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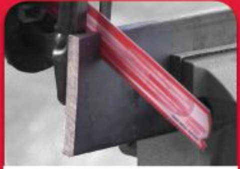

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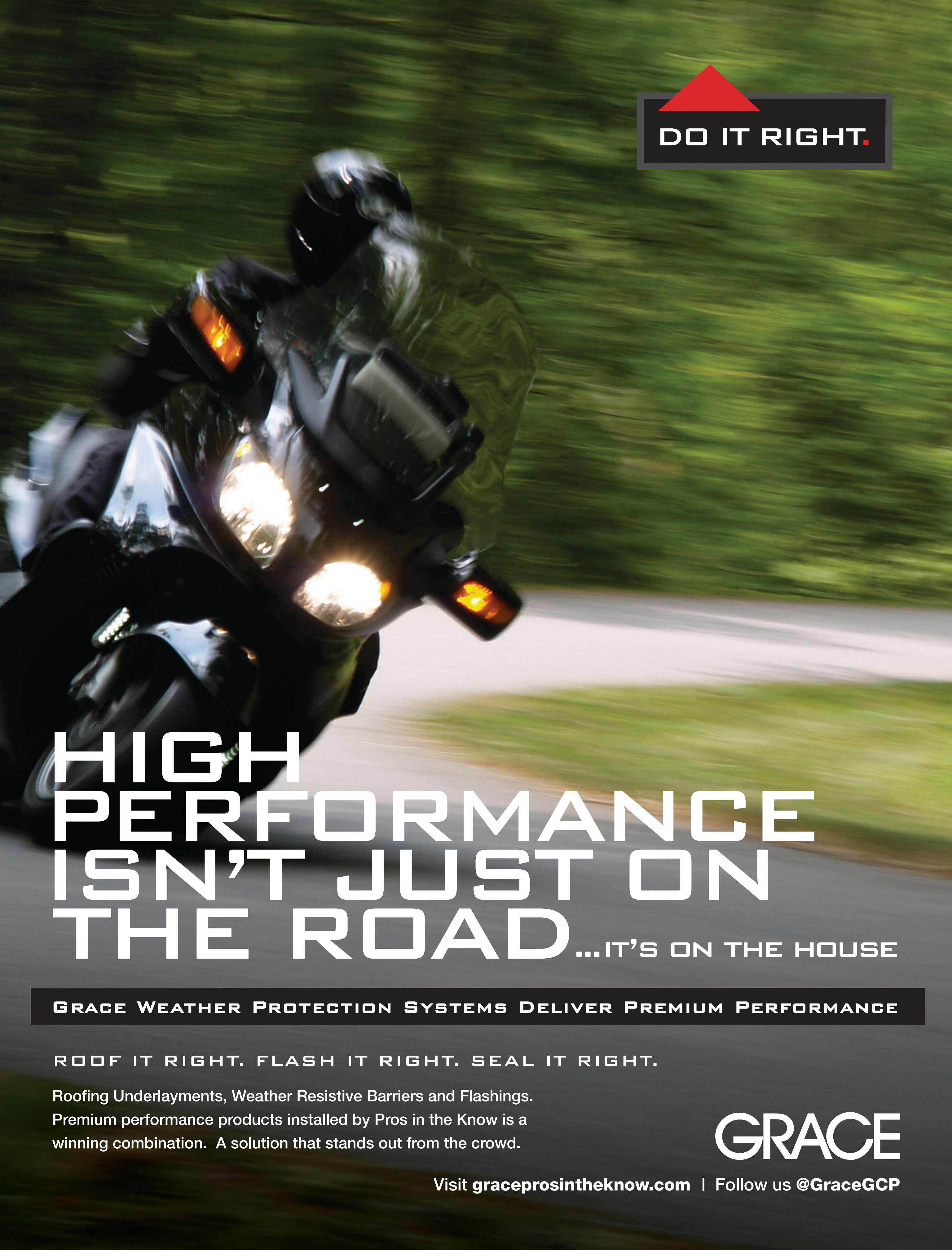
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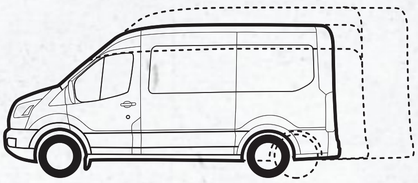

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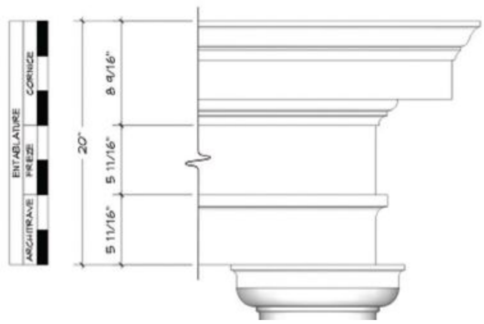

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On the cover: Carpenter Shane Fenton, with Thompson Johnson Woodworking, shingles a porch-post pedestal for a restoration project on Peaks Island (Portland, Maine). Photo by Ted Cushman.

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DEPARTMENTS

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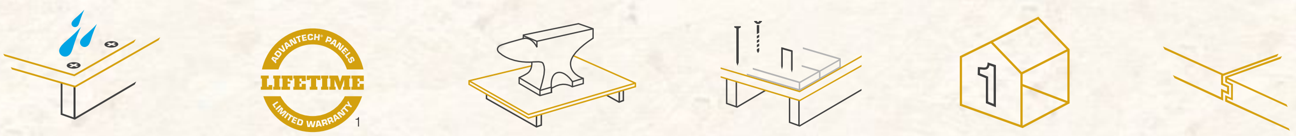

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"TOP-SEALING DAMPER BLOCKS A BIG HOLE," BY MIKE GUERTIN (JUN/15)

Jason Laws (online, 6/29/15): I think that a flue-top damper is a nice idea, but it would never work in my area—northern Maine. It will either freeze shut or freeze open, or the 4 feet of snow on it will put a real damper on things. Dampers should be kept inside, where they belong, out of the weather. Most people don't use fireplaces to keep warm, so there would not be a steady stream of heat to melt off the snow and ice, as with a wood stove that is used 24/7. Any fun with the fireplace would come to an abrupt end as soon as the room filled with smoke.

Mike Guertin responds: People may be reluctant to install a flue-top damper for the valid reasons Jason Laws notes. There are many building practices and products that are not suitable to all regions because of climate, geology, or local building codes. It's important to consider what will work best given the local circumstances.

There are several parts of the country that have conditions like Maine's—heavy snow and long winter periods. We may actually have a worse climate here in southern New England than in northern Maine. We get heavy, wet snow that frequently ices over, freezing rain, and fluctuating temperatures hovering around the freezing point. The 2014–2015 winter was the worst we've had in my lifetime (deep cold, several snowfalls of 2 feet or more, 8 feet or more of accumulating snow over weeks of time that required roofs be shoveled, high winds, and the like). Despite this winter weather, there were no problems operating the four flue-top dampers on the rental houses I have.

"TRUE THROUGH-WALL FLASHING FOR BRICK VENEER" (ONLINE, 7/8/15)

Fred Nowicki (online, 7/12/15): The drawing in the second slide seems a tad misleading. The right side shows brick below the rafter. That is more prevalent in a mass wall, not typical of a veneer. If the author is truly attempting to showcase proper sidewall flashing of a veneer on a sloped wood roof, a key component—a steel support angle affixed to the wood sidewall to carry the load—has been omitted. Furthermore, with that slope of roof, metal lugs need to be welded to angle to prevent masonry from sliding downward.

Randy Ward (online, 7/12/15): Why wouldn't it be better to have a continuous L-shaped flashing with a U-shaped edge flat on the roof, with the bricks sitting on the L-shaped flashing?

Harrison McCampbell responds: With the drawings I provide to clients and contractors, I'm merely trying to impress on everyone involved the concept of catching the water and letting gravity do the work—in shingle fashion and in a permanent way that doesn't require any maintenance.

The method I advocate for supporting the brick is to use horizontal (level) steel angle, either spanning the building's width below the roofline (shown on page 38 of the July issue) or with short, level pieces stepped up the roof slope. If I'm following you correctly on the idea of using sloped steel angle, you might be able to cut the bricks at an angle (which is a lot of extra work) and keep them from sliding down a steel angle with metal lugs (even more work), but you are still going to need to install a true through-wall flashing.

In response to the question of a continuous U-flashing, are you going to cut the brick to sit on the pan? Again, that's a lot of extra work. And how are you going to keep the bricks from surfing down the pan?

Most of the time on the jobsites I see, the traditional tried-and-true methods of masonry flashing have faded into the sunset and the most common approach to "flashing" is to simply do what everybody else is doing (most of the time, saw-cut flashing). But what everybody else is doing may not always be based on proven standards.

"MAJOR SURGERY FOR A FAILING FAT WALL," BY TED CUSHMAN (ONLINE, 7/2/15)

Jkrigger (online, 7/6/15): I think what you saw in this home is all too common. Builders and retrofitters trust cellulose insulation and OSB too much. Cellulose and OSB are the two most moisture-vulnerable building materials we commonly use. I have never and will never install cellulose in a floor cavity or closed roof cavity. I've seen it wet too many times in these types of applications.

Cellulose may be fine for walls in dry climates, I think. However, for homes in climates with more than 40 inches of rain and an average relative humidity (RH) of more than 80%, I'd never insulate a wall with cellulose. That excludes a lot of places near the Atlantic, Gulf, and Pacific coasts of North America.

The settling might have had as much to do with wetting as with inadequate installed density. Case in point from a vastly different climate zone: My sister bought a rental house in Venice Beach, Calif., a few years ago at auction without seeing it. Average temperature for the location is 70°F; average rainfall, 14 inches; average RH, in the high 70s. The home is built on a slab with stucco siding. She walked through the door and smelled mold. The attic cellulose and carpet were dry. But when she cut open the wall, she found the cavities half-full of sopping wet cellulose, and she had to gut the place and re-insulate. In Venice Beach and in Vermont, the question is, why did the cellulose get wet? Can we blame it all on inadequate installed density? Or, will persistent high RH during some years and seasons cause wetting that fails to dry?

The ventilated rainscreen might solve this and might not. I've been saying for 25 years that cellulose is too vulnerable to moisture for many uses, to little avail. Cellulose can absorb more than 100% of its own weight in water. The current thinking is that cellulose manages moisture well and resists wetting. But my advice is: Don't bet on it!

Editor's note: John Krigger is co-author of *Residential Energy: Cost Savings and Comfort for Existing Buildings* (Saturn Resource Management) and one of the foremost weatherization and home-performance trainers in the U.S.

FOAM CUTTING TECHNIQUE

Jim Stacey, Richmond, Calif., wrote: I've been getting *JLC* since it was printed on napkins, but have never been able to contribute anything. Maybe now I can, with this experience. If you need to cut rigid foam, you can buy an "electric knife" (about $21 right now at American Science and Surplus; sciplus.com), or you can improvise for practically nothing, assuming you already have a propane torch and a long kitchen knife that no one will miss. Turn on the torch and put it where it can't get knocked over. Mark the foam where you want to cut it. Put on a glove (this determines if you are paying attention). Put the knife blade in the flame and in a few seconds, cut the foam until the blade cools. Heat and cut. Heat and cut. Do not put knife back in kitchen drawer.


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Q When I recently visited the southern New Jersey coast, a fellow contractor told me that he made most of his shower pans out of fiberglass. Is this feasible to do on site?

A Michael Byrne, a veteran tile installer and consultant, and the moderator of *JLC*'s Ceramic Tile Forum, responds: Many different materials have been used to line wet areas over the centuries, including tar, used by ancient Egyptians, and lead sheets, used in Roman baths. Copper is still used today on occasion. But now these materials have been largely replaced with chlorinated polyethylene (CPE) or polyvinyl chloride (PVC) sheet material.

Fiberglass can also be used as an effective shower pan material. First, fiberglass cloth is fitted in the pan area (see photo, right), which then gets impregnated with resin to form a waterproof pan. But like every other type of pan material, the devil is in the details. Obviously, you want the pan to last as long as the structure where it is installed. But if the homeowner wants to remodel the bathroom—or if the pan was poorly fabricated and needs to be taken out—fiberglass can be difficult to remove from studs, backing, and subflooring.

Like any other shower-pan material, fiberglass resin and cloth must be installed over a subfloor with a ¼-inch-per-foot slope to the drain. Just as important is the resin itself. Most are water- and chemical-resistant, but some may not be: If fiberglass is specified for your install, a boat shop is probably the best source for resin and cloth. Crack prevention is another reason to use fiberglass materials formulated for nautical use, because boat structures are constantly bending, deflecting, and twisting. Building structures also move about, and fiberglass resins that cure rock-hard may corner-crack. Harder resins may also develop cracks around drain housings that are not adequately supported.

Fiberglass is a good choice for tile showers or sunken tubs that are curved or irregularly shaped. Regardless of the shape of the installation, however, shower pans made from fiberglass resin and cloth need to be properly supported. For most applications, this means installing blocking between studs that extends at least 9 inches above the sloped subfloor.

When it's time to hang metal reinforcing mesh for the overlying mortar bed, fiberglass actually excels over other materials. As the mesh laps over the fiberglass pan, it can be securely attached to the pan with dabs of resin.

One problem when working with fiberglass is keeping resin off the bolts where the pan attaches to the drain housing. I've found that the best way to keep bolt threads clean is to screw the bolts at least two full turns into the housing and then wrap the entire protruding bolt with Teflon tape.

The curb is also an area that requires special attention when making a shower pan out of fiberglass. Make sure the fiberglass resin and cloth cover all three sides of the shower curb and lap up the jambs or sides of the shower opening.

One final area of concern is the interface between the outside face of the curb and the bathroom subfloor. Protecting the bathroom subflooring with resin and cloth is one option, but I don't recommend it. Instead, I'd use a sheet or liquid-applied membrane made for use with tile. Just be sure to join the two surfaces with a sealant that is compatible with whatever membrane you use as well as the cured fiberglass surface.

Q A client in a northern area has a concrete patio with a brick border. A dozen bricks have come loose where the patio steps down to a sidewalk. How should I do the repair?

A John Carroll, a mason and builder from Durham, N.C., responds: The most likely cause for the failure of the mortar is the freeze/thaw cycle. Water expands as it hardens into ice. As people who live in cold climates know, this expansion is a powerful force. It can crush boats and lift buildings, so it's no surprise that it can separate and break mortar and bricks.

The deterioration of exterior masonry is usually a cumulative process. One year, the ice causes a crack; the next year, the crack admits more water, which in turn causes more deterioration. It's a downward cycle, with ever increasing levels of damage.

The hardest part of this job is preparing the surface under the bricks. First take off all the loose mortar. You can use a cold chisel and a 2-pound hammer for this task; I also use a rotary hammer and a grinder with a diamond blade. Once you're down to a good, solid base, clean the surface of dust, dirt, and any organic matter, such as moss or mold. Using Clorox to get rid of organic matter is fine if you rinse it well when you're done. Before you lay the bricks, allow the surface to dry. You can speed up the drying process by using a leaf blower or hair dryer. The surface doesn't have to be bone-dry; just make sure there are no puddles sitting on it.

Before you start mixing the mud, be sure you have the right bricks and mortar. Exterior paving is a punishing environment for masonry, so it's imperative to choose the right materials. I would advise against reusing the old bricks. The pores of used bricks are usually filled with the old mortar, which prevents the fresh mortar from providing a good mechanical bond.

Instead, use paver bricks, which you can get at a masonry supply house. Paver bricks are harder and have more compressive strength than standard bricks. Most importantly, they absorb much less water, which makes them more resistant to the freeze/thaw cycle.

The mortar should be Type S or Type M masonry cement mixed with sand and water. In areas subjected to very hard freezes, I recommend Type M, which has a higher percentage of Portland cement. Use two-and-a-half to three parts sand to one part masonry cement. You don't need to mix an entire bag of mortar. For the number of bricks you need to lay, fill a gallon bucket with masonry cement, then fill the same bucket 2 ½ times with sand. Fill the same bucket with water and add about half of it to the mix. Mix this concoction thoroughly, then slowly add water until the mud becomes soft and mushy. It must be wet enough to absorb into the pores of the bricks, but it can't be soupy.

