little over 13 pounds (with battery). One innovative use: When equipped with a U.S. Saws core drill bit, this grinder can cut an 8-inch hole through 12 inches of concrete on a single charge. The grinder sells for $1,200 and includes a guard, two LiHD 36V 6.2-Ah batteries, charger, and case. *metabousa.com*

BY CHRIS ERMIDES

▸ Festool Cordless/Corded Sanders

Festool's new sanders feature a brushless motor that can be run from a battery or from a cord. Cordless power is provided by a BP 18 Li 3.1 Ergo battery pack, a new slide-style battery (shown at right) that works with a Festool TCL 6 charger. Corded power is provided by the ACA 100-120/18V Ergo main adapter, which integrates with Festool's Plug-It cord system. Three models are available: a 5-inch round random orbit sander (ETSC-125), a detail sander (DTSC 400), and a rectangular orbit sander (RTSC 400). All have a no-load rpm of 6,000 to 10,000 rpm. Festool reports they have 30-minute runtime under load when powered by a fully-charged battery. Each weighs about 3 pounds (with battery). Pricing varies from $195 to $600, depending on kit configuration. *festoolusa.com*

▸ Bosch GSA18V-125

The new cordless reciprocating saw has a handle that's designed to be ergonomic. Orbital settings, a speed dial, and a variable-speed trigger provide control over the cut. It has overload protection separately for the battery and the motor, and monitors the load to maintain cutting speed. When powered with a CORE18V battery, the saw offers performance on par with a corded recip. Cost: $400 (kit); $300 (tool only). *boschtools.com*

▸ Martinez M1 Hammer

With a titanium handle and replaceable grips and heads, this hammer is versatile and virtually indestructible. The slightly angled face is meant to more solidly strike the nail. The grip comes in either a curved or straight style ($30 each). Tim Uhler says it took about a month to get used to the size and balance of the hammer, but now he loves it. He also says it's not cheap, but it's the last hammer you'll ever have to buy. Cost: $225 *martineztools.com*

▸ Milwaukee PackOut

Boxes, organizers, and totes of multiple sizes and configurations easily stack and lock together in this storage system. A rolling box with handles is the foundation piece; there are also IP65-rated boxes and organizers, as well as totes made with 1680D ballistic material, metal hardware, and pockets. All pieces lock to one another via feet and spring-loaded clips. Prices vary by component. Configuration shown: $465. *milwaukeetool.com*

▸ Shaper Origin

A hand-held CNC machine you can program to cut out virtually anything you can design is just awesome. It has great potential for woodworkers, cabinet makers, flooring installers, and trim carpenters to produce accurate and repeatable results. The technology is powered by computer vision using an on-board camera that reads marker tape, which you install on the work surface. The $2,400 sticker tag sounds shocking—until you see what you can do with the tool. *shapertools.com*

▸ Hitachi C10RJ

This jobsite saw has a powerful 15-amp motor with soft start that produces a no-load speed of 4,500 rpm and includes an electric brake. It comes with a rolling stand equipped with folding legs. Telescoping arms extend the rip fence to either side for a 35-inch capacity to the right and 22 inches when set on the left. The C10RJ also has overload protection with automatic shut off to prevent damage to the motor. Cost: $480. *hitachipowertools.com*

▸ Hilti PM 40-MG

Using a green diode, so lines are highly visible, this unit shoots three plumb lines 90° from each other and a 360° horizontal line. Accuracy is impressive at 0.07 inch over 33 feet, and so is runtime: up to 10 hours on a fully charged 12V 2.6-Ah battery. Maximum operating distance is 65 feet without a receiver, and 165 feet with one. The unit is expected to sell for $790 with one battery, a charger, and a case. *hilti.com*

▸ Truewerk T-2 Work Pant

Truewerk's T-2 pants look professional and have work-related features. The four-way stretch fabric is immediately comfortable and doesn't take weeks to break in. Water-repellent (though not waterproof), they don't soak with water at the first splash from the sky, a puddle, or water line. At $109, they aren't inexpensive, but from what I've heard from other users, they are built to last. I found them to be durable. *truewerktools.com*

▸ Ridgid R860424B

This brushless forced-air propane heater runs on either one 18V battery or a regular extension cord. A variable-power dial adjusts between 30,000 and 60,000 Btu. According to the maker, the heater will run for up to 12 hours on low or 7 hours on high when equipped with a 5-Ah Hyper Lithium Battery. It uses 0.30 gallon of propane per hour and will heat up to 1,350 square feet. The UL-certified unit has overheat protection and an electric ignition switch, and comes with a 3-year limited warranty. Cost: $130 (bare tool only). *ridgid.com*

