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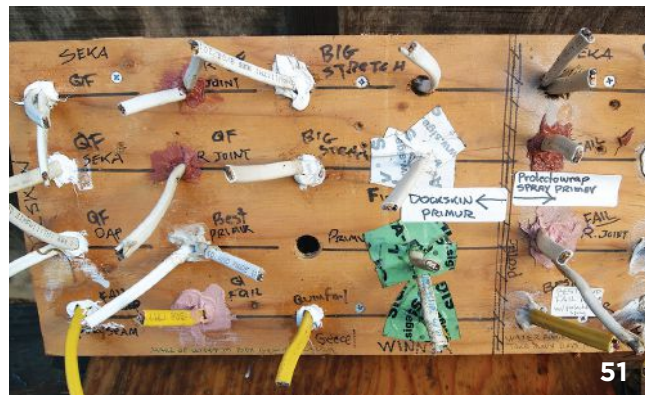
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ON THE COVER: Mark Sword of VRGC uses an 18-volt brushless impact driver to fasten a column cap on a framing project in Berkeley, Calif. See the story on page 43. Photo by David Frane.

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Letters

Hot-Water Systems

I enjoyed reading Gary Klein's article on hot-water conservation ("Efficient Hot-Water Piping," 3/13). This is how I have designed hot-water systems for over 40 years (see blue line in drawing at right):

1. Remove the water-heater drain valve near the bottom of the water heater and use that location for the cold-water inlet. Plug the original cold-water inlet.

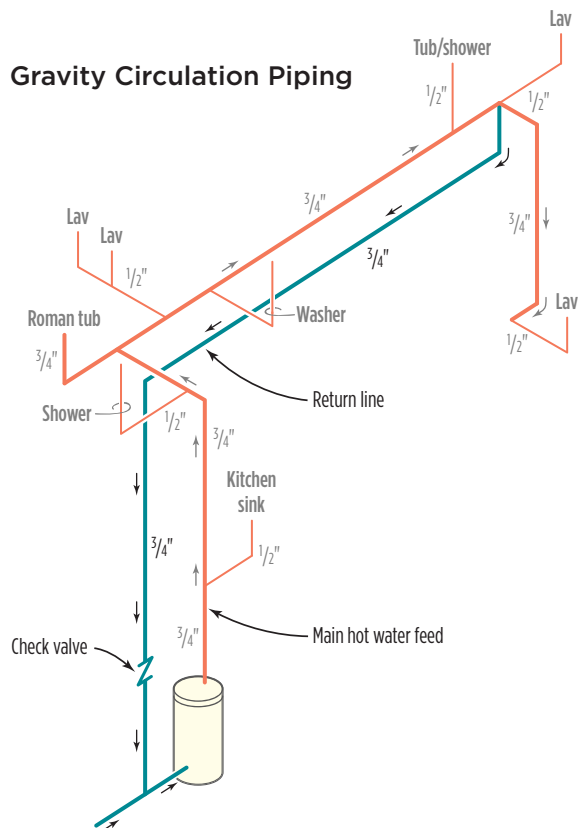
2. Run a 3/4-inch main line and a 3/4-inch return line. Put a spring-loaded check valve in the return line to prevent incoming cold water from entering the return line.

3. The return line should drop gradually without bending upward at any point.

4. The hot water will naturally rise on its own, and when it cools it will return to the water heater.

Normally this is all that needs to be done, but in some larger, newer houses it is difficult to get a downward-sloping return line. In those instances a 1/20-hp circulating pump can be installed in the return line. The pump costs less to operate than a 60-watt light bulb does, and the cost is offset by using less water.

Ken Landes
Blue Springs, Mo.



TJ Shear Brace Installation

The March article "Building Stem Wall Foundations, Part II" addresses the use of Simpson Strong-Tie MASA mudsill anchors to attach the mudsill to the foundation. On page 57, the author describes the installation of the TJ Shear Brace anchor-bolt spacer (Simpson Strong-Tie recently acquired the TJ Shear Brace product line from Weyerhaeuser). The caption for Figure 7 (see photo, right) states, "In the rush of the pour, the template was installed upside-down, so the author will just pop it out after the concrete has set up."

The TJ Shear Brace anchor-bolt spacer is intended to be embedded and remain in the concrete. Not only does it help to accurately locate the anchor bolts, but it also plays an integral role in the design and performance of the anchorage as a part of the lateral force-resisting system.

We would like to thank the author for the mention and use of our anchors and shear walls, but we also want to ensure that our products are installed in accordance with the applicable installation instructions so the intended performance is achieved.

Caleb J. Knudson, P.E.
Simpson Strong-Tie



Editor's note: We followed up with Mr. Knudson by phone to find out what role the anchor-bolt spacer plays in the shear-wall bracing system, and also to ask what remedies might be available to a contractor who discovers, as our author did, that the TJ Shear Brace anchor-bolt spacer had been installed upside-down.

While the engineering is by no means simple, the simplest

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Letters

answer to the first question, according to Mr. Knudson, is that the anchor-bolt spacer, by virtue of its size, thickness, and shape, both reinforces the concrete and transfers the shear forces from the anchorage into the concrete.

As for available remedies, the good news is that there may well be a nondestructive solution. According to Mr. Knudson, Simpson Strong-Tie typically would work with the engineer of record to calculate the actual demand load on the shear brace system, taking into account the capacity of the anchor bolts and any additional ties that may be embedded in the concrete. In a best-case scenario, this re-evaluation of the load might conclude that the system will function properly without modification. If some additional anchoring is required, it might be possible to use the flat anchor-bolt spacer made for CMU installations in conjunction with epoxy-based anchor bolts to re-establish a connection sufficient to transfer the shear forces. As a last resort, a section of the concrete wall would need to be removed and recast, with the anchor-bolt spacer properly embedded and the new concrete properly tied into the existing wall.

We also checked the installation instructions in the TJ Shear Brace Specifier's Guide (TJ-8620). While several drawings clearly note that the anchor-bolt spacer "remains in concrete," the fact that the hardware component in question is called a "spacer" may lead to confusion about its role as an integral part of the shear transfer system. Changing the name to "shear transfer plate" or something similar might go a long way toward preventing this misunderstanding.