After mixing the mud, spread a layer about ½ inch thick on a scrap of plywood about 2 feet square. Set this aside and begin laying the brick. Lay a full bed of mud about ¼ inch thicker than the anticipated finished height of the joint. In normal brickwork, the finished joint is ½ inch, so the thickness probably needs to be at least ¾ inch. Now set the brick in place and set a small level on the surface of the patio and extend it over the brick. Tap the level down, driving the brick into the mortar until they both sit flush with the patio surface. Don't tap with the trowel handle—the trowel is always covered with mortar, and wet mud will sprinkle down and make a mess of your brickwork. Use a rubber mallet instead.

Bricklayers often butter the edge of each brick as they lay it, which is a difficult task to master. I prefer to set the bricks first and fill the joints later. Here's where the mud you spread on a piece of plywood comes into play. After the bricks are in place, retrieve the "mortar board." Having been spread in a fairly thin layer, the mortar should be slightly stiff at this point. Put a glove on your non-trowel hand and pry up a chunk of the mud (about 3 inches by 3 inches) with the trowel. Hold the chunk in the gloved hand just over the joint and use a ⅜-inch tuck pointer to slide the mud into the joint.

The object is to fill the joints without knocking the bricks out of place. Pack the joints full to maximize the surface area that bonds to the brick and locks it in place. More importantly, completely filled joints eliminate pockets where water can accumulate and freeze.

When you have filled all the joints, go back over them with a jointer. Don't try to clean up the mortar while it's still wet. Instead, leave the crumbs of mortar on the surface and let them dry. The following morning, vacuum up the loose mortar. Then clean up the faces of the bricks with a damp synthetic abrasive pad such as a Scotch-Brite pad.

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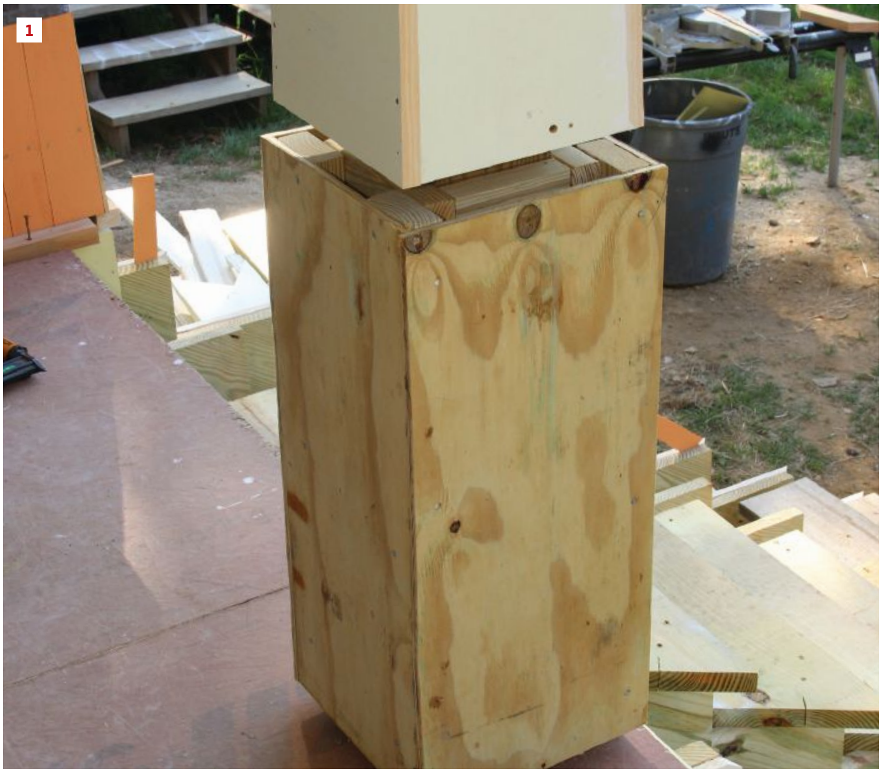

A Craftsman-Style Front Porch

Since last winter, *JLC* has been following a construction team from Thompson Johnson Woodworks in the coastal community of Peaks Island, Maine, a mile from shore in the Portland harbor, as the crew has carried out a whole-house energy-efficient gut-rehab job on an aging vacation house. In a series of online stories and slideshows, we've focused mostly on framing, insulation, airtightness, and the exterior water-managed rainscreen system. The energy overhaul was comprehensive, turning the leaky old building into an airtight example of modern building science that can be heated with a pair of mini-split heat pumps.

But as the job neared completion, all those high-performance details got covered up. Now, all you can see is the siding and trim—and while those details may not make the dwelling cheaper to live in, the curb appeal they add can certainly boost the property's value.

TAPERED COLUMNS

In July, we dropped by the job to see carpenters Mark Pollard, Shane Fenton, and Dale Cunningham add some finishing touches to the home's front porch. They wrapped the pressure-treated 6x6 structural porch columns (which support an upstairs front room) in a trim package designed to recall the look of a traditional Craftsman home of about 1915, the year the house was originally built—but using materials updated for the 21st century.

The upper portion of the column wrap is a tapered surround built out of four flat faces ripped with a track saw and nailed together at the column corners with stainless steel nails. The inside dimension of the tapered box is ⅛ inch larger at the upper end than the 6x6 structural post, to allow for possible shrinkage and swelling in service.

Photos: Ted Cushman


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11

The top end of the build-out isn't nailed to the post, but tacked into the soffit above so that the structural post can move freely. At its lower end, the tapered box-out is fastened to pressure-treated wood blocks attached to the post, but only on the two faces where the railings are attached—again, to allow the box some freedom to move with changes in the weather.

The lower section of the column is built out in the form of a simple vertical box made with pressure-treated 2x4 lumber and plywood **(1)**. The crew wrapped the 6x6 post with 2x4 blocking, then attached vertical 2x4s over the blocks—connecting the upper and lower rings of blocking—and finally fastened the plywood to complete the box-out.

Over the plywood, the crew attached the same MortairVent rainscreen back-ventilation fabric that they had previously used to create a breathing space under wood shingle siding on the home's upstairs dormers **(2)**. The fabric creates an air space that promotes drying for the factory-primed and factory-stained shingles, and helps to extend the service life of the paint job. The carpenters nailed solid wood blocking to the boxes at locations where the lower railings would be attached **(3)**.

Next, the crew shingled the plywood boxes with pre-primed and pre-stained white-cedar shingles up to a horizontal mid-height plinth—which Pollard calls a "shingle base cap"—made of clear red cedar 2-by stock.

The process of shingling the boxed-out base was no different from shingling four very short house walls: The carpenters tacked strips onto the boxes to keep each course straight and level **(4)**. At corners, they scribed the back of each shingle for the matching tapered cut **(5)**. If the cut was not quite perfect, they shaved the shingle edge in place with a razor knife **(6)**.

RAILING AND BALUSTERS

Now it was time to build the railing and baluster assembly. The upper rail would connect to the side of the mid-height plinth at the top of the column base box, and the lower railing would fasten through the

shingles into the previously installed blocking attached to the plywood box. Project lead Mark Pollard started by finding and marking the center of the red-cedar shelf.

Pollard cut the top rail (also clear red cedar) with a miter saw **(7)** and fit it into position, holding the end in place with a clamp **(8)**. Then he cut and temporarily positioned the lower rail **(9)**, setting the rail on some blocks and shimming it up to fit underneath the second course of shingles.

With top and bottom rails temporarily positioned, Pollard measured and test-fit a piece he calls the "sub-top rail." He would use the sub-top rail, along with the bottom rail, to assemble a whole set of balusters on the bench.

Next, Pollard found the center of the top rail, and plumbed down from that point to transfer the center marking to the bottom rail **(10)**. His balusters would be laid out from this center point for a symmetrical finished appearance.

Now, Pollard could permanently fasten the top railing into place, and use the sub-top rail and the bottom rail to preassemble the rest of the railing and baluster system. He primed the end of the top rail with spray primer, then screwed the top rail to the shingle base cap plinth using 3-inch #8 stainless steel screws **(11)**.

Next Pollard set about assembling the baluster and railing section. Starting from his previously determined center point, he laid out marks for the balusters on the bottom rail at a 3¾-inch edge-to-edge spacing, as required by code (the space between balusters cannot exceed 4 inches). Then he predrilled pilot holes for screws, set a 3-inch #9 stainless steel screw in each hole, and screwed the balusters onto the bottom rail from the underside of the railing **(12)**.

A purist, Pollard notes, might argue that the baluster spacing should be adjusted so that the space between the last baluster and the shingled column base was equal in width to the space between the balusters themselves—or, perhaps, to half the baluster spacing. Pollard was content with an end spacing of about 2 inches between the end baluster and the column.

Next, Pollard fastened the top end of each baluster to the sub-top railing, attaching the rail to the end of the balusters with three pneumatically driven 15-gauge stainless steel nails **(13)**.

Now Pollard could set the entire baluster system with the bottom railing and the sub-top rail into place under the already-positioned top railing. He shimmed the whole assembly up tightly against the upper railing **(14)**, then fastened up through the sub-top rail into the top railing using 1½-inch #7 stainless steel nails **(15)**.

Finally, Pollard attached the bottom rail to the posts with 3-inch #8 stainless steel screws **(16)**, and the job was done.

Ted Cushman is a senior editor at JLC.


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BY MELANIE HODGDON

/BUSINESS TUNE-UP/

Markup and Margin

In previous articles (*Business,* May/15 and Jun/15), we differentiated between overhead costs and production costs (classified in accounting as "cost of goods sold" and often abbreviated COGS); thought about profit as just another expense; and then saw how looking at gross margin makes it easier to analyze the overall profitability of your jobs. In this article, we'll explore the concept of margin. Only by understanding margin can you set accurate volume and markup goals.

As an example, we estimated that our overhead costs for the coming year would be $32,000 and we identified $8,000 as a target net profit. That meant that we'd need $40,000 left over in gross profit when we finished producing work. That $40,000 could come from a variety of different sales volumes (A, B, C, and D in chart, below).

Gross Margin = Gross Profit ÷ Income
Using the formula for gross margin, let's find it for each of the jobs. Although it's a no-brainer that getting $40,000 from a $100,000 job is a more profitable scenario than getting $40,000 from a $1,000,000 job, let's put some actual margin figures to it.

Doing so, we can see that the $1,000,000 job had a 4% gross margin while the $100,000 job had a 40% gross margin. Another way of looking at it is to say that for every $1 that came in on Job A, only 4 cents were left to cover overhead and provide for profit, while for every $1 that came in on Job D, 40 cents were left to cover overhead and provide for profit.

So, if you apply the gross-margin formula to your own financials, what do you get? Looking at the chart, it's easy to see that the higher the gross margin you achieve, the lower your sales volume needs to be in order to provide the required dollars of gross profit.

Let's say your gross margin turns out to be 28%, which just happens to be midway between Job C at 16% and Job D at 40%. Then if you needed $40,000 for overhead and target profit, you would need to sell and produce at the same degree of profitability somewhere between $100,000 and $250,000.

But isn't there a more accurate way to pinpoint what you need to sell? And what about markup? Most contractors calculate their costs and then add a markup to it, whether they add the markup to the sale price when the job is sold at a fixed price, or they add the markup to actual costs if they sell T&M.

The key is the relationship between gross margin and markup. Although both use the gross-profit figure, gross margin relates gross profit to income while markup relates gross profit to costs.

Markup = Gross Profit ÷ COGS
As shown by the markup results in the chart, if you're willing to add a 66.67% markup to your costs—and you're able to sell work at that price—you can earn your $40,000 by selling only $100,000. On the other hand, if you only dare to mark up about 19%, you'll need to sell $250,000 (two-and-a-half times as much!) in order to make that same $40,000 of gross profit.

What markup should you use? What volume can you sell and produce with your resources? It's all in the numbers.

Melanie Hodgdon is the owner of Business Systems Management. melaniehodgdon.com

Markup and Margin

	A	B	C	D
Income	$1,000,000	$500,000	$250,000	$100,000
Cost of goods sold	$960,000	$460,000	$210,000	$60,000
Gross profit	$40,000	$40,000	$40,000	$40,000
Overhead	$32,000	$32,000	$32,000	$32,000
Profit	$8,000	$8,000	$8,000	$8,000
Sum of overhead + profit	$40,000	$40,000	$40,000	$40,000
Gross margin	4.00%	8.00%	16.00%	40.00%
Markup	4.17%	8.70%	19.05%	66.67%

The top lines of this chart illustrate that we can make our required overhead and target profit in a variety of job scenarios. But while the sum of overhead and profit is the same for all four jobs, the margin and markup are vastly different. The lesson is clear: The higher the markup you are willing to add, the less volume you need to sell.

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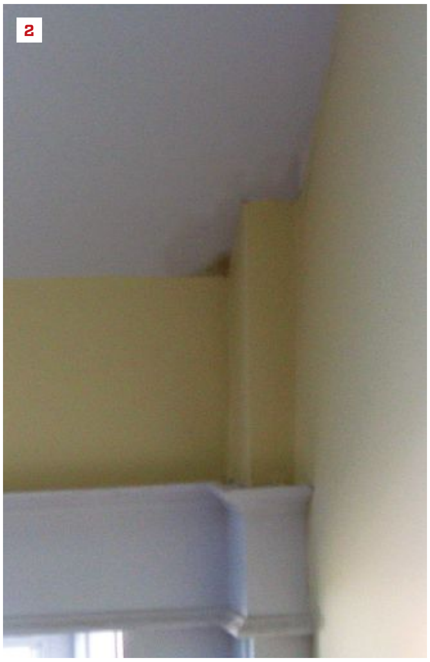
BY MIKE GUERTIN

1



2

Finding the Source of a 'Roof Leak'

The house was less than a year old when the owner called me in late February to investigate persistent roof leaks that the builder had been unable to repair. The water seemed to be coming in around the skylights, leaving moisture stains above and below the openings. The builder had tried to fix the problem by removing the asphalt shingles around the skylights, installing waterproof membrane, and re-flashing the curbs. At first, the problem seemed straightforward, but when I asked some follow-up questions, the symptoms and timeline didn't add up.

The house was built in the fall and the owner moved in just before Christmas. Moisture stains appeared within a couple of weeks **(1, 2)**. Roof repairs were done in mid-January, but new stains showed up soon after.

We hadn't gotten much snow or rain that winter, so with no precipitation that might cause ice dams on the roof, how could water leak into it? Background information from the owner and a look around inside the house began to paint a different picture.

The first thing I noticed was that the indoor humidity was high, with water condensing on the inside of the windows and skylights. The relative humidity (RH) measured 65%. But there wasn't any obvious moisture source, like a wet basement or lots of house plants.

Then the owner mentioned that the foundation and first-floor walls of the house were built with insulating concrete forms (ICFs). The builder probably didn't realize how much water would dry out of the concrete during the first year. I calculated that more than 1,500 gallons of water was in the concrete that filled the ICFs. With the short construction period, a lot of that water was probably still drying to the interior of the house.

The upstairs of the Cape was divided into three sections: a loft with tongue-and-groove plank ceiling applied to the underside of the rafters, a vaulted open foyer with the skylights, and an unfinished storage room that held the air handler and ducts. Kraft-faced fiberglass batts were installed in the rafter bays of the storage room with poly sheeting covering part of them.

Photos: Mike Guertin

The Kraft facing on the insulation looked fine, but when I pulled the insulation out of a couple of rafter bays, I found saturated fiberglass **(3)** and saturated plywood roof sheathing **(4)**. In some bays, there was actually frost on the sheathing and insulation **(5)**.

Vent chutes were installed in the rafter bays, but solid blocking between the rafters along the top of the exterior wall prevented any ventilation air from circulating. There were no intake vents along the eaves and there was no ridge vent at the roof peak.

Moisture-meter readings of the plywood ranged from 26% to 76%. Staining on the sides of the rafters showed where water had dripped down to the ceiling level. I removed a recessed light from the tongue-and-groove ceiling area of the loft and pushed the insulation aside. The moisture in the sheathing measured between 24% and 35%.

I didn't cut into the drywall around the skylights to check, but I surmised that the same condensation problem was occurring in those rafter bays too. Either humid air was piggybacking on air leaks or moisture was diffusing through the drywall and condensing on the cold underside of the roof sheathing. What appeared to be roof leaks at the skylights were most likely condensed water saturating the drywall and dripping through the perimeter trim.