▸ DeWalt DCC2560T1

The DeWalt FlexVolt cordless 2.5-gallon air compressor has a brushless motor and oil-free pump. It is powered by one FlexVolt 60V Max battery and weighs just under 24 pounds (with 6-Ah battery). According to the maker, the compressor can fire up to 1,220 brad nails per charge; it has a maximum tank pressure of 135 psi and delivers 1.2 SCFM @ 90 psi—plenty to run finish nailers and set an occasional framing or roofing nail. Operational noise level is reported to be 79 dBA. Available currently, the compressor sells kitted with one 6.0-Ah battery and one fast charger for $300. *dewalt.com*

BY ROE OSBORN

Driftwood Dreams

Huge driftwood trees bleached to a silvery gray by the salt and the sun pile up randomly on the beaches on the Pacific coast of Washington state **(1)**. As tempting as wood like this twisted and knobby giant of a burl might be, removal of driftwood is highly regulated **(2)**. Smaller logs that can be handled easily often become part of shelters like this lean-to built between two beach boulders **(3)**.

I spent my youth on the shores of Rhode Island, and long before I put on my contractor belt, I had become a serial beachcomber. My most prized finds were chunks of silvery grey driftwood worn smooth by the waves of the Atlantic Ocean. Rarely would I find a piece of wood big enough to be used for anything but a coffee-table decoration. But on a recent visit to the Pacific Northwest, I was blown away to see the beaches littered with huge driftwood trees, some with trunks that were many feet in diameter **(1)**.

Evidently, the entire Pacific Coast of the northwestern United States is cluttered with driftwood trees. Locals I spoke to said that most of the trees are swept from the banks of rivers to the north. From there, they float out to sea until they get caught in the prevailing north-to-south Pacific Ocean currents. Finally, they wash ashore in one of the fierce storms that routinely pound the Northwest Coast. Some of these trees supposedly spend years drifting in the ocean before making their way onto a beach.

As I picked my way through the piles of silvery driftwood trees, my mind began to devise ways to use them—as lumber, as art, or maybe just in their natural driftwood character integrated into a regular structure. One twisted and gnarly burl that grabbed my attention was more than 10 feet long **(2)**. But then I considered how difficult it would be to mill these driftwood trees. The salt and sand embedded in the trees would probably destroy most any type of blade, and even if you came up with a feasible way to mill the trees, just getting them off the beach would be a monumental task. On the beach, there were lean-to shelters made from smaller pieces **(3)**, but the larger trees seemed to defy any attempt that might be made to move them.

Back home on the East Coast, I did some research and discovered that gathering driftwood on those beaches is regulated by the state and that taking large logs or taking driftwood for commercial purposes is prohibited. The beach-goers I saw seemed accustomed to the presence of these giant ocean travelers, walking in and around the maze of silvery logs to reach the open sand near the water's edge. I'm sure they'd seen the "amazed tourist" look before on faces other than mine.

Roe Osborn is a senior editor at JLC.

Photos: 1 & 2, Roe Osborn; 3, Laurie Sullivan

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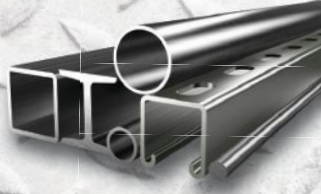