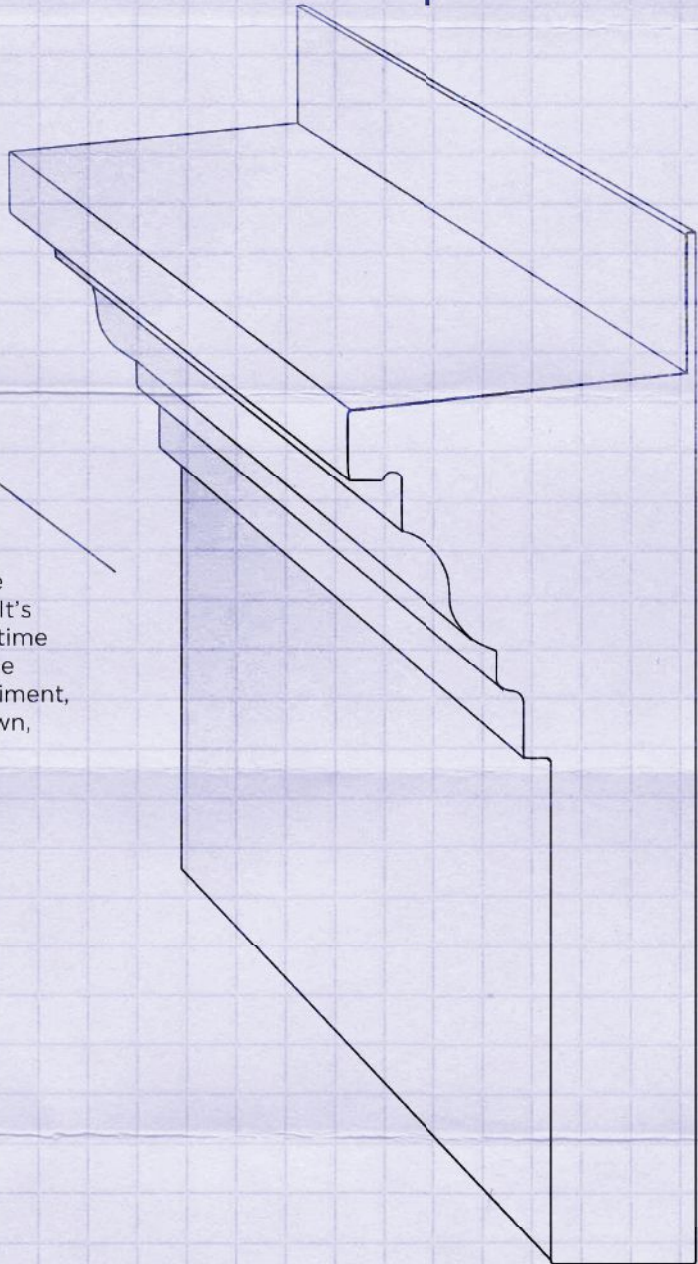
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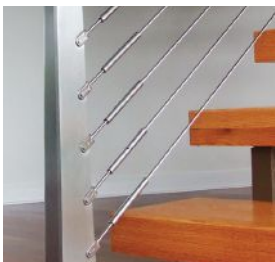
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From the JLC Forums

Patching Veneer Plaster

Tips from an April 2013 thread on fixing a hole in a plaster ceiling.

[Icesailor](#)

I'm a master plumber in business for 40+ years. I am in the process of selling the house I now live in, and the prospective buyers hired a "home inspector." The only thing he found was a spot of slightly peeling paint in a second-floor bedroom ceiling, so he poked a hole through it. Now there is a hole in what was an absolutely flat, Imperial skim-coat plaster ceiling.

I fixed the leaking roof flange in the main plumbing vent that caused the leak; the problem is the hole. What is the best way to patch it without it showing badly that it was patched? (I have access from above.) A 12" x 16" patch will do. Should I sand and feather the skim coat on the existing board so I can use mesh tape? I'm trying to make it as unnoticeable as possible. I'll have to paint the whole ceiling and the wall next to it so it matches. Any thoughts or suggestions are appreciated.

[calvert, Dallas, Pa.](#)

You can just clean up the edges of the hole and glue a piece of drywall or plywood in place above the hole followed by an application of "hot mud," such as Durabond 20 or Durabond 45. You can then put a light top coat of spackling paste over that. You can lightly sand to flush up the new surface to the original. You don't really need tape if you use the hot mud.

If you really have to make a patch 12" x 16" you could glue and screw a piece of drywall in place and leave a 1/4" gap around the patch and fill it with hot mud, as above, skim, and sand. Don't use mesh tape.

[Icesailor](#)

Where the water leaked, it caused the board to "cup" down and I can see that the board has pulled away from the strapping. That's why the 12" x 16" patch I am thinking of doing. Durabond is a consideration.

I've cut a lot of holes in veneer plaster in my time. I never cut out willy-nilly but always on solid backing. I leave it for the patchers to do their job right. That said, I've never seen a patch that didn't look like a patch, especially in a ceiling. I was afraid of the joint cracking without mesh tape. Cutting the old wallboard usually leaves a raised edge which ends

up higher than the new board. I wanted to grind it off and lower it for mesh tape.

It has become a project, not of my doing. This "spot" was next to a closet that has a ceiling opening. If the guy had looked in there first, before blowing a hole in the ceiling, I wouldn't be in this mess. The board, although it had been wetted, didn't have any holes in it. And the leak was because the rubber boot on the flashing had failed.

I just want to do it right. It's a personal character defect of mine. The plumbing and heating I do for my customers is meant to last. So is what I do for myself.

Maybe I shouldn't worry about it. In another month or so, I won't live here.

[calvert](#)

Icesailor, if the original blueboard is 1/2" and you have a veneer finish over it, then the new piece of drywall will still allow a thickness of Durabond and spackling paste to be applied over it and blend flush to the edge of the original material.

You didn't say if the finish is a one-coat or a base-and-finish plaster system. If you decide to sand or grind into the finish coat to provide for taping, be prepared for a bit of a task, as the veneer plaster "one coat" material is quite hard, and the base coat in a two-coat system is even harder.

As I stated in my earlier post, if you allow a sizable enough gap between the new blueboard/drywall patch and the original material, something in the 1/4" to 3/8" range, pack it with hot mud, and then skim the patch with hot mud followed by the spackling paste, you will then basically be able to lightly sand the surface to be in plane with the original plaster surface.

Then wet paper tape and apply it over the joint after sanding a slight bevel into the edge of your original finish material. Wetting the tape will allow you to slick it down to a very tight joint with the assurance that the paper will not be drawing out moisture and creating a weaker bond to the compound or spackling paste. By the way, I am saying "spackling paste" and that is what I mean, not pre-mixed joint compound. Paste is a finer particle size than joint compound and more closely approximates the consistency of true lime putty finish plaster.

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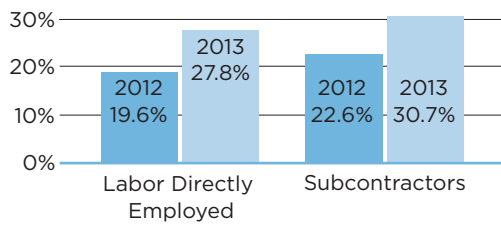
Remember the Labor Shortage? It's Back

Less than a decade ago, one of the biggest problems facing residential builders was a long-running shortage of both construction laborers and skilled workers. The issue disappeared during the housing bust that began in 2008. But now, with the building industry growing again, there are signs that the labor shortage could again become a troubling fact of life.

As evidence, NAHB economist Paul Emrath points to the results of two recent NAHB/Wells Fargo Housing Market Index surveys, which asked single-family builders nationwide about labor shortages in a dozen categories of directly employed and subcontracted workers. The labor-shortage questions had long been part of the survey, but had been omitted for several years during the downturn. When they were asked again — in June 2012 and March 2013 — the results took many by surprise.