RECOMMENDATIONS

I made several recommendations to fix the problem. First, the house needed to be dried out. There was no mechanical fresh-air ventilation system in the house, so one would need to be installed, preferably a heat recovery ventilator (HRV), which would exhaust moisture-laden air and bring in drier air from outside. In addition, dehumidifiers could be used to accelerate drying. When the weather warmed up, windows could be opened and fans used to circulate the air.

I also recommended removing the insulation from all the rafter bays. This would need to be done after the deepest winter cold had passed and would mean removing the tongue-and-groove wood ceiling in the loft as well as the drywall in the foyer.

During the summer, after the roof sheathing and rafters had dropped below a 15% moisture level, the roof could be re-insulated with high-density spray foam. Spraying foam would be a messy job inside a finished house, but it seemed like the best choice. High-density foam would help block moisture vapor to keep the underside of the sheathing dry. Then new drywall could be applied to the ceilings in all three areas to cover the foam. Finally, the tongue-and-groove ceiling could be reinstalled over the drywall, but without recessed speakers or recessed lights that could cause air leaks.

After those modifications were made, the owner would need to monitor the air-moisture levels during the winter and operate the ventilation system to keep RH in the house at around 40%.

Mike Guertin is a builder and remodeler in East Greenwich, R.I., and a presenter at JLC Live.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BY TED CUSHMAN

Selling Remodeling With Energy Audits

Weatherizing homes is a serious specialty. Do it well, and it can pay for itself in reduced energy bills, with improved comfort as a bonus. Do it poorly, and it's a waste of time and money, or worse, a cause of moisture and indoor-air-quality disasters. Either way, weatherization work is nickel-and-dime stuff: Most of business ranges between $5,000 and $15,000.

But it doesn't have to stop there. For some weatherizing pros, weatherizing is also a marketing tool that opens the door to a broader marketplace for larger custom remodeling work.

Vermont contractor Jim Bradley and Maine contractor Josh Wojcik are two good examples: Both run businesses that leverage their weatherization competency to help nurture thriving general remodeling practices. For each company, good weatherizing work is a way to prove itself to clients and to build a loyal customer base.

SURVIVAL STORY

"Weatherization work," says Portland, Maine, builder and remodeler Josh Wojcik, "is our gateway drug." Wojcik's company, Upright Frameworks, is a success story for the 2009 federal stimulus package's weatherization program. In 2006, Wojcik gave up a New York City career as an "environmental infrastructure policy wonk," he says, and moved home to Maine to build houses.

The son of a lifelong builder, he teamed up with his father ("who has forgotten more about construction than I'll ever know," says Wojcik) and his mother (who knew how to keep the books), and started a company to build energy-efficient new homes using structural insulated panels (SIPs).

He was off to a good start—until the crash came, about two weeks after he opened his doors. "Overnight, five or six new-home projects we had on the schedule

Upright Frameworks weatherization tech Zachary Rogers installs dense-pack insulation through the soffit of a house and into a cathedral ceiling from the roof. Professional work practices on weatherization jobs help build the company's credibility for more-extensive remodels.

Photos: Ted Cushman

disappeared," says Wojcik. "We were dead." But the influx of weatherization money brought the company back to life.

When the stimulus package was at its peak, doing weatherization work was like sipping from a fire hose, says Wojcik. "We didn't do what some people did, though," Wojcik says. "I didn't buy a bunch of trucks and expensive equipment. We stayed lean."

The company focused on quality control and customer satisfaction, developing an S.O.P. that it still uses. "We test-in, and we test-out," says Wojcik, "so you can measure the improvement. And we spend a lot of time up front talking to the customers. We explain the principles behind the work we're planning to do. And we ask them about their experience in the house—what's comfortable about the house and what's not—and we address those comfort issues. So they can feel the difference when we're done."

Wojcik also makes sure that his crews represent his company well. "We hire people who are friendly, personable, and polite," he says. "Often they'll get to be friends with the client."

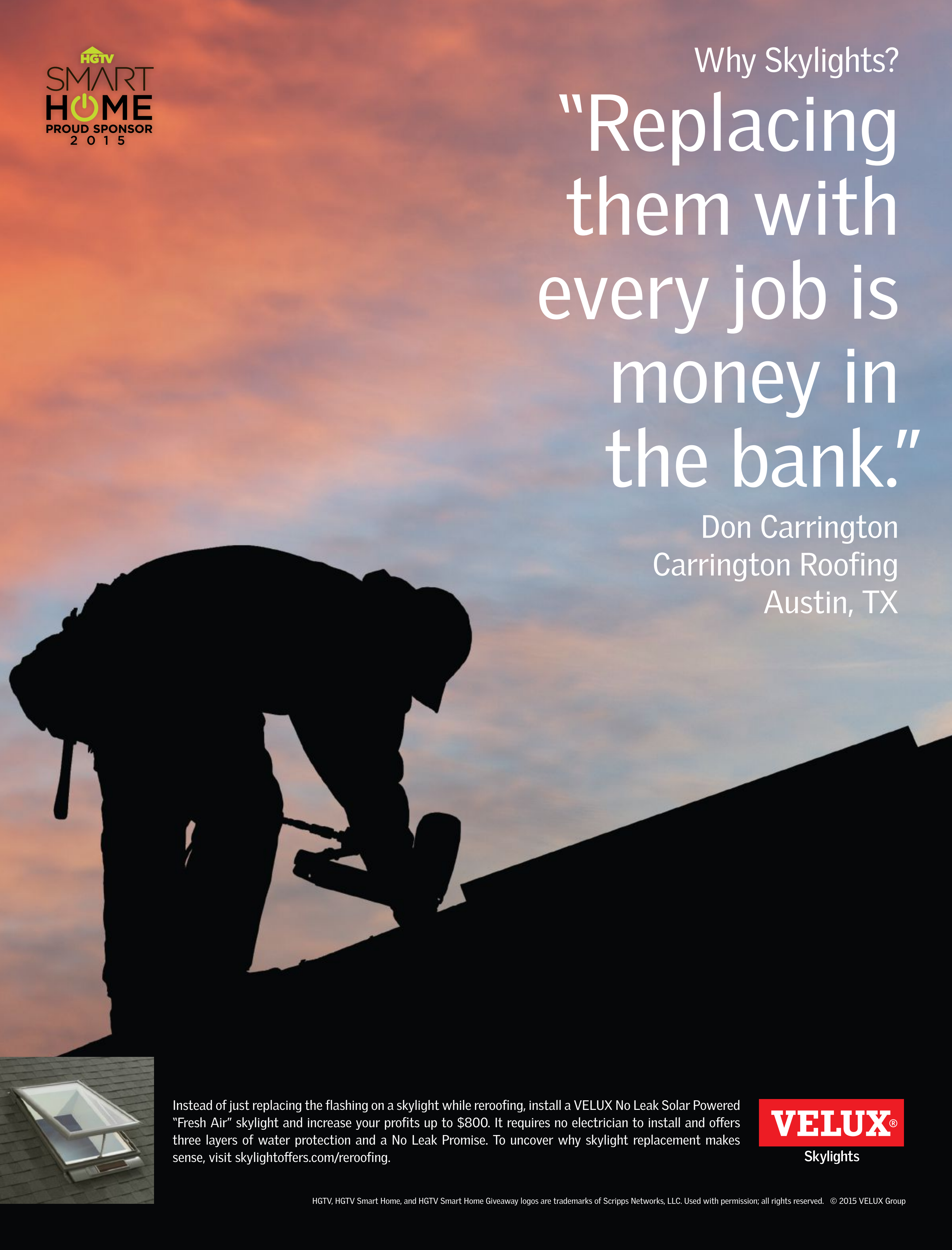
The big surge of federal weatherization money has dried up, says Wojcik, although there are some modest state-level incentives available. But with five years of weatherization work under his belt, Wojcik now has a database of 500 or 600 satisfied customers—a solid foundation of repeat clients and referral sources. He still does a lot of weatherizing, mostly at unsubsidized market rates, and mostly based on referrals by previous clients (or from energy auditors and home inspectors).

But with the economy back on its feet, Upright Frameworks is back in the business of major remodeling and new construction—working almost entirely for previous weatherizing customers, or people they've referred to Wojcik. "Other than continuing to do weatherization, we don't do a lot of marketing," says Wojcik. "Word of mouth keeps the phone ringing."

A known quantity. The strategy depends on happy weatherizing clients. "A lot of the people we work for have had an unsatisfying experience with another contractor before," Wojcik says. "We make sure we don't disappoint them. We schedule the jobs

An open cathedral roof on a Vermont house is shown after the removal of failed insulation (top). Above, a Caleb Contracting worker seals a weather-barrier seam on the roof after re-sheathing. A significant fraction of Caleb Contracting's weatherization referrals end up as roof reconstruction jobs on homes built in the 1970s and 1980s.

Photos: Chris West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months in advance, but we show up the exact day we said we would. We allow enough extra days in the schedule so that we can finish on time, even if there's bad weather or we find an unexpected problem. We're friendly, we're polite, we protect their house during the work, and we clean up at the end of every day. We leave the place as clean as we found it, or cleaner."

Wojcik is careful to match the customers' expectations to reality. "When we fix their house," he says, "they can feel the difference. And we use good energy auditors and accurate data, so if we promise that they're going to see a difference in their utility bills, they really do see one. So now, if they sell the house and buy a different house and they want to remodel the new house, or if they decide to build a new house, who are they going to call? The contractor they already know and they already like and trust—us."

A Caleb Contracting crew member vacuums cellulose insulation out of a failed double-stud wall on a 1980s house in northern Vermont. Jim Bradley's crew is reconstructing the wall system after infrared and blower-door testing revealed major settling of the insulation, moisture damage, and pest infestation.

Photo: Tim Healey

TROUBLE IS HIS BUSINESS

In Vermont, remodeler Jim Bradley tells a very similar story. Bradley's business, Caleb Contracting, specializes in home-performance work in northern Vermont. A steady stream of small and medium jobs keeps him busy, with much of the work coming his way by referral from Efficiency Vermont, the state's energy-efficiency utility. In the past six years, Bradley has won nine awards from Efficiency Vermont for small home-performance jobs, including weatherization work with price tags in the $8,000 to $12,000 range.

But a surprising fraction of those referrals result in contracts for much more extensive work. Like Wojcik, Bradley follows a "test in, do the work, test out" S.O.P. And fairly often, a thorough "test in" investigation reveals major defects in the building—issues that can't be properly addressed with simple air-sealing and insulation. Often, Bradley ends up doing serious structural repairs, such as replacing siding, roofing, or even roof and wall framing assemblies.

This summer, Bradley is reworking all the walls of a country house where settling cellulose in the 12-inch-thick walls left much of the house without insulation and plagued by moisture, rot, and pest infestation. With a cost of $130,000, the job scope is far beyond the typical home-performance project; but without home-performance diagnostics—namely, infrared thermography and moisture testing—the extent of the problem wouldn't have been revealed.

In another case, Bradley's crew came in to weatherize a house where a previous contractor had left the clients unsatisfied. "The contractor spent $8,000, but he hardly reduced the building's air leakage at all," says Bradley. "We spent about the same amount and cut the air infiltration in half." The following year, the clients called Bradley back to insulate and finish a living space over the attached barn. The improvements to the attached structure, which adjoined the home's kitchen, made the kitchen cozy and livable for the first time. "And now that they're spending more time in the kitchen," says Bradley, "they're talking to me about a gut-renovation of the kitchen. It's a foot in the door that keeps going, especially if you do a great job."

Ted Cushman is a senior editor at JLC.

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Framing a Split-Pitch Hip

Let a construction calculator do the work

BY TIM UHLER

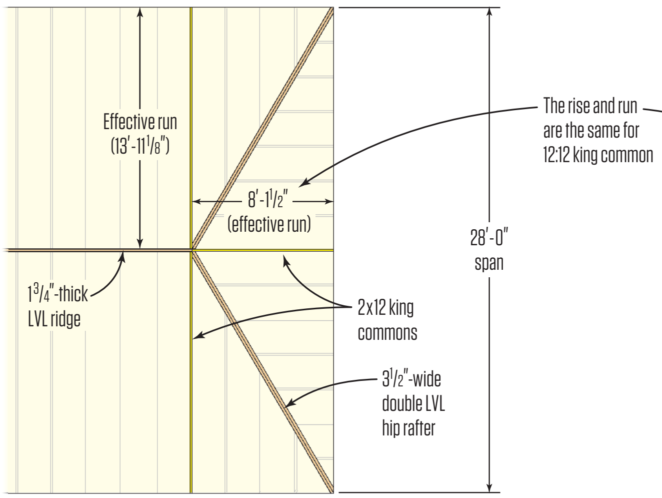
In the September 2013 issue of *JLC*, I detailed how I lay out and stack a regular-pitched hip roof. I approach an irregular "split-pitch" roof similarly, and stack it exactly the same way. Because the roof on each side of the hip has a different pitch, the layout is a little more complicated, and it's a little more tedious to calculate the hips and jacks, and to lay out and cut the hips. Still, we employ this roof style on many of the homes we build.

REGULAR HIPS

First, let's review a regular hip roof: To accurately lay out a regular hip roof, the first step is to make sure that the runs for all common rafters at the main pitch are exactly the same. If the span of the roof is 28 feet, then the effective run of the common is half the span, less half the ridge. So, for this example, the effective run of the common rafter is 28 feet minus 1 ¾-inch (LVL ridge thickness)

1 Effective Run of King Commons

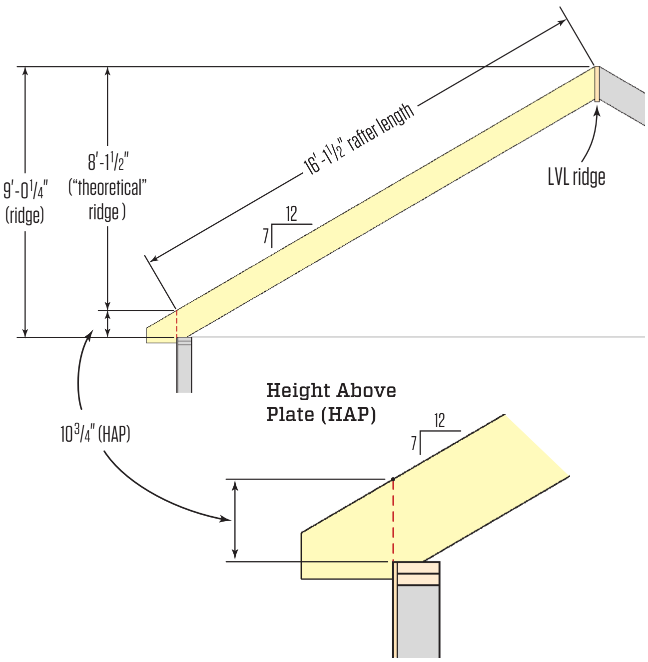
28'-0" (span) – 1 3/4" (ridge thickness) = 27'-10 1/4" ÷ 2 = 13'-11 1/8" (effective run for 7:12 king common)



2 7:12-Pitch Rafter Length and Ridge Height

13'-11 1/8" (effective run) Run 7 Inch Pitch Rise = 8'-1 1/2" ("theoretical" ridge)

Then, hit Diag = 16'-1 1/2" rafter length (keep CM settings, continue on to step 3) ...

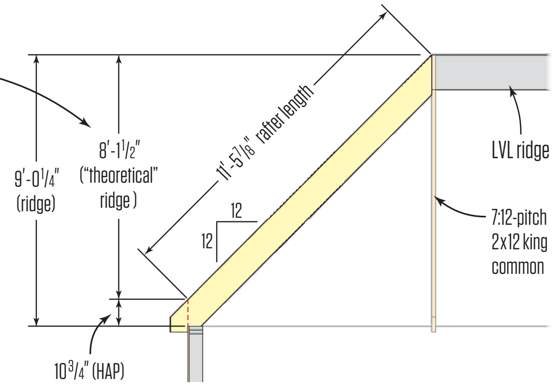


8'-1 1/2" ("theoretical" ridge height) + 10 3/4" (HAP) = 9'-0 1/4" (ridge height)

3 12:12-Pitch King Rafter Length

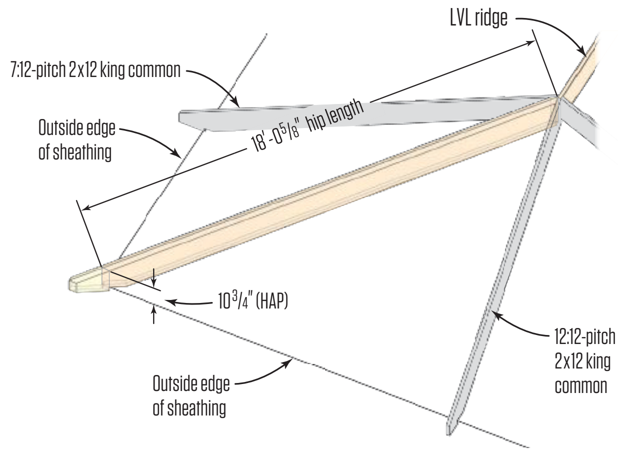
...Then, click Rise = 8'-1 1/2" = Rise 12 Inch Pitch Diag

= 11'-5 7/8" rafter length (keep CM settings, continue on to step 4) ...