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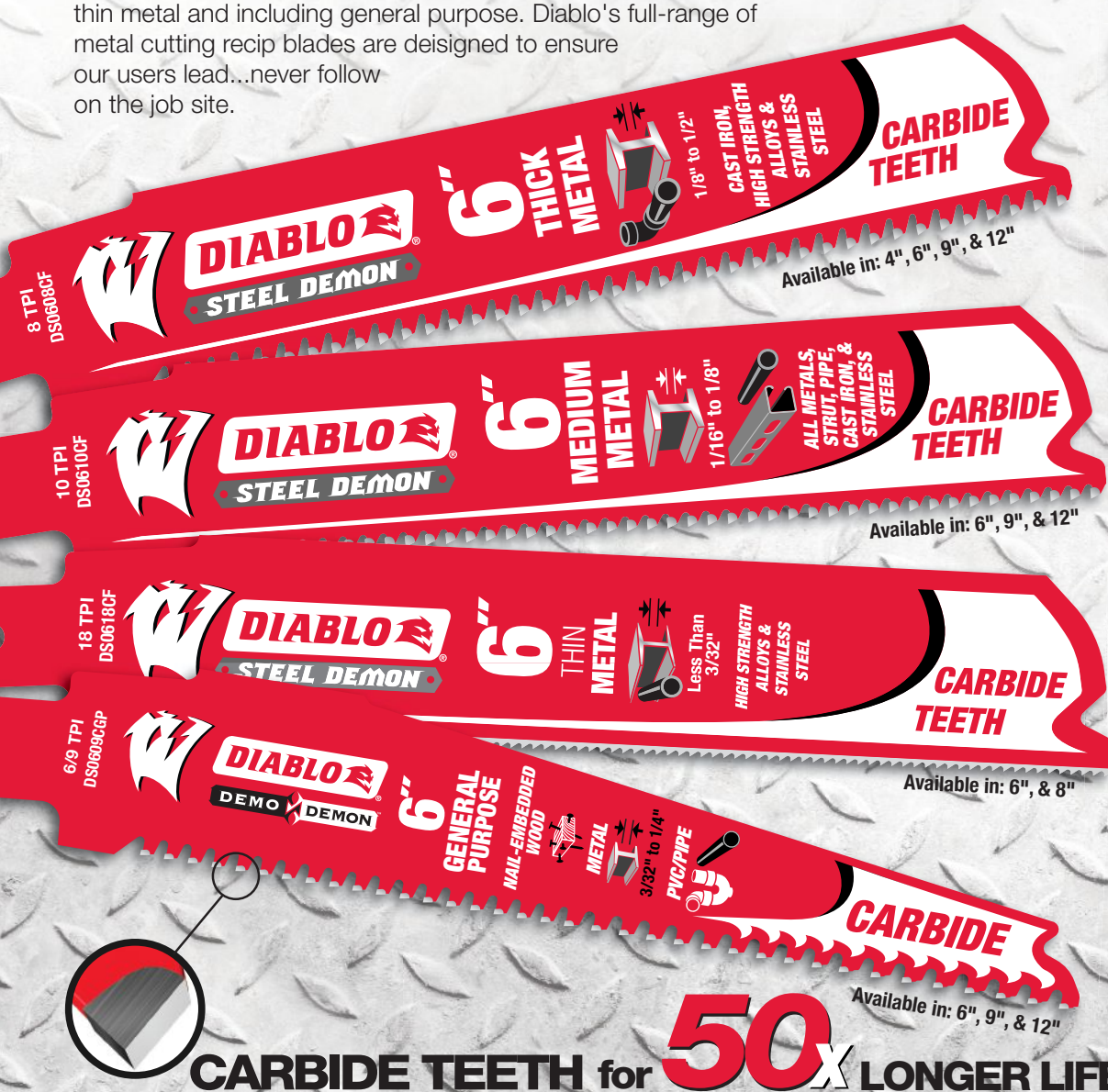

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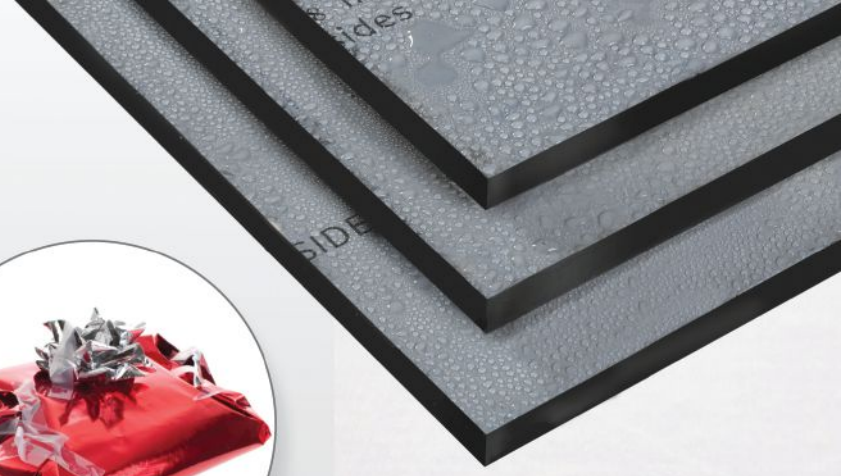

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