“The numbers were up in every trade we looked at,” says Emrath. When

Builders Reporting Shortage of Labor/Subcontractors (Average across 12 trades)



Credit: HMI Special Analysis; NAHB

the results were averaged out across all trades — including rough and finish carpenters, electricians, framing crews, roofers, plumbers, and a half-dozen other categories — 27.8% of builders surveyed in March reported shortages of directly employed labor, up from just 19.6% nine months earlier. The figures were similar for subcontracted labor (see graph, above).

According to Emrath, the significance of those findings goes beyond the numbers themselves, which are still well below the levels of scarcity typical of robust building activity. “The cause for concern is that this is happening so early in the recovery,” he says. “The fact that we’re seeing labor shortages already suggests that we could be looking at a serious problem in the future.”

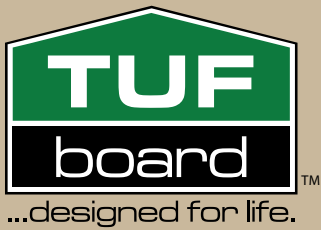
To put that another way, the only reason 2013 looks like a relatively good year for housing is that the preceding years were so much worse. If NAHB projections are correct, the current year will be the sixth worst for housing since World War II — the five worst being 2008, 2009, 2010, 2011, and 2012. From the end of the war to 2000, housing starts averaged 1.5 million



Tom Marsik for WRA

A new home in Dillingham, Alaska, has set a world record for the tightest residential structure ever built, according to a news release from the World Record Academy. The 600-square-foot two-bedroom home, on the Bristol Bay campus of the University of Alaska Fairbanks, registered an air infiltration rate of 0.05 ACH50, or less than a tenth of the maximum allowed under the Passive House standard.

Homeowners who live in energy-efficient properties are less likely to default on their mortgages than those who don't, according to a recent study conducted at the University of North Carolina. Researchers compared a sample of about 71,000 Energy Star and non-Energy Star-rated homes with loan performance data. The more efficient the house, the lower the default risk, with each one-point decrease in a home's HERS index correlating to a 4% decrease in the risk of default. The study controlled for the size and age of the house, neighborhood income, the local unemployment rate, and other factors. However, a fact sheet from the nonprofit Institute for Market Transformation, which funded the research, notes that one possible explanation couldn't be ruled out: that “buyers of energy-efficient homes may be more financially astute than other borrowers.”



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JLC Report

per year and never fell below 1 million. With fewer than a million starts expected this year, you'd expect there to be plenty of eager carpenters and painters to go around. So where are they?

Not your usual downturn. In the normal short-run construction cycle, Emrath says, workers are used to going through periods of unemployment. In effect, a base level of unemployed workers and tradespeople serves as a reserve labor force that enables builders to ramp up without missing a beat when things get busy.

But after a slump as long and deep as the one now ending, other forces come into play. "A lot of people got out of the mentality that work was ever going to come back," says Emrath. Over the years, many older workers have retired. Others have retrained for new jobs — which they may be understandably reluctant to leave — while still others have moved and now live in areas where building has been slow to recover. Some foreign-born workers have returned to their countries of origin.

Will new immigrants save the day? In the short and medium term, one potential answer to the developing labor shortage is an increase in legal immigration. While that's been a politically touchy issue in the past, it's gained considerable traction since the 2012 presidential election, due in part to groups like the Essential Worker Immigration Coalition (an arm of the U.S. Chamber of Commerce), which has aggressively lobbied for more visas for foreign workers.

Congress is expected to enact a comprehensive immigration law sometime in the current session. The earliest glimmering of what such a law might look like is a bipartisan Senate bill rolled out in the middle of April, which would dramatically increase the number of H1-B visas available for highly skilled workers — many of whom work in high technology or medicine — from 65,000 to as many as 180,000, depending on demand. The bill would also create a new classifi-

cation for low-skilled workers — presumably including many in the construction industry — called the W-visa.

Only 20,000 such visas would be issued in the first year, however, with the construction industry's share of all W-visas

capped at just 15,000. Given that the U.S. had 1.25 million construction laborers and helpers in 2010 (according to the BLS), it's unclear how much that number of additional workers — just 300 per state if distributed evenly — would help. — *Jon Vara*



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North Carolina Lawmakers Consider Local Design Restrictions

The North Carolina House of Representatives has approved a bill that would prohibit local governments from using zoning ordinances to regulate building-design elements for single-family homes or duplexes. The current version of the bill — designated HB 150 — defines “building design elements” as exterior building color, materials, roof style, type or style of porches, location of architectural styling of windows and doors, number or types of rooms, and interior layout of rooms.

The law is needed, says North Carolina HBA staffer Lisa Martin, because burdensome local design ordinances have become increasing common in recent years. “The University of North Carolina School of Government looked at aesthetic controls on residential structures, and they found a huge number of them — something like 40 cases where local governments were restricting things like roof pitch or color or porch design,” she says.

Opponents of the bill maintain that preventing local governments from regulating the number of kitchens and baths in a home would allow multifamily dwellings to proliferate in neighborhoods now zoned for single-family homes or duplexes. The North Carolina chapter of the American Planning Association also claims, through its website, that HB 150 would hurt homeowners “who have made an investment based on an expectation that the community would continue protecting the character of the neighborhood through design standards.”

Martin finds such arguments unconvincing. “What they’re really talking

about, in a lot of cases, is finding a way to use zoning to eliminate certain socioeconomic classes,” she says. “That’s why the North Carolina Housing Coalition and other affordable housing advocates want

to see it pass.” Moreover, says Martin, design restrictions are simply unfair to consumers. “What if you don’t want the front porch required by zoning? What if the homeowner would rather spend that



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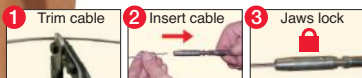
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JLC Report

Wood has long been used by humans as a source of fuel and building material, but if a process developed by researchers at Virginia Polytechnic University can be commercialized, it could become a food source as well. According to *Science News*, bio-process engineer Y.H. Percival Zhang has used genetically modified bacteria to produce enzymes capable of re-forming cellulose molecules into amylose, an edible starch. Given the high cost of the enzymes, Zhang estimates it would cost about \$1 million to produce enough starch to meet one person's carbohydrate needs for 80 days. But with more research, he says, it may be possible within the next decade or so to reduce that figure to 50¢ per person per day.

In another victory for big data, two UCLA economists have cross-referenced energy billing data from 280,000 California homeowners with voter-registration records and concluded that liberal households in liberal communities use significantly less electricity than conservative households in conservative communities. When compared with registered Republicans, Democrats consumed 5.1% less power and Green Party members 15.5% less.

NAHB and the International Code Council have jointly published a new book for contractors seeking to get a handle on the 2012 IRC, which is being adopted by a growing number of jurisdictions nationwide. The illustrated *Quick Guide to the 2012 International Residential Code* breaks down new requirements in the 2012 code, including provisions for ventilation, wall construction, duct sealing, hurricane protection, and fire safety. It's available in either hard copy or e-book form from NAHB's builderbooks.com.

money on another bathroom instead?"