4 Hip Rafter Length

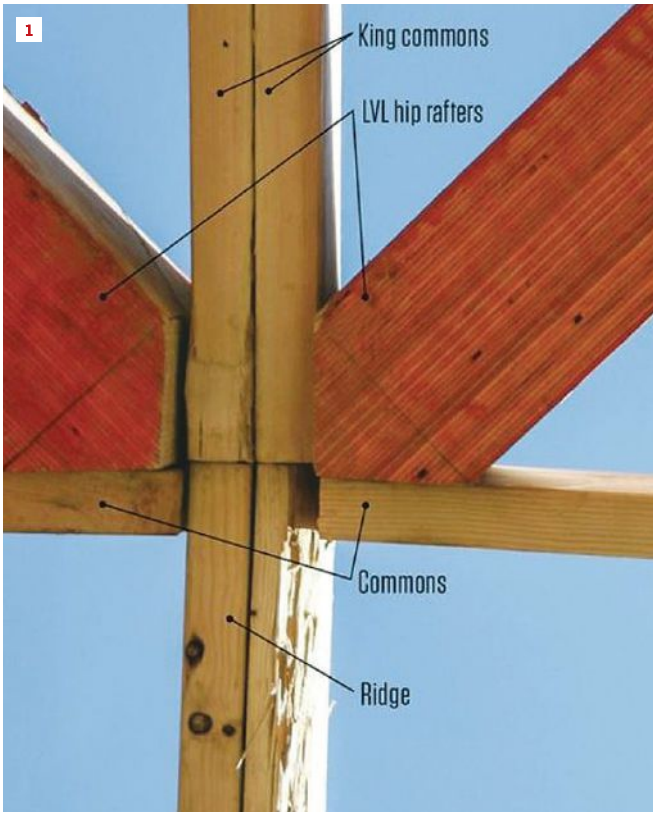
... 7 Inch Conv Hip/V Hip/V = 18'-0 5/8" hip length ...

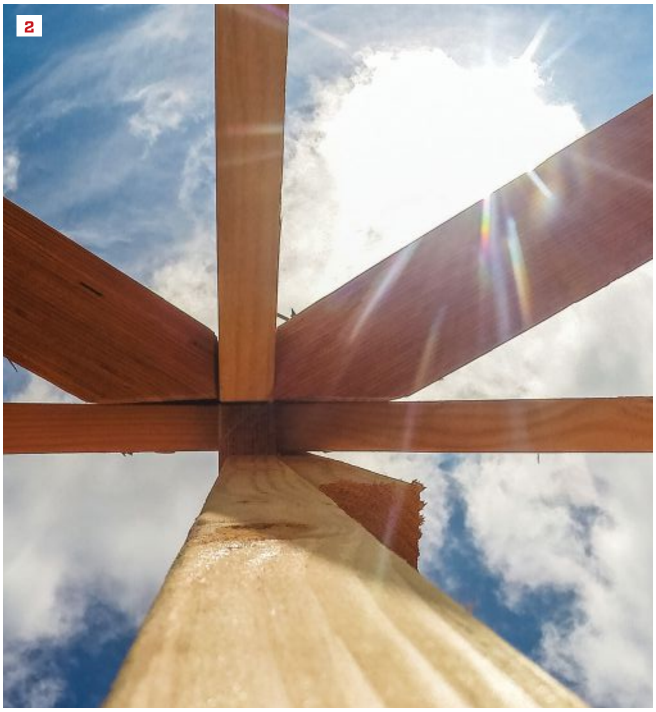


5 Hip Rafter Slope and Cheek Cuts

...Then, click Hip/V = 26.74° plumb cut Hip/V = 63.26° level cut ...

... Hip/V = 59.74° cheek cut Hip/V = 30.26° cheek cut





divided by 2. This equals 13 feet 11 ⅛ inches. For the king common at the end of the ridge, the run is exactly the same: 13 feet 11 ⅛ inches. Laying out the roof this way means the hips will have double cheek cuts and will slide right into the corner between the commons and the king commons **(1)**.

An advantage to laying out the hip like this is that there is no adjustment to be taken into consideration for the ridge "growing" in length nor is there any need to "drop" the hip. By first subtracting the ridge thickness from the overall span, we determine where the edge of the ridge is located without doing any more math.

IRREGULAR HIPS

An irregular roof is one where the slopes are different or the plate angles are other than 90°. The configuration is essentially the same as for a regular roof; the big difference is that you have different cheek cuts where the hip intersects the king commons **(2)**. And of course, there are more variables to keep track of when you are laying out an irregular roof. But it's not overly complicated.

The process I use is similar to the regular roof layout: I start with the main roof slope (in this case, 7:12) and use that to figure out where the edge of the ridge needs to stop for the steeper, 12:12 hipped end.

Using the same math on my Construction Master Pro calculator—28 FEET - 1 INCH ¾ ÷ 2 = 13 feet 11 ⅛ inches—gives me the effective run of the 7:12 common rafters. To find the ridge height, I enter RUN 7 INCH PITCH and then click RISE. This equals 97 ½ inches. This is the height where the 12:12 hipped end meets the 7:12 roof.

Because the rise and run on a 12:12 roof are the same, 97 ½ inches is also the run of the 12:12 king commons. So we can pull this measurement, 97 ½ inches, to locate on our plates where our 7:12 king commons should be placed.

Note: If we didn't have an equal rise and run—for example, if the pitches were 7:12 and 10:12—I'd calculate it as follows. The first part, to find the effective run, is the same: 28 FEET - 1 INCH ¾ ÷ 2 = 13 feet 11 ⅛ inches. Then enter RUN 7 INCH PITCH RISE, which equals 8 feet 1 ½ inches. Now click RISE 10 INCH PITCH and then RUN. This yields a height of 9 feet 9 inches.

It's straightforward when we let the Construction Master do the work. From here, you can click DIAG to find the 10:12 king common length (12 feet 8 5⁄16 inches).

IRREGULAR HIP LAYOUT

I start the layout from my kings to simplify sheathing later. The span is 28 feet long. The main roof is pitched at 7:12, and the hip is 12:12. I write down all of the numbers as I determine them so I don't need to calculate them again.


3


4


5


6

Effective run of the 7:12 commons:

28 FEET – 1 INCH ¾ ÷ 2 = 13 feet 11 ⅛ inches

To find the **length of 12:12 king common,** hit DIAG and RISE to get 16 feet 1 ½ inches; click RISE to get 97 ½ inches; click = RISE, then 12 INCH PITCH, then DIAG. You should end up with a 12:12 king common length of 11 feet 5 ⅞ inches.

Hip length: Now click 7 INCH CONV HIP/V to find the irregular hip length: 18 feet 0 ⅝ inches.

Cheek cuts: Click HIP/V again to find the hip slope, 26.74°, and again until you see 59.74° and 30.26°. These are the cheek-cut angles for your hip and also for the jacks on either side of the hip.

Note: Another method to find the angles for the cheek cuts is to use a triangle with one leg at 12 inches (press RUN) and one at 7 inches (press RISE), then click DIAG until you get the angles.

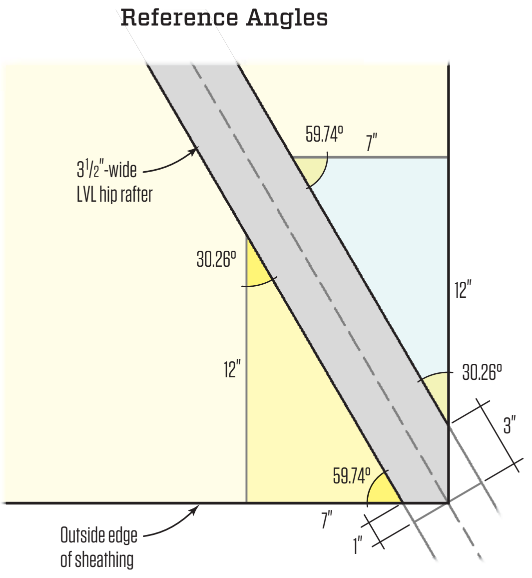
CALCULATING THE JACKS

Whereas with a regular roof, we can cut two pairs of jacks (four at each length), on an irregular hip, we need to calculate the jacks for each side of the hip separately. This means that we need to have a pair of jacks for each pitch and need to do a little more ciphering.

7:12 side. The 7:12 jacks are calculated using the 12:12 effective run. This places us at the edge of the 7:12 king. To find the effective run of the first, longest jack, I first need to adjust for the thickness of the hip where it crosses the wall plate. Here's where my drawing

(see "Keeping Track of the Angles," right) comes in handy. Using the CM calculator, I enter: 1 INCH ¾ RISE 59.74 PITCH, then click DIAG to get 2 inches.

Next, I need to subtract the jack spacing to find the long point of the first jack. In this case, with 24-inch-o.c. rafters, we have a 22½-inch rafter bay. The whole calculation looks like this: 97½ inches (run of 12:12 kings) - 22½ inches (rafter spacing) - 2 inches (hip adjustment) = 6 feet 1 inch, or 73 inches. In looking at the drawing, I see that this 73 inches is the measurement along the 7:12 plate from the edge of the hip to the long point of the longest jack. I then enter 73 INCH RUN 59.74 PITCH and click RISE to find that 10 feet 5 ⅞ inches (or 125 ⅛ inches) is the effective run of the longest jack to the hip.



KEEPING TRACK OF THE ANGLES

If you really want to understand roof geometry, I recommend going to raftertools.com. Sim Ayers does a great job of laying out how the angles work together, and his Rafter Tools app, which includes well-drawn examples of each roof configuration, helps simplify what can otherwise be a complicated subject.

For my purposes, there's just one theoretical point that helps me keep track of the different angles for an irregular hip: understanding the angles where the hip crosses the wall plates. A regular hip will bisect a 90° wall corner at 45°. The two angles at the plate corner are critical to the layout and saw sets for the cheek cuts. I keep track of these angles by using a framing square to draw out a right triangle to represent the roof pitch of the main roof. In this case, with a 7:12 pitch, one leg is 7 inches and the other is 12 inches. In this right triangle, the other two angles are 30.26° and 59.74° (found using the HipV key on the Construction Master Pro calculator; see step 5 in illustration, page 42). These angles match the angles on either side of the hip rafter. I can create this triangle with a framing square and orient the drawing to match the actual building. A way to remember which way to orient the triangle is to remember that the steeper pitch has a smaller run. This triangle, and remembering how it relates to the wall plates, helps me keep straight on which angles go where when laying out the cheek cuts.

Calculating the Jacks

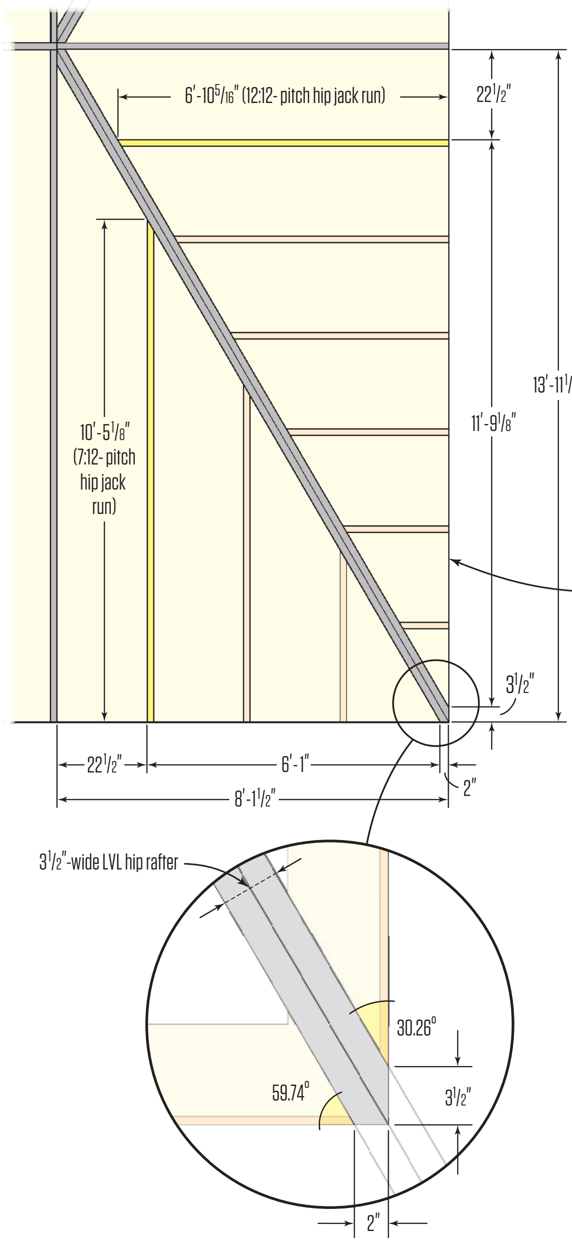
6 Find Effective Run of Longest 7:12 Hip Jack:

Adjusted run – rafter spacing (less jack thickness) – hip adjustment = effective run of longest jack

Adjust for thickness of 3 1/2"-wide LVL hip: half of hip (1 3/4") crosses top plate at a 59.74° angle, therefore:

1 3/4" **Rise** 59.74° **Pitch** **Diag** = 2" (hip adjustment)

8'-1 1/2" (adjusted run) – 22 1/2" (rafter spacing) – 2" (hip adjustment) = 6'-1" (effective run)



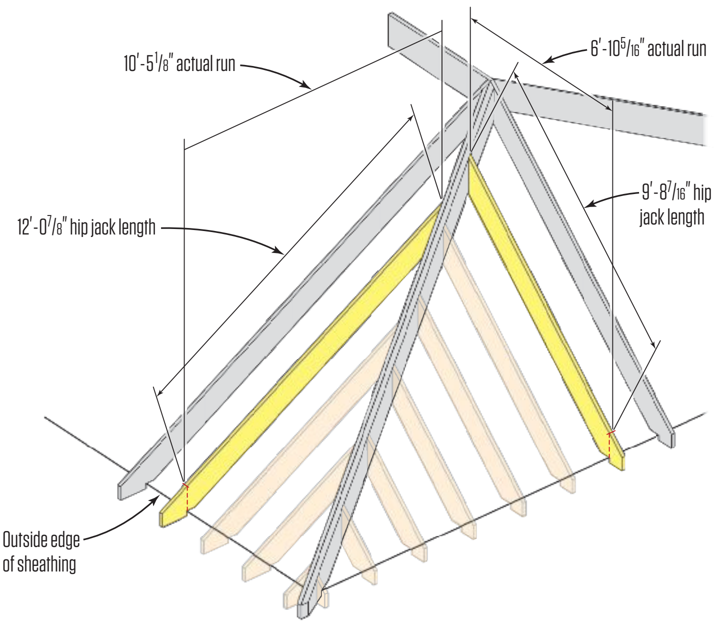
7 Find Lengths of 7:12-Pitch Hip Jacks:

6'-1" **Run** 59.74° **Pitch** **Rise** = 10'-5 1/8" (actual run to long point of longest jack)...

... **Run** 7 **Inch** **Pitch** **Diag** = 12'-0 7/8" (longest hip jack length)...

... 12 **Inch** **Conv** **Hip/V** **Jack** **Jack** = the jack difference of 3'-11 5/8"...