Although similar legislation proposed in 2009 and 2011 failed to become law, the current bill's comfortable 98-17 margin of victory in the house suggests that

things could be different this time. Once HB 150 has been reconciled with a companion bill now in the Senate, it will likely receive a final up-or-down vote later this spring. — J.V.



The advertisement features a large roll of ScotchBlue Painter's Tape as the central focus. The roll is white with a blue plaid pattern on the side and a blue arrow-shaped logo. Text on the roll includes 'ScotchBlue™ Painter's Tape', 'ORIGINAL MULTI-USE', and '3M'. Above the roll, the ScotchBlue logo is displayed with the tagline 'Don't be fooled by imitators.' Below the roll, the text reads 'No comparison.' At the bottom, it says 'ScotchBlue™ 25+ years of proven performance.' The background is a gradient of blue and white. In the bottom right corner, there is a small 3M logo and a copyright notice: '© 2013, 3M. All rights reserved.'

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Q&A

In February 2013, our sister publication Concrete Construction (CC) reprinted "Better Garage Floors," a JLC feature that originally ran in our May 2011 issue. CC received the following question about the recommendation to use air-entrained concrete for a garage floor, which typically has a troweled finish. We've adapted the response, which appeared in CC's April 2013 "Problem Clinic" column.

Q. Troweling Air-Entrained Concrete

Can't hard-trowelling air-entrained concrete lead to delaminations?

A. Jerry Holland, chief engineer for Structural Services in Atlanta responds: The trowel versus air-entrained concrete issue is a tough balancing act. The options are:

1. Light troweling with air-entrainment. If the owner decides to go with a lightly trowelled air-entrained garage slab, even in the northernmost or mountainous locations, I suggest considering a moderate air content (4.5% +/- 1.5%) rather than the more typical 6.0% that is used for an exterior broomed slab in severe freeze-thaw areas. There are a couple of reasons for this. First, the potential for delaminations increases exponentially as the air content increases. And second, even light troweling decreases the moisture and chloride ingress into the top of the slab, thereby making it less likely that the slab will be fully saturated to a significant depth when freeze-thaw cycles occur.

When troweling air-entrained concrete, the contractor should do the following:

- Delay each finishing step as long as possible.
- Keep the surface as "open" as feasible through the finishing steps, and finally close the surface as late as possible.
- When lightly troweling the surface at the end of finishing, "leave some fuzz on the surface," as the finishers say.

2. Light troweling without air-entrainment. If the decision is made not to air-entrain a garage slab in a severe freeze-thaw environment, the surface should be troweled as densely as feasible to minimize moisture and chloride ingress, and a silane sealer should be used.

The contractor should talk with the

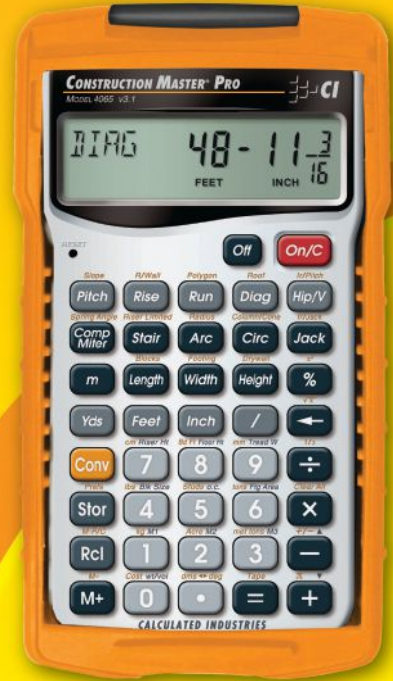
owner about de-icer usage on the driveway leading up to the garage (de-icer can also be tracked into the garage). For new concrete going through its first season of snow and ice, it's best to use only sand and to avoid de-icers, because they increase the propensity for concrete surface disruptions both outside and inside the garage. However, sand — though it can improve traction — will not act as a de-icer. So if a de-icer appears to be necessary for safety, it should be used very sparingly.

For the second winter, in addition to sand, a sodium chloride de-icer, such as rock salt, may be used (sparingly). Other de-icers tend to attack the concrete.

All of these difficulties and compromises should be discussed with the owner, who should be shown similarly finished garage slabs. Also, the owner should give approval of the finish ahead of the slab construction. (Remember that all important discussions should be followed up in writing.) Another discussion to have with the owner is that the garage slab must be kept as clean and dry as possible in cold weather.

CC's response also acknowledges a reader who noted the following from the Portland Cement Association's book Concrete Floors on Ground: "... place, strike off, and float the concrete as rapidly as possible without working up an excessive layer of cement paste. Keep the float blades flat in initial floating to avoid densifying the surface too early ... delay further finishing as long as possible by covering the surface with polyethylene or otherwise protecting it from evaporation."

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On the Job

Low-Profile Sidewall Flashing

by John Carroll

Roof/wall intersections are tricky. To be truly effective, the step flashing has to be integrated with both the roofing and the siding. Since the roof can't be completed before the siding, either a single person has to install both the siding and the roofing, or the sider and the roofer have to work together to make sure the flashing is properly installed.

Many builders use plastic or metal kick-out flashings at the base of long roof sections to direct large volumes of water running down the roof away from the siding below. I find these flashings ugly and easily broken, however, so I try to avoid them. Instead — particularly for short roofs that are more protected from the weather — I use a low-profile flashing detail that directs water to the front face of the siding, where it does no harm as it flows down the building.

The specific approach I use depends on how the lap siding courses align with the intersecting roof. On a job I recently completed, for instance, the bottom edge of the first piece of siding that overlapped the flashing was just a couple of inches above the bottom edge of the roof. This is a little higher than ideal but quite acceptable, and the bottom piece of flashing (painted gray) ran out over the face of the siding (1).

On another job, the siding courses didn't work out quite as well, so I was faced with a decision as I installed the siding. If I put in another piece of siding, about 6 inches of the first piece of step flashing would be exposed. But if I put in the flashing before the next piece of siding, I would have to finagle it so that the flashing extended down past the bottom edge of the roof. I chose this second course of action as I wove the siding, flashing, and roof shingles together.

First, I marked the location of the next course of siding on the underlying course with a pencil line (2). Then I installed a rectangular piece of aluminum flashing so that it covered the top edge of the siding and extended down to the pencil line (3). I also installed the drip edge on the lower edge of the roof deck, and the starter course of roof shingles over the drip edge.



On the Job | Low-Profile Sidewall Flashing

Next, I cut a piece of step flashing at an angle that followed the line marking the bottom of the next piece of siding (4, 5). After installing this custom-cut piece on top of the starter course of shingles, I installed my first full piece of step flashing so that it extended down to the bottom of the starter course (6).

After nailing down the first course of shingles over the starter course (the upper shingle courses had already been installed but not flashed), I slipped in the remaining step flashings (7). When I installed the final two courses of siding, I left a proper gap between the siding and the shingles (8) so that water running down the step flashing would flow unobstructed off the roof (9).



John Carroll is a builder in Durham, N.C.

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Using XactRemodel to Increase Profitability

by Shawn Van Dyke

To save time, many contractors estimate custom remodeling projects using square-foot costs, and many homeowners expect to see estimates or proposals for a remodeling job calculated this way as well. Unfortunately, this kind of estimating isn't very accurate. Only a proposal with a detailed scope of work will ensure that you get paid for the work you are performing and that the owners get the level of service they expect. To achieve these results, my company exclusively uses XactRemodel estimating software by Xactware.

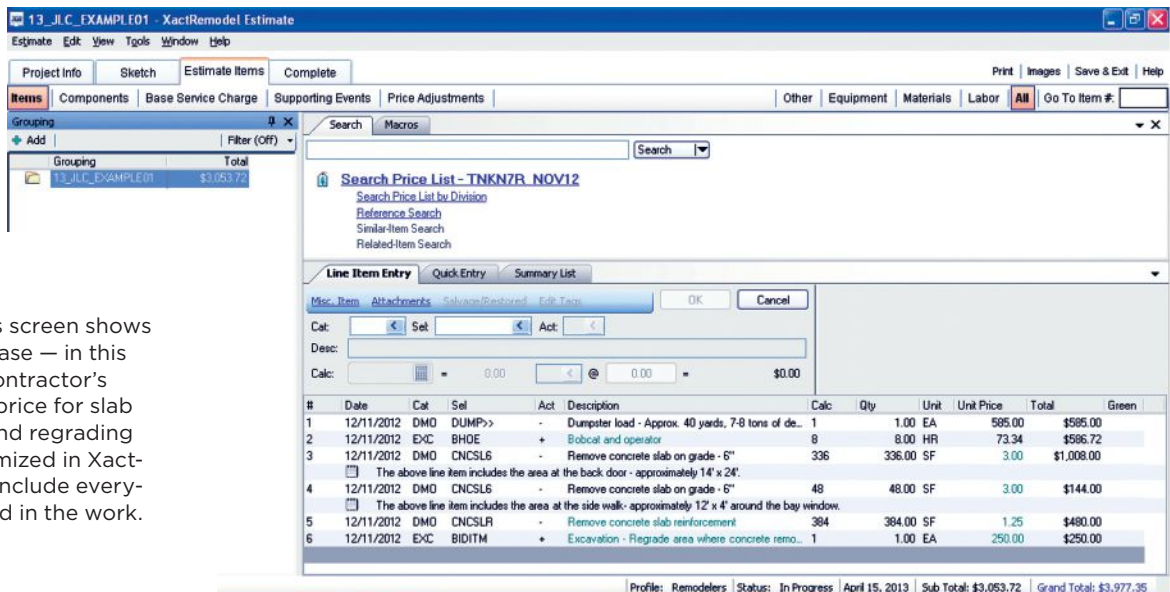
I have been a licensed general contractor specializing in custom design and remodeling for residential and commercial projects since 2005. While doing insurance restoration work, I became familiar with Xactware's Xactimate software, which is used by insurance companies to determine the scope and value of a claim. When I learned that Xactware made a version specifically for remodelers, called XactRemodel, I bought it for my business.

For me, the primary value of XactRemodel lies in its database of item costs, which are updated every month by region. This pricing data has saved my company endless hours of calling subcontractors, suppliers, and manufacturers in search of the latest cost information while

preparing clients' budgets and allowances for various types of projects. Don't get me wrong: No software is a "cure-all" for properly estimating a project, determining the scope of work, and receiving qualified proposals from professional subcontractors. But I don't like to send my subs all over town quoting jobs I'm not sure I'm going to get or that the client can't afford to do. Using XactRemodel allows me to propose jobs without wasting my subcontractors' time, and provides me with a tool to prepare a detailed scope of work to be performed that I can show the customer.

On a recent project, for example, we had to remove a portion of a 6-inch concrete slab that had been installed incorrectly by someone else. I called my concrete subcontractor and asked him to estimate the square-foot cost for labor and equipment to remove the slab and regrade the area to create positive drainage away from the house (we would provide the Dumpster). After his estimate came back at \$3 per square foot, plus \$250 for a Bobcat for the grading, I calculated his price for the job at \$1,402 (384 square feet × \$3 + \$250). I then used XactRemodel to determine the value of the total scope of work to be performed (see Figure 1).

Figure 1. This screen shows how a job phase — in this case, a subcontractor's square-foot price for slab demolition and regrading — can be itemized in XactRemodel to include everything involved in the work.





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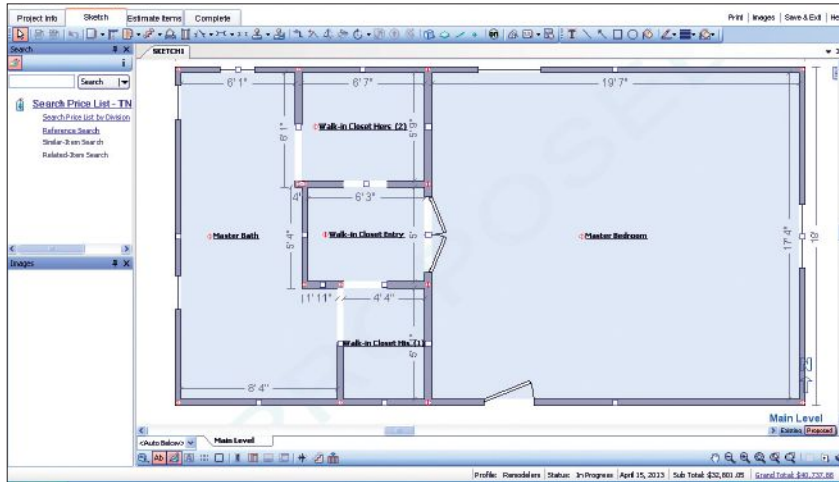


Figure 2. Using XactRemodel drawing tools, the author created this floor plan for a master-bath remodel, then let the software generate takeoff quantities to build a complete line-item estimate.

According to XactRemodel, my cost to the customer for all the slab-related work (line items 2–6) would be \$2,468.72. After the customer signed the contract, I called the subcontractor and told him we got the job. It was only then that he needed to visit the site and send me a quote. Though it came in slightly higher than his over-the-phone estimate, it was still within the price I had quoted to the customer.

Standard Documents

My company typically prepares an agreement for our projects, either a “Contract for Services” (for large remodeling projects) or a “Proposal for Services” (for smaller jobs). We set it up as a complete construction contract that covers the general legal requirements for performing the work, and in it we refer to an attachment we call a “Scope of Work,” which we produce using XactRemodel.

The Scope of Work is a detailed list of every task and all materials for a given project, from demolition and floor protection to quantity of shoe molding and fixture allowances. It spells out exactly the work we will be performing. Including this

document in our contract protects us from “scope creep,” a major cause of lost profitability. It also protects our clients, because it gives them a precise list of the work that is to be performed. We especially like the fact that when clients request changes on a project, we can point to the agreed-upon scope and justify the additional charges.

The Scope of Work is helpful when dealing with our trade contractors, too. Because XactRemodel holds the details of every phase of the project, we can produce “Trade Reports,” which we give to subcontractors to define the scope of their work or to serve as work orders.