... **Jack** = 8'-1 1/4" **Jack** = 4'-1 5/8" **Jack** = 0'-1 15/16" for the remaining jack lengths



8 Find Effective Run of Longest 12:12 Hip Jack:

Adjust for thickness of 3 1/2"-wide LVL hip: half of hip (1 3/4") crosses top plate at a 30.26° angle:

1 3/4" **Rise** 30.26° **Pitch** **Diag** = 3 1/2" (hip adjustment)

9 Find Lengths of 12:12-Pitch Hip Jacks:

13'-11 1/8" (adjusted run) – 22 1/2" (rafter spacing) – 3 1/2" (hip adjustment) = 11'-9 1/8" (effective run)

11'-9 1/8" **Run** 30.26° **Pitch** **Rise** = 6'-10 5/16" (actual run to long point of longest jack)...

... **Run** 12 **Inch** **Pitch** **Diag** = 9'-8 7/16" (longest hip jack length)...

... 7 **Inch** **Conv** **Hip/V** **Jack** **Jack** = the jack difference of 1'-7 13/16"...

... **Jack** = 8'-0 5/8" **Jack** = 6'-4 13/16" **Jack** = 4'-9"...

... **Jack** = 3'-1 3/16" **Jack** = 1'-5 7/16" for the remaining jack lengths


7


8

To find the length of the longest jack, I use this number and click RUN 7 INCH PITCH, then click DIAG to get 12 feet 0 7⁄8 inches (or 144 7⁄8 inches). I keep going now to find the lengths of the rest of the jacks: Enter 12 INCH CONV HIP/V, then click JACK for the jack difference, 3 feet 11 5⁄8 inches (47 5⁄8 inches). Now each time I hit JACK, I step it down. My jack lengths are 97 1⁄4 inches, 49 5⁄8 inches, and 1 15⁄16 inches (this last one is basically just a tail).

12:12 side. I follow the same procedure to find the lengths of the jacks on the 12:12 side, by subtracting a 22 1⁄2-inch rafter bay to get to the long point of the jack. But on this side of the hip, the hip adjustment is deeper. To find it with the calculator, I enter 1 INCH 3⁄4 RISE 30.26 PITCH and click DIAG to get 3 1⁄2 inches.

To find the length of the longest jack on the 12:12 side, I take the effective run for the longest 12:12 jack—11 FEET 9 INCH 1⁄8 RUN—then enter 30.26 PITCH and click RISE to get the effective run for the longest jack = 6 feet 10 5⁄16 inches. To get the jack length, click RUN 12 INCH PITCH, and then DIAG to get 9 feet 8 7⁄16 inches.

After that, hit 7 INCH CONV HIP/V a couple of times and then click JACK. The calculator will show you the difference in length between each jack (1 foot 7 13⁄16 inches), and each time you hit JACK, it will count down the length of the jacks: 8 feet 5⁄8 inch; 6 feet 4 13⁄16 inches; 4 feet 9 inches; 3 feet 1 3⁄16 inches, and 1 foot 5 7⁄16 inches.

HIP RAFTER LAYOUT

The layout of the hip itself is more complicated on a split-pitch hip than on a regular hip because it doesn't cross the plate at 45° like a regular pitched roof. This means that we need to lay out each side of the hip separately.

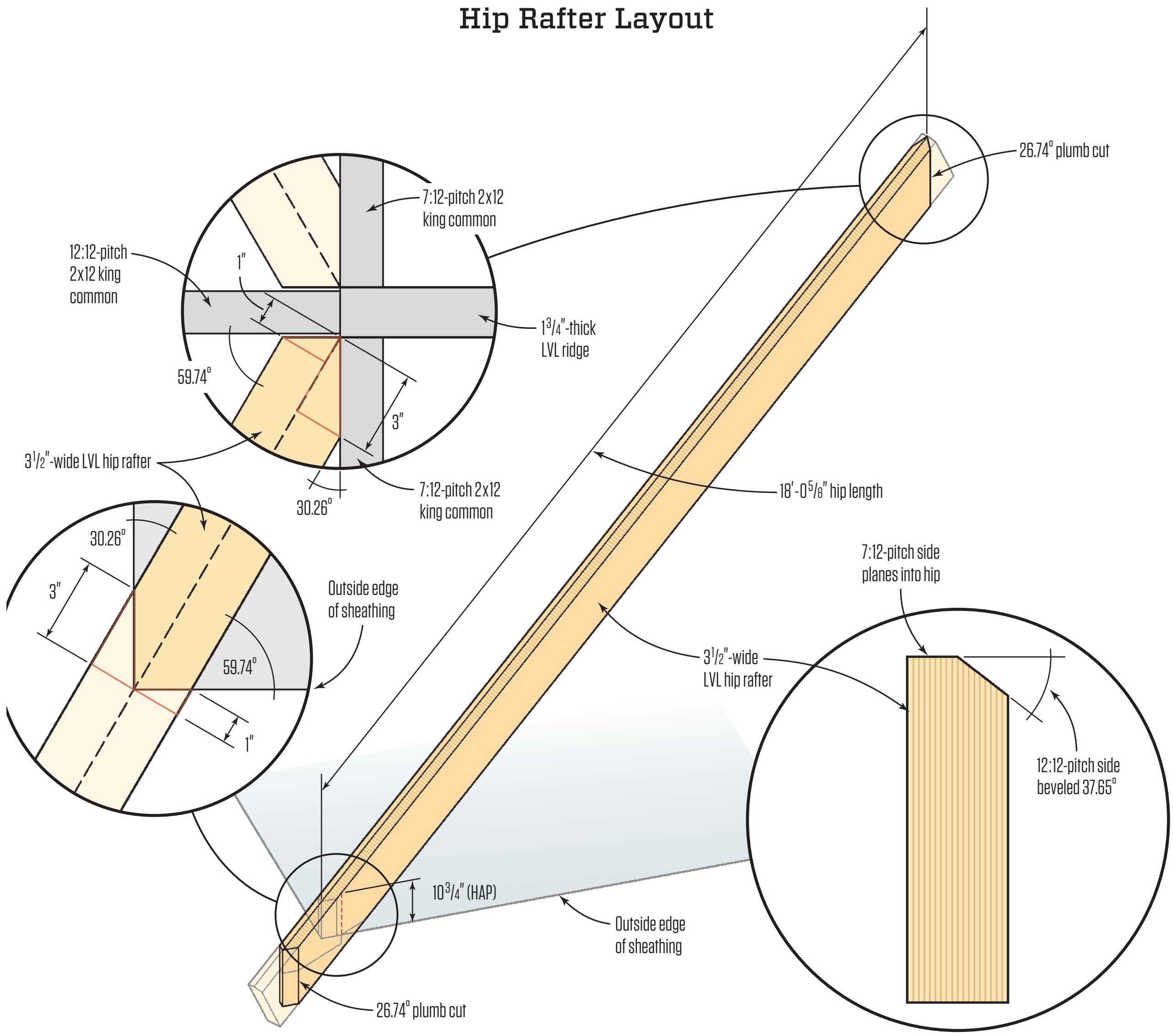
I start on the shallow (7:12) side. Going back to my drawing of the reference angles, I can see that for the double cheek cut between the ridge and kings, one side is steeper than the other.

Step 1: Mark a 26.74° plumb cut and cut that with a 0° bevel on the saw. Since I'm starting on the side of the hip that is facing the 7:12 roof, I need to draw a parallel plumb cut 3 inches back from the plumb cut I just made **(3)**. When I cut this, I will set my saw to 59.74°.

Step 2: I then draw a plumb mark down the 12:12 side of the hip. I need to cut this plumb line at a different bevel for the cheek cut on the 12:12 side; I look at my drawing and see that the edge of the hip crosses the plate 1 inch back from the outside corner. I draw a parallel plumb mark 1 inch "uphill" **(4)**. I cut this bevel at 30.26° to complete the double cheek cut **(5)**.

Step 3: Next, I hook my tape on the center of the hip and pull the hip length, 18 feet 0 5⁄8 inch, and square that line across the top edge of the hip, and drop plumb lines

Hip Rafter Layout



on each side. On the 7:12 side, I lay out a parallel plumb cut 3 inches "uphill" from the first plumb line on this side; and on the 12:12 side, I draw a plumb line 1 inch "uphill" and parallel to the first plumb line. On each of these "uphill" plumb lines, I mark the height above plate (HAP)—10 ¾ inches—from the top edge of the hip. This gives me the layout for the seat cut.

Step 6: There is some meat of the LVL above the HAP mark, which means I need to bevel the top edge of the hip rafter on the 12:12 side. To figure the bevel, I use the BuildCalc app. I enter 1 FOOT RUN 7 INCH PITCH 12 INCH CONV HIP/V and then press HIP/V until I get all the angles. I find that 37.65° is the bevel I need **(6)**.

STACKING THE ROOF

My approach in stacking the roof is to set the ridge first, then stack the 7:12 rafters and the 12:12 king common. This gives me the basic structure I need to support the hip rafters. I can then drop the hips in and set all the shortest jacks on both sides of the hip **(7)**. I then install jacks near the middle of the hip, which allows me to keep the hip straight. After that we nail the rest of the jacks at the hip **(8)**. At this point we line up the jacks at the plate, but leaving it unnailed at the plate to make blocking easier.

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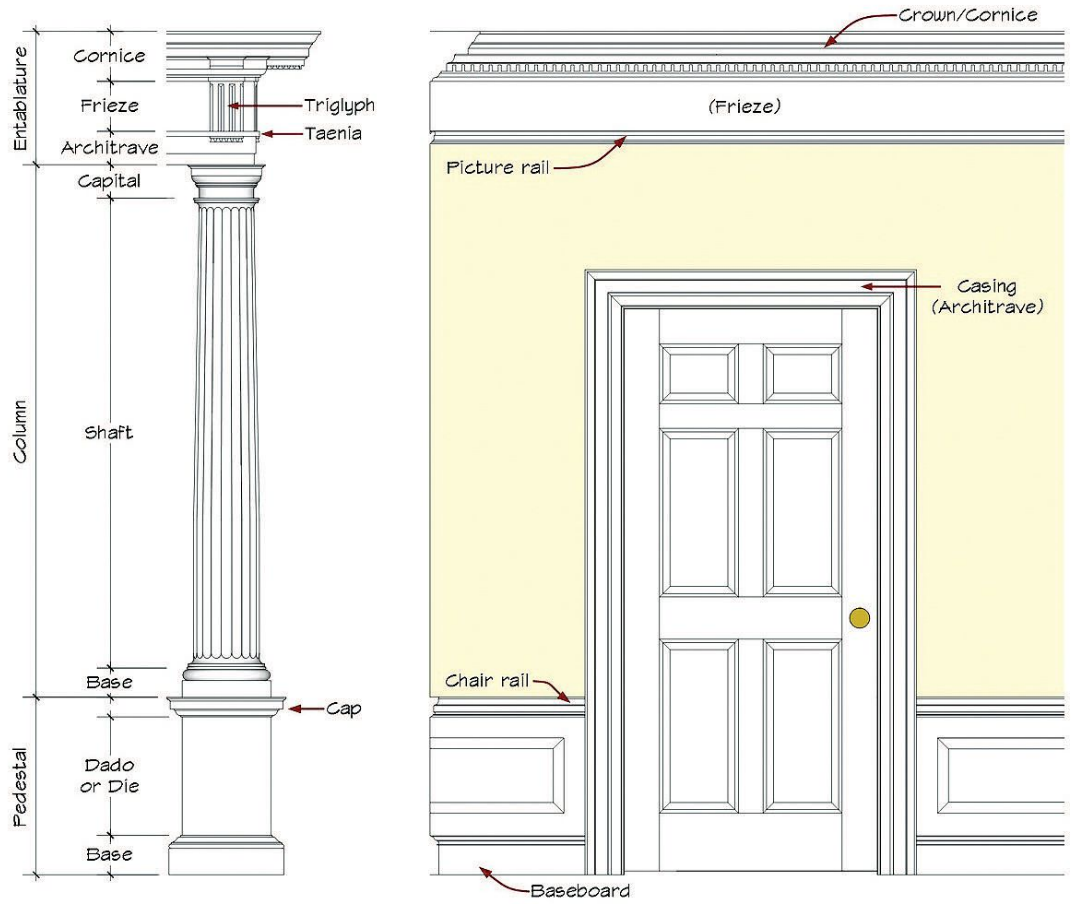


A Look at Traditional Trim Designs

Historic styles guide the trim details we use today

BY GARY KATZ

While I spend much of my time traveling around the country teaching carpenters and contractors the ins and outs of finish carpentry, I don't often have the opportunity to work for myself—until recently. I bought a home in the Pacific Northwest and during the remodel, I decided to trim all the windows and doors in a Craftsman style, which I've always admired because it's a perfect blend of classical architecture and gothic ornamentation.

If the terms Craftsman, classical, and gothic have you scratching your head, I'm hoping this article will give you some insight into the history and design of the trim that we install in clients' homes every day.

Photos: Gary Katz

CLASSICAL DESIGN: ALL ABOUT PROPORTION

Classical interior trim designs date back several thousand years to the Classical Orders derived from Greek and Roman architecture. These orders are really just general rules of proportion and ornamentation for posts and beams—the columns are the posts, and entablatures are the beams or lintels. In this case, an "order" is the relationship of a horizontal element to a vertical element. Even a simple doorway with its vertical jambs and horizontal header represents an order. So it follows that all of the trim that we install in homes originates from those orders (see illustration, above).

Most of the carpenters I meet in my travels have an intuitive understanding of proportion when it comes to building and trim.

But often they miss the nuances that make a structure or trim look or "feel" right to the observer. For instance, if you're building a patio cover, and you're using a 6x12 beam spanning 12 feet, you don't want to support that beam on 4x4s. That size post might handle the load just fine, but it would look terrible—like my skinny legs. A better look would be 6x6 posts, and an even better look for that span would be an 8x12 beam.

Classical rules for proportion help to solve those and other kinds of design problems. They provide the exact size of the column, and the proportional sizes of the column's plinth (or base), the capital (or top of the column), and the entablature details, including the architrave. Proportional rules are really nothing more than a method of dividing an entire column, including the entablature, into a system of parts (see Entablature Proportions, below left).

This illustration uses the Tuscan order as an example. Notice that the entire entablature is divided into seven parts: The architrave is two parts, the frieze is two parts, and the cornice is three parts, including the crown molding, which is one part.

But this article isn't about classical design, it's about trim carpentry. So let's take a closer look at how the classical orders of the Greeks and Romans translate into the trim details of Minneapolis and Boston.

THE ESSENTIAL ARCHITRAVE

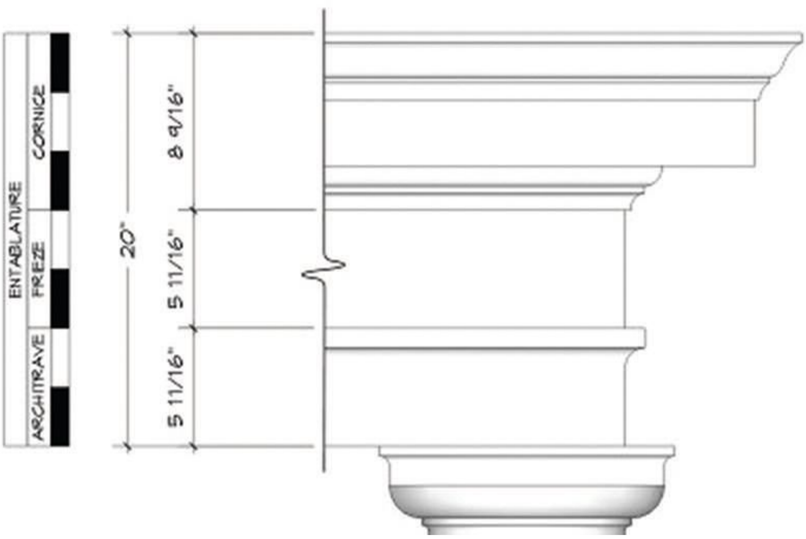
In the illustrations we've seen so far, one of the basic components is the architrave. A few thousand years ago, window and door openings were "framed" by columns and entablatures, and the architrave detail trimmed the top edge of those openings.

Today we don't build homes in the meticulous detail rendered in pattern books, but we do use architrave molding. As the pattern-book authors drew the classical orders, they took the architrave detail and modified it as the finish trim around window and door openings. And they referred to this trim element as architrave molding.

A great example of this is from Abraham Swan's "The British Architect," originally published in 1758. In this plate (below right), the top of the architrave is defined by an ogee profile—just like a back band—followed by three descending fillets. Notice the similarity between this architrave design and many casing profiles—such as the Craftsman-style casing discussed later—we use today. Of course, window and door casings are considerably reduced in size and proportion, but the progression of shapes is still basically the same.