Estimating Tools

XactRemodel’s features make it easy to produce and customize estimates for projects of any size and complexity. For example, the “Line Item Entry” tab enables the user to create a list of line items for the work that is to be performed, and to organize it either by phase or room by room. Quantities can be entered manually, or you can automate the process by using a set of drawing tools to create floor plans and elevations (**Figure 2**), even 3-D ren-

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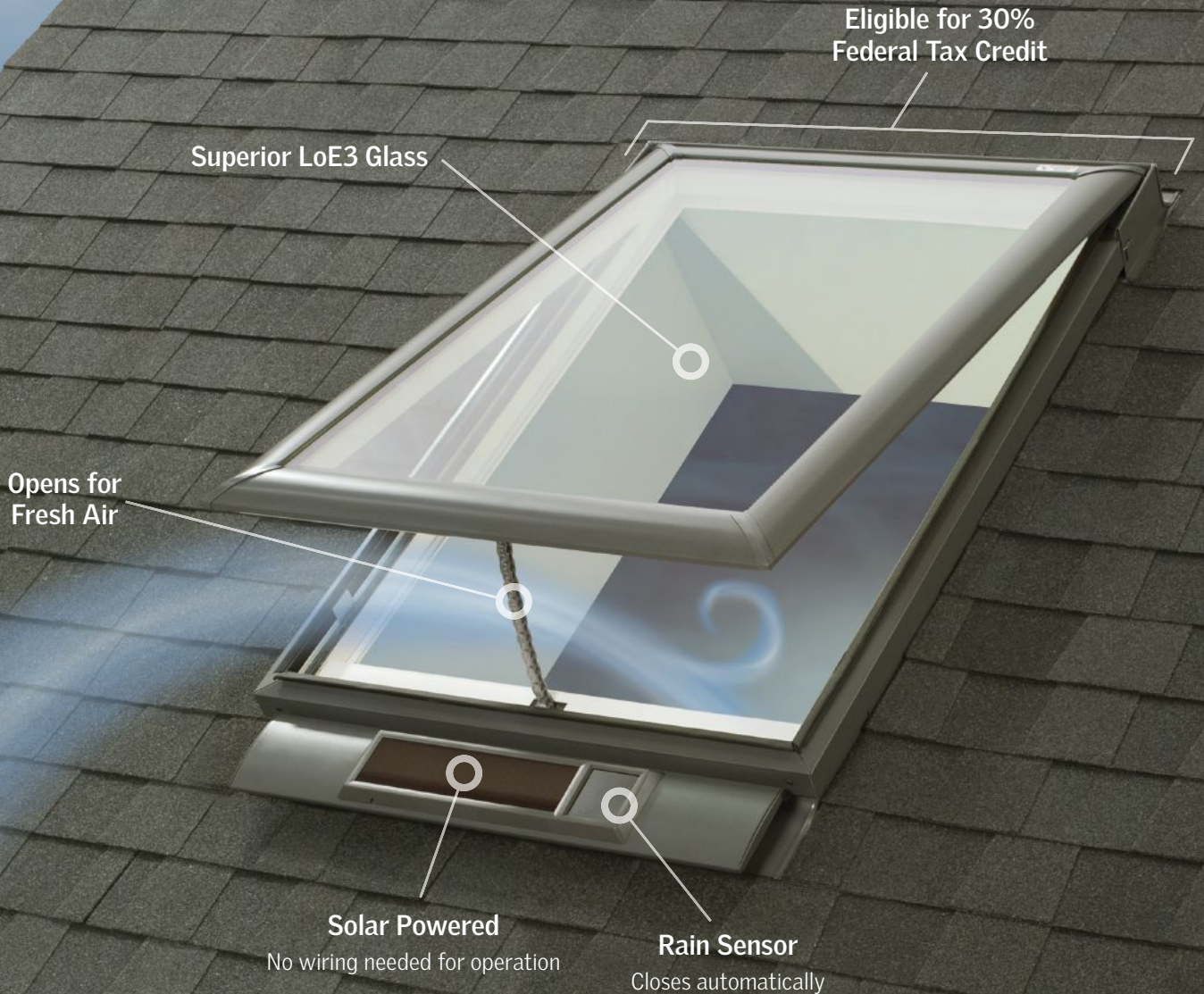
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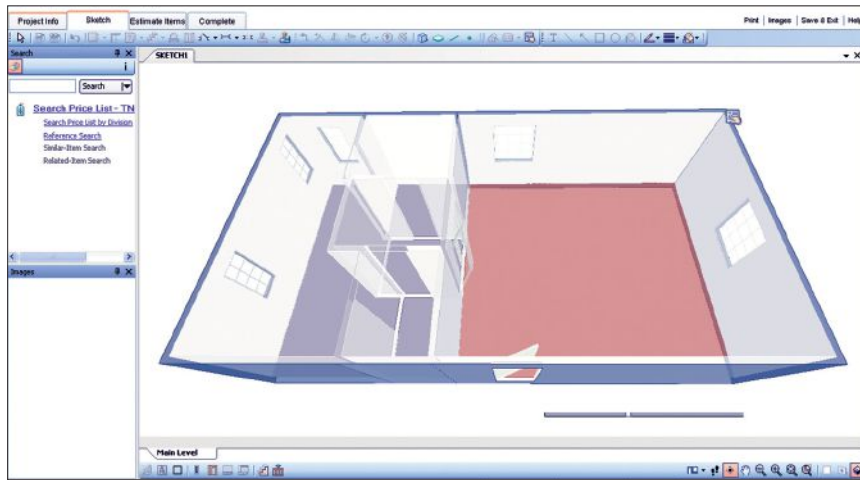


Figure 3. XactRemodel can convert a floor plan to a 3-D model that can be resized and rotated or used to conduct a “virtual walk-through” of the project. Though it’s not intended to be a rendering tool, color and texture can be added to help homeowners visualize the finished product.

derings (**Figure 3, page 39**). If you choose to start with a floor plan, XactRemodel will automatically calculate everything from the sketches, including perimeters, volumes, and floor, wall, and ceiling square footages.

I usually write a project’s line-item scope of work in the order the tasks are to be performed. I imagine what needs to be done, from demolition through finish work, starting at the floor and working around the room and up to the ceiling. This gives me a systematic way to prepare a proposal. After I “build” each project in XactRemodel just as I would out in the field, the program provides me with a value for each and every aspect of that work.

Preparing an estimate this way does take some time, but it also allows me to think through every aspect of the project while I am putting together the proposal. In many cases, you can speed up the process by setting up a “macro,” which is a kind of template for any scope of work you design. This means you can easily duplicate the scope of work from a previ-

ous project that is similar to the current one, and then add or delete line items as necessary.

Custom Pricing

As with any software, the output is only as good as the input. We have found that the XactRemodel cost database is excellent for scoping out small repair and maintenance projects but falls a little short for larger, high-end custom jobs, such as a kitchen or bathroom remodel. For example, the value in the database for painting walls (two coats, labor, and materials) is about 54¢ per square foot. Since most of our remodeling projects are for higher-end clients, we have found that value to be too low for the level of quality we provide. Fortunately, XactRemodel gives you the ability to change any value within the database to fit your company’s standard pricing.

You can also adjust pricing for what XactRemodel calls “market conditions.” Instead of changing the database price for a given item, which affects global pricing, you can raise or lower the cost of a given item on the fly by adding or subtracting

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from the database price. This adjustment affects only the project you are working on, so the original database price is available as usual for the next estimate.

XactRemodel has a few other related features. It lets you adjust the markup or margin, either for a given line item or for the entire scope of work. It also calculates sales tax on materials and fixtures, and includes the total in the overall cost breakdown. In addition, myriad customizable reports are available to help you manage and track the progress of a project.

Training

One drawback to using XactRemodel is the steep learning curve: The power of the software and the depth of its capabilities can be intimidating at first. Fortunately, Xactware offers training on all its software products, both in actual classrooms and in online virtual classroom environments. At the company's website (xactware.com), you can see the available options for training. The cost varies depending on the type of course you select; you can expect to pay about \$500 for a multi-day training course.

I found the self-paced tutorials to be very helpful, and I also attended some of the online training courses. Once I mastered the interface of XactRemodel, my estimating productivity improved greatly, and I was able to create multiple qualified proposals in a single day. It took me about two months of using the software every day to get to the point where I felt comfortable and had confidence that I was using it efficiently. Currently, I am the only person in my office trained on XactRemodel, but my project manager uses the Scope of Work and Trade Report features daily to track the progress of jobs.

We buy our XactRemodel license one year at a time at a cost of \$599 annually; Xactware also provides for monthly subscriptions.

Using XactRemodel has increased the profitability of our company more than

20% in the past two years, mostly because it has shown us the value of the services we are providing — not just the cost of doing the work. If we are charging enough for the services we provide, then we will make a fair profit, which should allow us

to stay in business and serve our clients for years to come.

Shawn Van Dyke owns Redbud Construction Services, a licensed general contractor serving the Knoxville, Tenn., area.



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TOOL TEST

18-Volt Brushless Impact Drivers

High-efficiency brushless motors and better batteries push the capacity of these full-size tools further than ever

by Michael Springer

Brushless motors are the hot new topic in cordless tools. Given the current state of the technology, however, these motors are only going into certain types of tools, impact drivers chief among them. For this article I tested nine different tools but charted 10 sets of results. Since the latest Panasonic impact driver runs on either 14.4- or 18-volt batteries, I tested that tool both ways.

Electronic Controls

Besides brushless motors, what sets these tools apart as a class is the addition of control electronics that allow users to step down driving speed and power. For most fastening jobs, users will bang away at high speed like they usually do, but the medium setting can help tame fast, coarse-pitch screws in soft drywall and brittle plaster. And the low setting is good for snugging screws up against hinge plates, or for any driving task where overdoing it could strip or break the fastener.

Most of these tools have three speed ranges, though one has four and another has only one. Some of the tools have internal electronics that allow motor- and battery-protecting functions and diagnostic displays.

Runtime

I tested runtimes by driving 1/4-inch by 3 1/2-inch coated Simpson SDS lags into the sides of thick Weyerhaeuser Parallam beams until each tool's batteries were depleted. I drove the lags in groups of 10 to

18-Volt Brushless Impact Drivers



Runtime and speed were tested by driving 1/4-inch by 3 1/2-inch lags into a thick Parallam beam. The author counted the number of lags driven per charge and timed driving speeds.

avoid overheating the motor or batteries. The runtime would be greater in dimensional framing lumber because it's not as dense as Parallam — our testing routinely shows an increase of about 25%.

Driving Speed

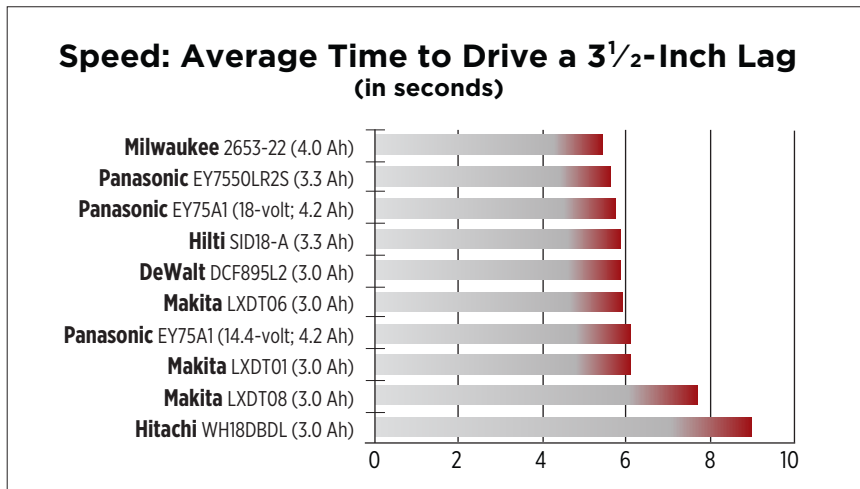
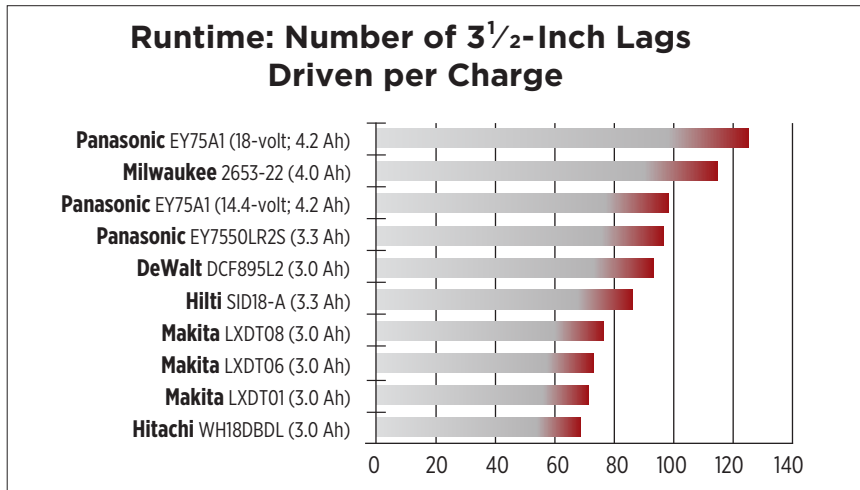
The most relevant measure of speed is the amount of time each tool needs to complete a uniform fastening task. To measure speed under a respectable load, I timed how long it took to drive a dozen and a half lags early in each tool's runtime test while the battery was fresh. After discarding the fastest and slowest times, I averaged the remaining times to arrive at the listed speed value.

Most of the drivers' times were within seven-tenths of a second of each other for this task, but a few lagged behind. After 55 lags were driven, subsequent timing showed that the top tools retained more of their original speed. After more than 100 lags, the top two models still posted respectable times — good for carpenters who run a lot of fasteners per day. (See runtime and speed results at left).