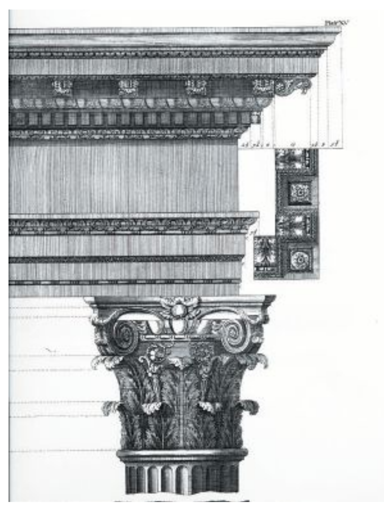
In Great Britain, casing is still referred to as architrave molding, and in some molding catalogues, you'll find that same designation. In this country, we refer to this molding as casing. But because casing isn't used only across the top of a door or window—it often miters at the head jamb and runs vertically down the legs—the terms architrave molding and casing refer generally to all the moldings that case or frame an opening such as a window or door.

Gary Katz is a frequent contributor to JLC *and presenter at JLC Live. He produces the Katz Roadshow and publishes THISisCarpentry.com.*



Entablature Proportions

The classical orders are built on proportional rules where all the elements are sized in relation to each other. In this example, the entablature of the Tuscan Order has been broken into seven parts between the architrave, the frieze, and the cornice. Note that the crown takes up a single part, or one-third of the cornice.



Architrave Equals Casing

In Abraham Swan's rendering of a Corinthian entablature, the descending shapes in the architrave are echoed in many of today's ornate casing profiles.

Illustration: Wm. Todd Murdock

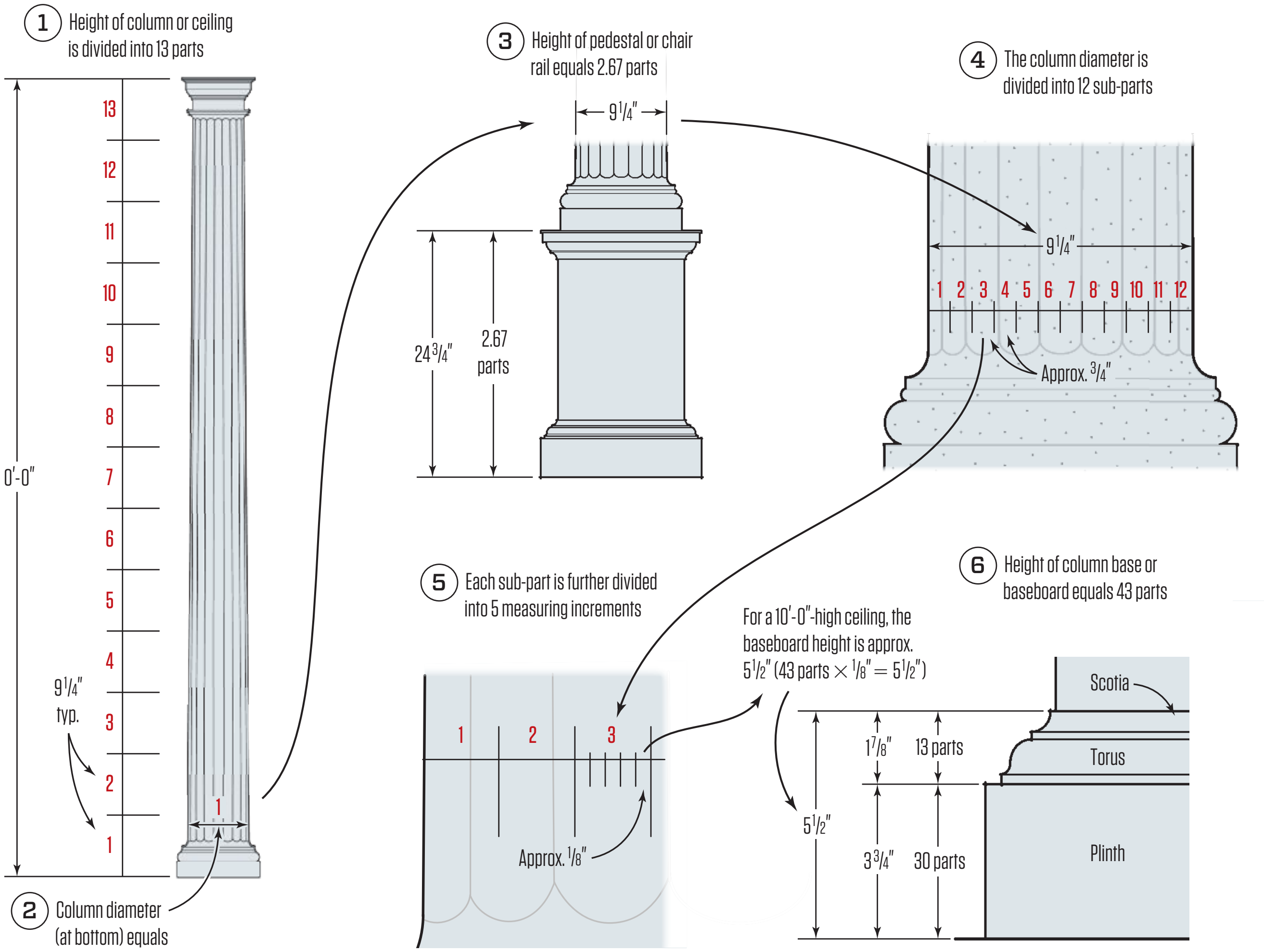
Pattern Books Pave the Way

In the 18th and 19th centuries, pattern books were the only real "academic" instruction for carpenters and craftsmen. In addition to some pretty elaborate renderings of the classical orders, these books had detailed drawings and plans for features such as doorways, windows, and stairs, and sometimes even complete floor plans.

In many ways, pattern books were the equivalent of the building magazines and "how-to" books of today. In William Pain's book, "The Practical Builder," published in 1774, he sizes (and positions) all his moldings based on a classical column. In the illustration below, he first breaks down a Doric column (one of the simplest of the orders) into 13 parts, with the diameter of the column equaling one part. (In our example, we use a 10-foot column, with a diameter of 9 1/4 inches). Then Pain divides the column diameter into 12 parts (or 3/4 inch), and each of those parts into five parts (around 1/8 inch in our example). Note that he positions the chair rail (the top of the pedestal) at 2.67 diameters, or 24 3/4 inches, from the floor.

These measurements are not exact, and they don't need to be. What is most important is that he has established a system for sizing and placing all the molding parts that you need to make and install. Using baseboard as our example, it's no accident that the baseboard in a room with 10-foot ceilings works out to be 5 1/2 inches tall—sound familiar?

William Pain Breaks Down Classical Proportions



HISTORIC STYLES

The design of casings (architrave molding) has changed and evolved into a broad variety of architectural styles throughout our history, but these styles aren't difficult to identify or differentiate from each other. Here is a general overview of how casing styles developed in this country over the last few centuries, along with a photo example of each style. You can look around historic homes and see countless variants on these styles, as well as examples where elements from multiple styles were used in the same home.

Georgian Style (1700–1800)

Colonial architecture is broken into three separate periods. The First Period homes are little more than lean-tos and log cabins—that's where the working class would have lived. Most of our clients would have lived in Georgian-style homes, and the casing around doors would have included crossette architraves—small horns or rectangular extensions at the head jamb, formed by additional miters in the casing. In more-opulent homes, such as the John Brown home below, ornate entablatures and pediments would have been added above the casing.

Federal Style (1780–1850)

Federal period designs are known as "neoclassical" or "newer" interpretations of the classical orders. This style is easy to recognize. Plinth blocks mimic the original plinths or bases on classical columns, and decorative rosettes imitate the capitals, as in this example from the Trousdale home. Fluted casing, sometimes with a single flute, was also prevalent and completed the appearance of a classical column.

Victorian (1830–1900)

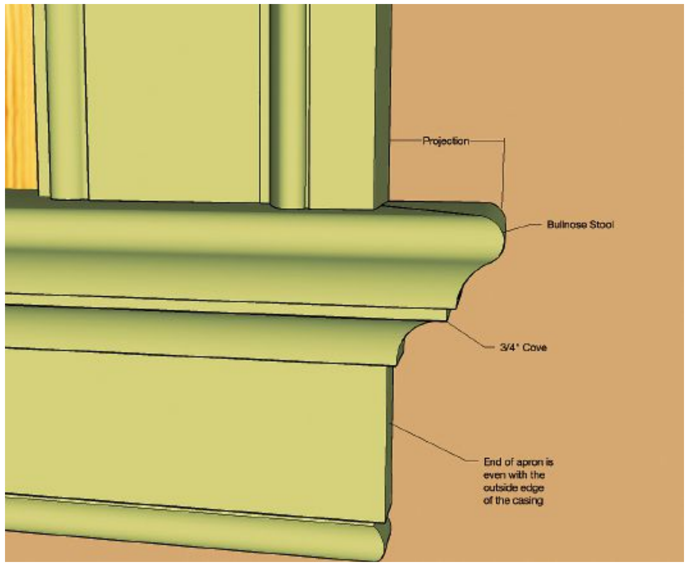
The Victorian period combined neoclassical design decorated with a variety of gothic details. The doorway shown in the photo above of the Piru house is cased with plinth blocks and rosettes. An extra rosette was added at the pedestal and chair-rail height. Again, wide fluted casing resembles a classical column. The overdoor is decorated with a spindled sunburst.

Craftsman (1900–1930)

Craftsman-style trim designs come in many shapes and sizes, but the most common design echoes the lines of the simple classical orders. In this photo, the casings sit on plinth blocks and an architrave bead above the door defines the head.

DESIGN RULES YOU CAN APPLY

Most carpenters know that rules are made to be broken. Many of us count on bending or breaking the rules to make details work out for specific projects. While there aren't many contemporary resources available that provide details for common interior trim designs, there are some examples taken straight from classical architecture that can help guide traditional trim installation.



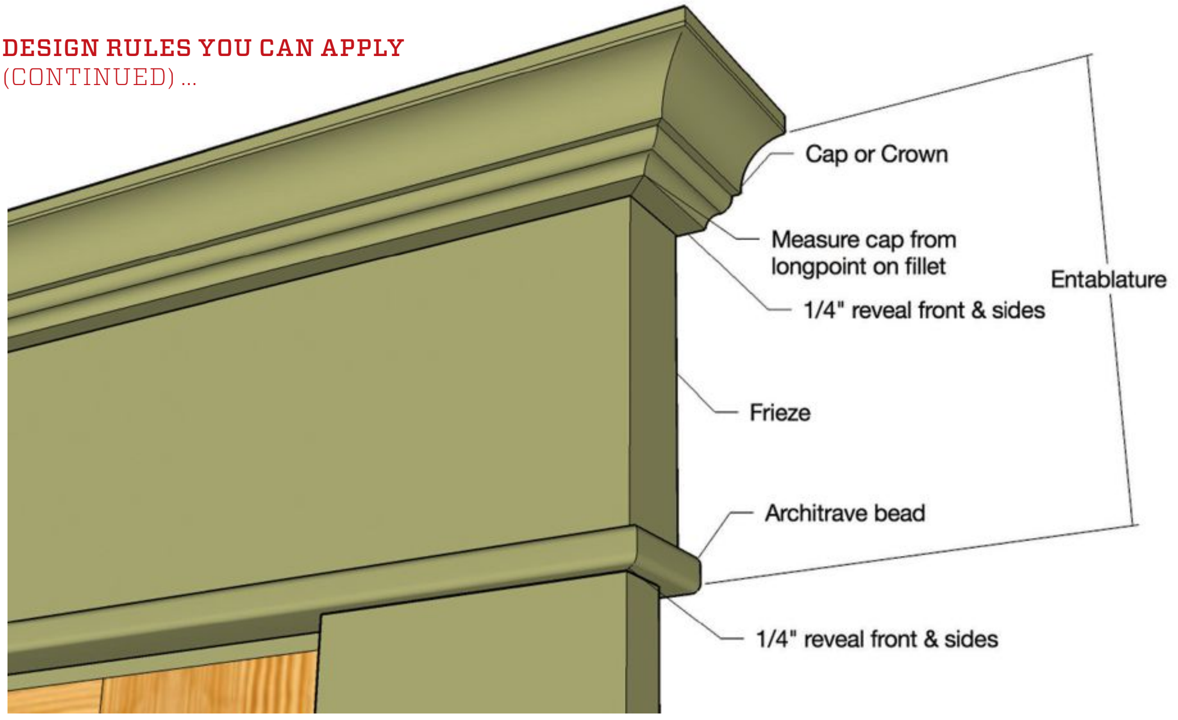
Stool and Apron Installation

When you install a window stool, the length of the stool is determined by the length of the apron, and the length of the apron is determined by the outside dimension (O.D.) of the casing. Simply put, the apron should be cut so that it's plumb with the casing (see photo, above left).

But when you install bullnose stool with a cove molding under the stool, you are forced to extend the stool projection. Stool is meant to replicate the cap or chair rail on a classical column pedestal, and the cove molding beneath the stool is a collar molding that wraps around the column or in this case, the window casing (see illustration, top).

Even without a bullnose stool profile, cove molding can push the stool extension considerably past the casing. This explains why I've seen the "plumb-cut apron" rule broken in several historic homes (see photo, above right). Again, in this situation the carpenter decided what would look the best.

DESIGN RULES YOU CAN APPLY
(CONTINUED) ...



Craftsman or Classical Door Trim

It's always nice to have one rule that applies to different situations. The "plumb-cut" rule can be applied to classical heads, too. In the Doric Order, a plumb line can be drawn from the end of the frieze right through the Doric capital, ending flush with the top of the column.

Classical head trim is very much like classical entablature. The head is assembled with an architrave bead or molding at the bottom (see illustration, top), a frieze, and then a cap or crown molding at the top. Like the stool and apron, the length of the frieze is usually the O.D. width of the casing, so the end of the frieze is usually plumb with the outside of the casing.

The length of the crown and architrave bead moldings is determined by the bottom reveal of the crown, which should be the same along the face of the frieze and at both ends. If the exposed reveal or fillet is 1/4 inch, then the length of the crown (which is measured from the long point of the bottom fillet) would be 1/2 inch longer than the length of the frieze, or 1/2 inch longer than the O.D. of the casing. The reveal of the architrave bead is identical to the crown, so the lengths should also be identical.

While projecting the head casing slightly (1/2 inch to 3/4 inch) can look appealing in some cases (see photo, above left), a dramatically emphasized projection isn't something all customers would appreciate (see photo, above right).

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Detailing a Superinsulated Slab

A less-expensive and energy-efficient foundation for a house

BY STEVE BACZEK AND STEVE DEMETRICK

Photos: Steve Demetrick, except where noted

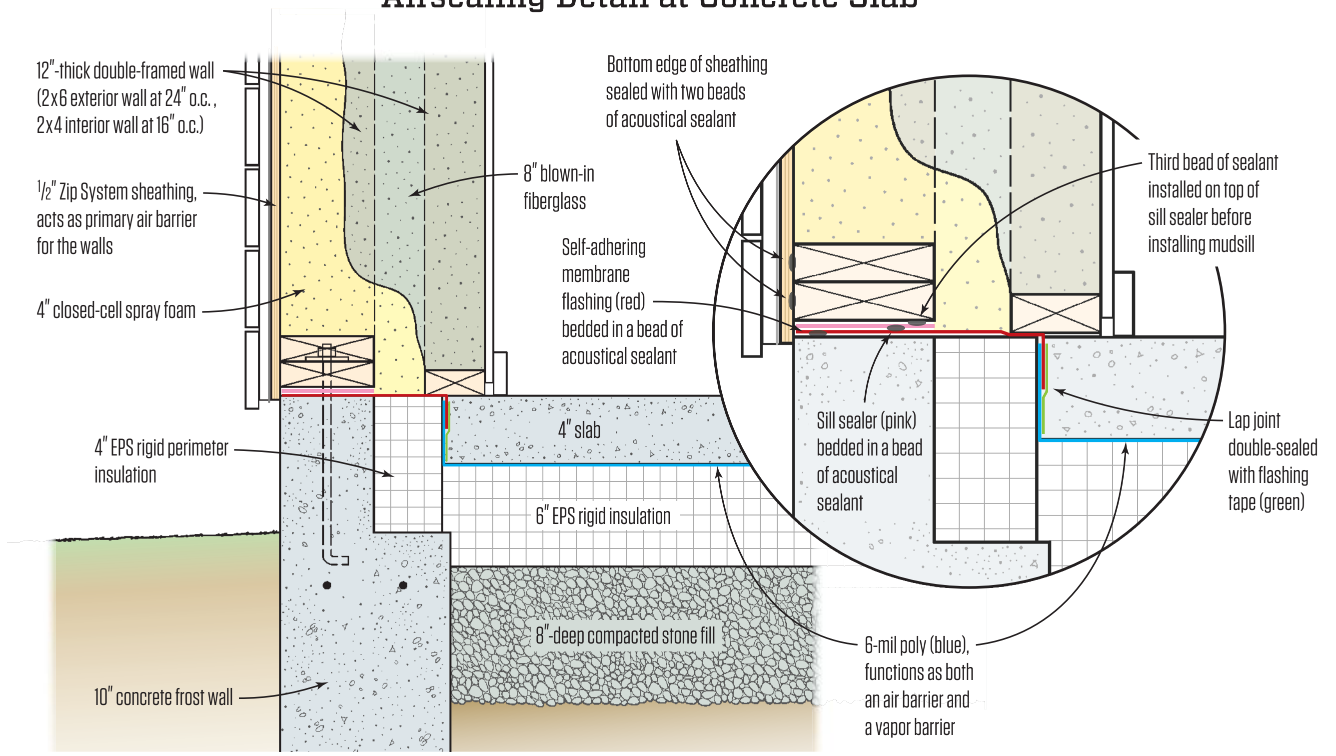
Every home can be thought of conceptually as a six-sided box, with a lid (the roof or topmost ceiling), four sides (the walls), and a bottom (the basement floor or the slab). From an insulation standpoint, people often assume that insulating the slab is a waste of time because it sits on the ground. But while the slab may generate less heat loss than the walls or the roof, it should definitely be included when addressing a home's overall insulation needs.

PROPORTIONAL INSULATION

But how much insulation is needed in the slab? The answer comes from looking at the house as a system—at the amount of insulation, along with level of airtightness and the energy requirements, for the whole house. The effectiveness of insulation tends to max out if it's not increased proportionally in all areas of the house. So if we insulated the lid and walls to high levels, an uninsulated slab would be a weak point in the insulation envelope—increasing R-values in the lid and walls would have little effect without increasing the insulation in the slab as well. For example, if we started with an R-100 roof assembly, increasing the roof to R-150 would have little impact on the home's performance unless we proportionally increased the insulation levels in the walls and the slab.

The good news is that the temperature delta (difference between highs and lows) in a slab is the lowest and most constant of any of

Airsealing Detail at Concrete Slab



the sides of the box. This is due primarily to the fact that the slab is coupled with the ground, which, for the most part, maintains a pretty steady temperature. Because of the ground coupling, the R-value requirement for the slab can be significantly less than that of the above-grade walls or the ceiling.

A proportional rule of thumb for a high-performance home design that uses a slab-on-grade foundation system is that the R-value of above-grade walls should typically be roughly half the R-value of the lid. Proportionally, the R-value of the sub-slab insulation should be half that of the above-grade walls, or roughly one-quarter the R-value of the lid.

For this project, we followed those proportions fairly closely. We calculated various insulating scenarios using Passive House planning software and decided on a roof R-value of about R-92, with the above-grade walls at roughly R-55, and the sub-slab insulation at around R-25.

CHOOSING THE TYPE OF INSULATION

Once we had determined the target R-value, choosing the proper insulating material was next. Rigid foam insulation seemed to be the best choice, and we chose expanded polystyrene (EPS) IX foam for a number of reasons. This type of foam is engineered and rated for ground contact, unlike many off-the-shelf rigid foams. And it is treated with borates to guard against insect damage.

EPS foam also has less impact on the environment than other types of foam, because of the blowing agent it's manufactured with. The EPS we used was processed in Rhode Island fairly close to where the house was being built, again reducing the carbon footprint of the material.

On top of all that, EPS insulation was the least expensive among our choices based on R-value per inch, and it came in the full thickness we needed. It's rated at R-4.13 per inch, so we needed a thickness of 6 inches to meet our requirement of R-25—and the EPS insulation was readily and conveniently available in 6-inch-thick panels.

PAY ATTENTION TO THE EDGES

Besides the insulation between the ground and the slab, the most critical but often ignored component of the slab-insulation system is the perimeter insulation around the edge of the slab (see "Airsealing Detail at Concrete Slab," above). The perimeter insu-

lation insulates the slab from direct contact with the foundation wall, which is most susceptible to heat loss because of its direct contact with the outside air. The perimeter slab insulation and the sub-slab insulation together wrap the slab on five sides and isolate it from any conductive heat loss through the foundation or the ground.

The house walls were to be 12 inches thick and double-framed with 2x6s 24 inches on-center for the exterior wall frame, and 2x4s 16 inches on-center for the interior wall frame. The foundation system consisted of 10-inch-thick concrete frost walls that extended 4 feet into the ground with a slab-on-grade inside the walls. The thickness of the frost walls gave us plenty of material to form a step in the top of the wall, creating a 6-inch-wide top surface to support and anchor the 2x6 exterior wall. The remaining thickness of the frost wall stepped down 8 inches to provide a 4-inch-wide shelf for the perimeter slab insulation **(1)**.

A 4-inch-thick by 8-inch-tall piece of EPS would then fit on the foundation shelf to be our perimeter insulation, and the 6-inch sub-slab insulation would butt into the perimeter insulation 4 inches down from the top. The concrete for the slab would fill the remaining 4 inches to the top of the perimeter insulation, creating a completely isolated and thermally broken slab.

SUB-INSULATION PREPARATION

Once we'd finalized the insulation strategy for the slab, we began preparing the ground below the insulation, also taking steps to deal with groundwater, water vapor, and radon management. The design decision to use the top surface of the slab as the finished floor made the detailing much easier because we didn't need to isolate the concrete slab from an additional layer of finish material.

The existing site conditions called for elevating the new slab and foundation above the existing grade. Technically, this arrangement is a "slab above-grade." We brought in fill and elevated the grade to put the slab at a height roughly 16 inches above the surrounding grade **(2)**. Raising the slab helped to minimize the risk of problems from groundwater.

For part of the fill under the sub-slab insulation, we compacted 8 inches of ¾-inch stone, which also acted as a capillary break between the compacted ground and the concrete slab. When the sub-slab bed was finished, the contractor who had brought in the stone

told us that ½-inch pea stone would have been easier to screed and compact flat: Lesson learned.

The layer of ¾-inch stone provided a means to collect any sub-slab radon. We ran 4-inch-diameter perforated pipe horizontally in the stone bed and connected it to a riser that exits the home through the roof, for a passive radon-removal strategy **(3)**. If needed in the future, an in-line fan, installed in the riser where it passes through the attic, would make the system mechanically active.

LAYING DOWN THE INSULATION

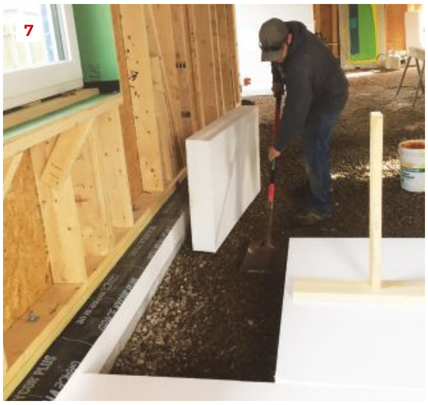
The insulation installation began with the 4-inch by 8-inch perimeter pieces that sat on the foundation shelf. To cut the 6-inch EPS sheets, we sawed through from both sides using a Festool track saw **(4)** and finished the cut with a reciprocating saw **(5)**. This approach gave us square and accurate cuts for a tight-fitting, gap-free installation and eliminated the need for any glue or fasteners at the perimeter pieces.

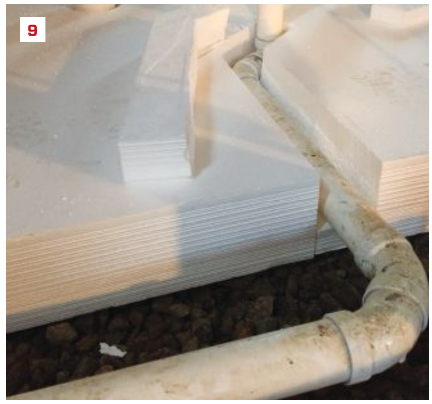
As the pieces went in, we fine-tuned the crushed stone under each one so that it would be evenly supported. If more stone was needed, we added a little from a 5-gallon bucket. We raked the stone smooth **(6)** and then flattened it with a flat shovel **(7)**. To make sure the stone stayed at a consistent level, we checked it using a laser and a site-built "T" made of 2-by stock with the heights marked on it **(8)**. The "T" also helped us tamp the stone flat.

The foam sheets needed to be cut to fit around posts and the drain lines that had been stubbed in to fall inside an interior wall when the interior walls were framed. The plumber had left one of those pipes above the level of the stone, using temporary props to set the pitch of the pipe. When the foam panels went in, we replaced the props with solid foam and cut a channel around the pipe **(9)**. We sealed around the pipe with canned foam and then set the cap for the channel in place. We oversized the holes slightly around the other stubs to facilitate installation of the foam panels and filled any gaps with canned foam.

MULTITASKING PLASTIC SHEET

After we finished fitting the insulation, we covered it with a sheet of 6-mil polyethylene that serves a number of functions. It acts as a backup to prevent capillary water movement from the ground to the slab, and it also serves as our vapor barrier in the





system, preventing any moisture from rising through the assembly and making the slab damp. Another reason for using the polyethylene sheet on top of the rigid insulation was to keep the wet concrete from seeping between—and under—the insulation panels during the installation. We had heard horror stories and seen scary pictures of wet concrete getting under insulation and causing the panels to "iceberg" or float up through the wet mix before it hardened.

But the most important function of the 6-mil polyethylene sheet in this assembly was to provide an air barrier for the slab. The challenge was finding a way to connect the poly sheet to the air barrier around the rest of the house.

Usually the slab is poured before the framing starts. In that case, we would simply drape the poly sheet over the foundation wall and integrate it into the mudsill assembly, which is part of the wall air barrier. But we were building this house in the winter in New England, when pouring an exposed slab would be difficult. In addition, the slab surface was to be the finished floor, and the winter snow and weather would have destroyed it. So we opted to frame the exterior walls of the house first, which meant we had to devise a strategy for connecting the air barriers after the walls were framed.

We relied on Zip System wall sheathing for the primary air barrier for the above-grade exterior walls—a detail that we've used successfully numerous times. With the slab pour delayed, we decided to install a 10-inch-wide piece of adhered-membrane flashing on top of the foundation before we started framing. We bedded the flashing in a bead of acoustical sealant and applied a second bead of sealant on top of the flashing before installing the sill seal and the mudsill **(10)**. A strip of flashing about 5 inches wide was left inside the 2x6 frame. Later, we peeled the backing from the flashing and adhered it to the edge of 6-mil poly to connect the air barriers **(11)**.

At all electrical and plumbing penetrations through the slab, we securely taped the poly sheet to the pipe or conduit using an all-weather flashing tape **(12)**. We also used flashing tape to reinforce and double-seal the seam between the flashing membrane and the poly. Two support posts in the house sit on concrete footings that are roughly level with the top of the foam panels. We wrapped the post bases with membrane flashing, extending it well over the level of the concrete, and then secured the poly to the membrane with flashing tape. We double-checked all the taped

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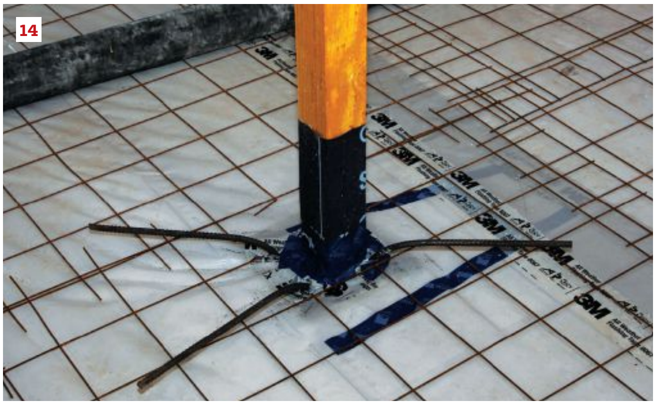

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connections to ensure the continuity of the air barrier after the slab was poured.

THE POUR

Before ordering the concrete, we placed 6-inch by 6-inch steel reinforcement mesh over the entire slab area, cutting it where needed to fit around pipes or posts **(13)**. To integrate the post footings with the slab, we included four lengths of rebar at the corners of each footing and bent these over the wire mesh **(14)**.

The lot was fairly tight and access for the concrete trucks was limited, so the concrete contractor opted to pump the mix in through the front door. The contractor set up a laser level—in an area that was formed off to stay dry—to check the slab level as the mix was distributed and screeded **(15)**. The height of the finished slab followed the top of the perimeter insulation pretty closely.

Because the slab surface was to be the finished floor of the house, the contractor created a smooth, polished surface using a power trowel **(16)**. Within a few days we were able to begin framing the inside 2x4 wall of the double exterior walls. This inside wall rests primarily on the thermally-broken insulated slab.

As a postscript to this particular project: We did a blower-door test when the air barriers for the walls and ceiling were completed, but before the slab insulation and poly were installed. We did a second test after the slab was poured with the completed sub-slab air barrier. The numbers from the two tests were very similar—enough so to conclude that the slab and the poly-sheet air barrier do not play a significant role in the airtightness of this house. Nevertheless, we still think it's worth taking these measures for the long-term integrity of the air barrier and will continue the practice. Different soil conditions in a different location might test differently.

In the end, we achieved our primary goals: creating a well-insulated slab that proportionally matched the insulation levels of the rest of the house, and ensuring that the home would meet a high level of thermal performance.

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Steve Demetrick is a residential builder and remodeling contractor in Wakefield, R.I.

Photos on this page: Roe Osborn

Products

BY LAUREN HUNTER

1. A Cut Above
New FlexTech Y9216 gloves from Wells Lamont are designed to protect against cuts and lacerations. The palm is dipped in a sandy nitrile coating for improved grip in oily applications; the shell is made from a blend of high-performance fibers and stainless steel to help ensure safety and comfort; and the back is uncoated to allow for air circulation. FlexTech Y9216 gloves can be laundered repeatedly for longer life and are available in six-pair packs for about $20. wellslamont.com

2. City Slicker
Slicker HP Housewrap from Benjamin Obdyke combines a water-resistive barrier and rainscreen into one solution for both residential and light-commercial applications. Made for use with wood, fiber cement, stone veneer, and stucco cladding, Slicker HP incorporates vertical channels to direct bulk water out of the exterior wall via a 1/4-inch drainage space. The rainscreen also can be removed without compromising the housewrap element of the material. Slicker HP costs 90 to 95 cents per square foot. benjaminobdyke.com

3. Flat-Roof Drainage Mat
Bonar's Enkadrain 3801 drainage mat is made for refinishing flat roofs. With a recycled propylene drainage core and lightweight filter fabric thermally bonded to each side, Enkadrain 3801 is 30% thinner than other mats on the market, is UV-protected for up to 30 days after installation, and is breathable to prevent water from collecting under it. Azek named Enkadrain 3801 as its preferred drainage mat for installing Azek Pavers on flat roofs (shown). Each roll covers about 600 square feet and costs $1.50 to $2 per square foot. bonar.com

4. Coastal Re-Launch
Weather Shield will re-launch its Premium Coastal line—which now has Miami-Dade approval—this September. Impact glazing options on the aluminum-clad wood windows and patio doors feature a resilient PVB layer fused between two panes of glass to help prevent flying debris from entering the home. The cladding comes in high-durability paint in 12 standard and 45 designer colors, and in eight anodized aluminum options. Hardware that's resistant to corrosion from exposure to salt spray is available. Pricing will vary. weathershield.com

5. Warm Floors of All Sizes
Ditra-Heat installers now have twice as many cable-length options for floor warming projects. Schluter Systems offers 34 cable lengths, including 17 each for 120V and 240V circuits. The additional lengths fill in gaps between previous length offerings, and can be used in spaces as small as 10.7 square feet, such as powder rooms. The Ditra-Heat system incorporates heating cables that snap into an uncoupling mat and gives installers flexibility to customize every installation. Pricing ranges from $225 to $1,300, depending on project size and scope. schluter.com

6. Clip It Together
The Ultimate Clip is Nichiha's improved installation system for its fiber-cement Architectural Wall Panels. Using a starter track and 26-inch clips, the system eliminates the need for multiple clip styles and sizes for different installations. The Ultimate Clip creates a 10-mm rainscreen to drain moisture and dry the wall, and it improves the Wall Panels' wind rating by up to 83%. Only two-and-a-half clips are needed per 6-foot panel in basic installations. Users can customize the system as needed. nichiha.com

7. Convection Heats Up
EuroChef's Verona brand offers the only 36-inch fully electric range on the market. High-power radiant burners deliver quick and even heat to the range's vitro-ceramic surface. The five-element configuration has a center dual element for large pots. The multi-function European convection oven provides seven cooking modes for baking, broiling, and defrosting, with convection options that prepare meals in less time than a conventional oven. Other features include a full-width storage drawer and an easy-glide rolling rack. Suggested retail is $3,250. veronaappliances.com

8. Get the Right Size
Kilz Hide-All primer sealer now comes in 1- and 5-gallon containers. The high-hide, fast-drying latex primer sealer can cover issues like bold colors and is formulated to prepare materials such as drywall, plaster, woodwork, and masonry, as well as previously painted surfaces, for painting. Apply with a brush, roller, or spray, and top-coat with latex or oil-based paint after just one hour. One- and 5-gallon buckets are available at Lowe's for $14 and $63, respectively. A 2-gallon bucket retails for $26. kilz.com

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9. Modern Reveal
Engineered for use with fiber-cement panels as well as fiber-cement and wood lap siding, Easytrim Reveals panel trim system helps create low-maintenance, modern facades. The product line includes nine profiles, with three options for horizontals, verticals, and corners. The components nest tightly together—caulk-free—to help ensure a flush fit for siding, while providing space for moisture drainage. Components pricing will vary by color and profile from $1.69 per linear foot for a primed horizontal, to more than $3 per linear foot for black anodized verticals (shown). easytrimreveals.com.

10. Rack ’Em
Weather Guard’s new EZGlide2 drop-down ladder racks are safer and easier to operate, particularly on high-roof vans. A long handle raises the ladder, positioning it safely beside the van at convenient loading height. The EZGlide2 is built with powder-coated aluminum to reduce its weight and maximize the carrying capacity of the van. Racks hold up to 100 pounds of gear per side, and fit extension ladders up to 40 feet long and step or podium ladders from 3 to 12 feet. An optional third cross-member fits a conduit carrier for secure storage. Standard models range from $900 to $1,200, depending on size and vehicle type. ezglide2.com

11. Trimmed in White
Fine-grit sandpaper and a carpenter’s patience have nothing on the smooth finish of Woodgrain Millwork’s Finished Elegance interior trim. Technology from Eastman Cerfis helps achieve a finish that’s more durable and water-resistant than sanded-and-painted trim. Installed with Finished Elegance caulk, the material requires no priming or painting, but does accept paint. Pricing per linear foot ranges from 50 cents for smaller, general-purpose profiles to $2.50 for bases, crowns, and casings. finishedelegance.com

12. Beautiful Bath Storage
Ryvyr has updated the transitional design of its Kent bath furniture collection. Suited for small bath and powder rooms, the collection now includes a wall-mounted vanity with a shallower, 17.7-inch depth. The solid-ash pieces are available in brown ebony and whitewashed finishes, with brushed nickel hardware. The maker’s countertops are all compatible with the vanities. Pricing starts at $785 for the wall-mounted vanity. Matching linen towers and mirrors are also available. ryvyr.com

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BY DAVID FRANE

Milwaukee's 6.0-Ah battery (left) promises slightly more power and longer runtimes for high-torque tasks. Bosch's inductive charging system (below) charges a tool while it sits on the charger. Here, a tool is charging in the optional "mobile holster."

A Year in Batteries

2015 is shaping up to be a big year for power-tool batteries, which means it will be a big year for cordless power tools. Improvements include higher amp-hour packs, improved battery chemistries, and high-tech enhancements such as Bluetooth connectivity and inductive charging. Some of the new batteries are already out and several are scheduled for release early next year. One was recently announced in Europe, and it's only a matter of time before it becomes available in the U.S.

AMP-HOURS

Batteries were not the sexiest products announced at a recent Milwaukee media event, but they were arguably the most important. Beginning in January 2016, the company plans to offer M18 packs rated at 6.0 and (amazingly) 9.0 amp-hours.

The 6.0-Ah pack is an Extended Capacity (XC) pack with upgraded cells. In use, it promises to provide proportionally greater runtime than existing 4.0- and 5.0-Ah packs, and with most tools, slightly more power. The jump to a 6.0-Ah pack was expected. Bosch already offers a 6.0-Ah battery (BAT622) in Europe, and as of this month, is offering it here.

Unlike the announcement of an upgraded XC pack, Milwaukee's announcement of a 9.0-Ah pack was completely unexpected. Half again as tall as an XC pack and about a half-pound heavier, the 9.0-Ah pack will be the first 15-cell, 18-volt pack on the market. The current standard for full-size 18-volt packs is 10 cells. The new 9.0-Ah pack will fit existing M18 tools but is not intended for use with all of them; it'd be overkill to put one on a compact drill or impact driver. The bigger packs were developed to power tools such as recip saws, circular saws, and the new "mega" tools announced at the media event—an SDS Max rotary hammer, a Super Hawg right-angle plumber's drill, and a magnetic drill press. Tools of this size

With a smartphone app, users can monitor the condition and charge of this Bluetooth battery. The app can also disable a battery that is out of range, to discourage theft.

work with XC batteries but do better with larger packs.

INDUCTIVE CHARGING

This year, Bosch introduced the world's first inductive charging system, which consists of a special charger and batteries that can be used with any Bosch lithium-ion power tool. Batteries can be charged, in or out of the tool, by placing them on the charger. A coil inside the charger sends electromagnetic waves to a coil inside the battery that converts magnetic energy to current used to charge cells.

With this system, battery amp-hours are no longer the main concern. The idea is to put the tool on the charger whenever it's not being used, so the battery is almost constantly charging. Unless you use the tool for an extended period of heavy work, the pack is unlikely to ever be depleted. Obviously, this works best when the operator is working at a single location with a tool that can easily be placed on the charger. A "mobile holster" helps make the system especially useful for service work: With the holster mounted in the truck, a tradesperson can easily recharge the battery on the way to and from jobsites.

The batteries aren't restricted to inductive charging. They can always be removed from the tool and charged in the usual manner on a standard charger.

LIHD PACKS

Metabo is about to introduce a new LiHD (Lithium-ion High Demand) pack that will surpass the Ultra-M pack introduced a couple of years ago. The 5.2-Ah Ultra-M came out when tool batteries sold in the U.S. topped out at 4.0 Ah. Until very recently, it was the highest-rated 18-volt battery sold in this country—a distinction that now belongs to the Bosch 6.0-Ah pack.

Metabo isn't worried about competition from higher-Ah battery packs. The new LiHD pack will top out at 6.2 Ah. Its claimed runtime is beyond what one would expect for an increase of 1.0 Ah—according to the manufacturer, the new pack will yield 87% more runtime (based on testing with a grinder cutting sheet steel) than the company's current 5.2-Ah pack. Even more surprising is the claimed increase in power of the LiHd—67% over 5.2-Ah Li-ion packs. Metabo claims the increased power output is the result of better cell chemistry, larger battery contacts and cell connectors, and improved alloys used in contacts and connectors.

The new batteries were recently announced in Europe, and it's only a matter of time before they're available stateside. Metabo's take on the LiHD pack is similar to Milwaukee's take on its 9.0-Ah pack: The new packs will boost the performance and runtime of existing tools and allow the company to introduce tools that until now have been difficult to run without cords. One example Metabo points to is an 18-volt slide miter saw that is currently sold in Europe but has yet to be offered here. Metabo makes a lot of grinders and tools for drilling and chipping concrete, so there are likely some new cordless products coming in those categories.

BLUETOOTH BATTERY PACKS

At a media event held in June at its assembly plant in North Carolina, DeWalt announced the world's first Bluetooth tool battery. Designed to be used with the free Tool Connect App, the packs can be monitored and "controlled" by Android and Apple devices.

The app is designed to provide diagnostics, actions, and alerts. Diagnostics include measuring temperature, condition, and state of charge of the cells. Actions include the ability to disable a battery when it is out of range (so it can't be used by someone who steals it). And alerts allow you to be notified when the battery overheats or is low on charge, or when charging has been completed.

In my opinion, the most useful things the battery/app combination can do are to notify you when charging is complete and to disable batteries when they are out of range. If Bluetooth batteries take off, then perhaps there will be increased functionality in the future: the ability to display tool diagnostics, charging cycles, and the like. The technology will initially be offered in 2.0 and 4.0 Ah, as of July 2015.

FASTER CHARGING

Early this year, Makita introduced a 5.0-Ah 18-volt pack (BL 1850). Less caught up in the amp-hour race than other tool companies, Makita is content to upgrade its packs after its competitors have already done so (Bosch, DeWalt, and Milwaukee introduced 5.0-Ah packs in 2014). To those who feel it's a problem not to be first, Makita would argue its standard charger is so fast (4.0 Ah in 40 minutes; 5.0 Ah in 45 minutes) that so long as power is available for charging, you are unlikely to run out of juice while using its batteries.

The company's answer to the growing desire for larger, more-powerful cordless tools was to double up on batteries—first via an adapter that let 36-volt tools be powered by two 18-volt packs, and later, via tools designed to accept two 18-volt packs at a time. Dubbed the X2 system, Makita's current lineup of dual-battery tools includes a 7 ¼-inch circular saw, a 1-inch rotary hammer, a chain saw, a blower, and a hedge trimmer.

David Frane is the editor of Tools of the Trade.

Crescent's 12-inch self-adjusting pipe wrench can be used like a ratcheting tool to quickly tighten or loosen rough-in plumbing and gas-line fittings from 5/8 inch to 1 1/2 inches in diameter.

Self-Adjusting Pipe Wrench

Crescent recently announced a new 12-inch pipe wrench designed for one-handed use. Unlike conventional pipe wrenches, which require you to turn a wheel to adjust the jaws, the Self-Adjusting Pipe Wrench (CPW12) tightens against the pipe when you turn it one way and loosens when you turn it the other. It works with common pipe from ⅝ inch to 1 ½ inches in diameter, including black-iron, galvanized, PVC, and copper. According to the manufacturer, this wrench can be used like a ratcheting tool to quickly tighten nuts, bolts, and couplings. However, given the way the teeth dig in, you would not want to do this with anything other than rough hardware.

Lighter and narrower than conventional pipe wrenches of similar capacity, the Crescent is easier to carry and will fit places other wrenches will not. The tool is made from stack-laminated steel with a corrosion-resistant black-oxide coating. The handle is encased in a comfortable dual-material plastic grip. Street price: $20. *—D.F.*

Quick-Shift Impact Driver

Most trade contractors own a single impact driver and use it for everything from big lags to small screws. But the problem with using one tool for driving that range of fasteners is lack of control: Drive too fast or let your attention wander, and you'll damage the surface or destroy the screw you're driving. Makita's XDT09 is designed to drive with both power and control. Power comes from the brushless motor. The control comes from having three speed and impact ranges and a feature known as "Quick-Shift Mode." In Quick-Shift, an electronic controller detects the amount of torque being applied to the fastener and automatically downshifts from third to second speed just before driving it home. The Quick-Shift mode is engaged by pushing a button on the base of the handle. Features include an LED light, a three-stage battery gauge, and a very short head that fits in tight spaces. Price: $370 (kit); $170 (bare; XDT09Z). *—D.F.*


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August Advertising Index

Classifieds

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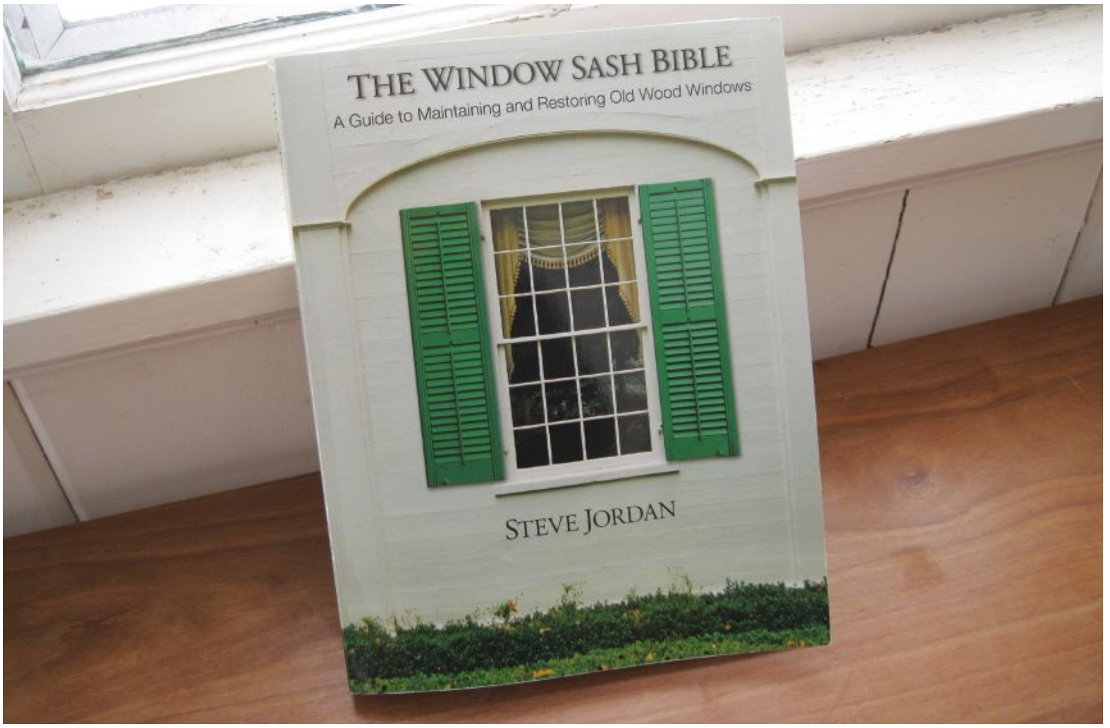
BY JEFFERSON KOLLE



Steve Jordan's book, "The Window Sash Bible," is the definitive reference on the topic of old windows. Not only that, it's a good read.

Fix Those Old Windows

It's an all too common practice to rip out all the old windows in a house and replace them with new ones. Steve Jordan, the author of the exhaustive treatise, "The Window Sash Bible," makes a strong case for fixing existing windows. He writes, "Old windows are usually meant to last a lifetime when maintained; modern windows last fifteen to thirty years and most cannot be maintained to significantly improve durability."

The book's breadth of knowledge is impressive, as is the detailed table of contents, index, glossary, bibliography, and source list for window parts. It's bothersome to buy a reference book and not be able to find what you're looking for. Not that I didn't want to read the entire manuscript, but if I hadn't and were only looking for, say, sash bolts, I could have found them listed in the seven-page table of contents.

There's a chapter on improving old windows' energy efficiency and airtightness, as well as one on interior and exterior storm windows and panels. Chapters on wood repair, paint stripping and repainting will show you how to do it right. Jordan's discussions and opinions regarding tools, techniques, and materials are based on his 40-plus years working in the field as a painter and restoration carpenter, and are well founded and thorough. If you must, there's a chapter on replacement windows that will help you avoid making the wrong decisions. And the final chapter deals with lead paint and your safety.

The book is also filled with window and glass history as well as reprints of vintage catalog and hardware pages. It all makes for interesting reading. I learned a lot, even something that'd been bugging me for years: the difference between a muntin and a mullion (see page 209 for the answer). Find out more about Jordan, his book (available for $40 at amazon.com), and his window repair business, in Rochester, N.Y., at windowsashbible.com.

Jefferson Kolle is a former contractor and JLC *editor living in Bethel, Conn.*

Photo: Jefferson Kolle

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