Torque

Torque output is notoriously difficult to measure. In the past, I've rated impact drivers' power by measuring how far they could drive large lags into thick blocks of wood. The order of finish was telling, but the test failed to produce values that could be objectively compared, because there was no way to gauge how much more power it took to drive the lags deeper.

For this latest test, I used two pieces of test equipment provided by test-equipment manufacturer Skidmore-Wilhelm (see "High-Tech Torque Testing," page 46). Though each test trial produced slightly different results, the top and bottom performers remained relatively constant while those in the middle shifted around (see tension and torque results on facing page). The most telling result was the confirmation that testing impact torque is still very difficult, regardless of the technology employed. Still,



using the high-tech test equipment taught me some things about impact drivers that I didn't know before — and that will change the way I use them on the job. Here's some advice based on what I learned.

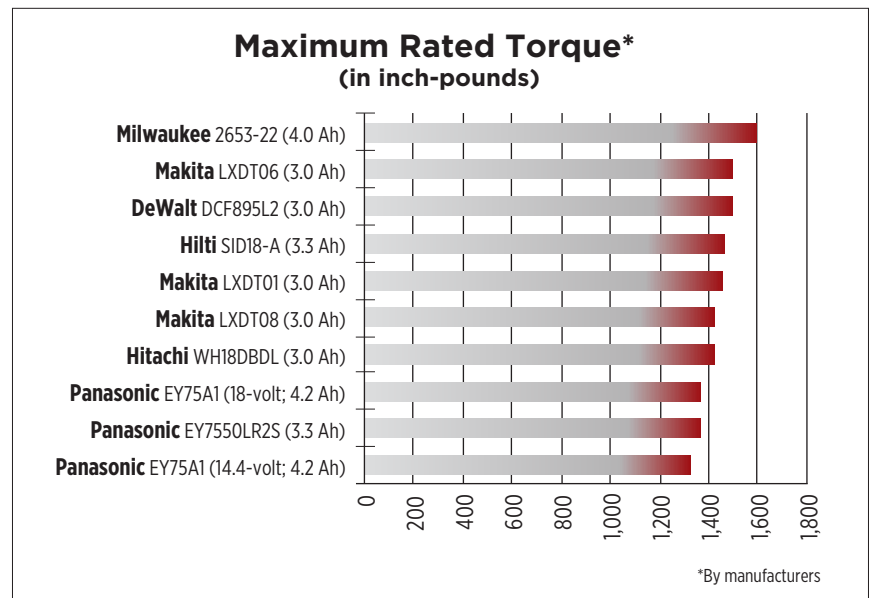
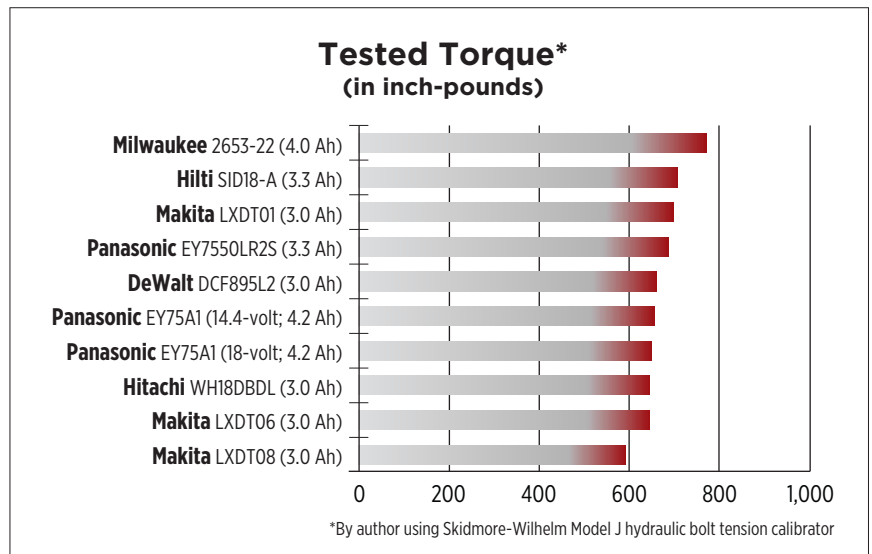
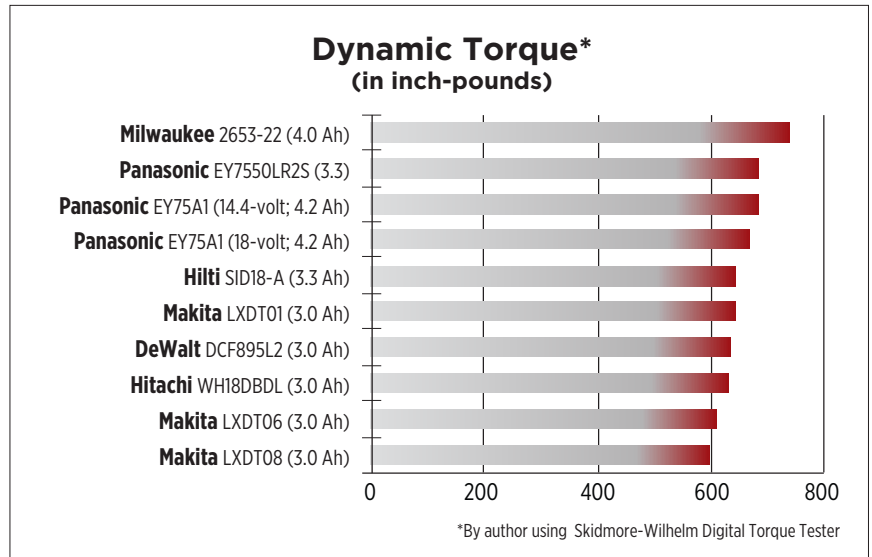
Add mass. Up to a point, driving a heavier mass will increase inertia, allowing an impact driver to deliver more force. I discovered this when, partway through testing, I switched from a standard impact socket to a twice-as-heavy, deep impact socket. All of a sudden some of the impact drivers were delivering more than twice the force output they had been before. But there are limits. I later added socket extensions but found that too much extra weight counteracted the action and didn't add force.

The use of a heavier socket proved more helpful for hard-joint driving (tightening bolts), so it couldn't hurt to try a heavier socket if you're having trouble driving a long lag.

Keep it loose. During force testing, the readings were higher if I kept a loose grip on the tool and didn't push too hard. Although this allows for a certain amount of play in the connections between the tool's bit holder, the socket adapter, the socket, and the head of a lag bolt, a few times every second the connections will slam tight in unison and the force output will spike.

Use impact-rated accessories. Not only are impact-rated accessories less likely to break — they transfer more of the power to the fastener being driven.

I know this because during the first test, every tool showed the same torque reading. It turned out that the wimpy adapter I was using was flexing at a certain level of torque, beyond which it could not deliver force. Switching to sturdy impact-rated adapters solved that problem, making it possible to differentiate between the most and least powerful tools. I'm sure some impact energy was still being lost to the adapters. After all, every adapter I used eventually broke after enduring a certain amount of strain.



High-Tech Torque Testing

For this test I used a T-2000 dynamic torque tester and a Model J hydraulic bolt tension calibrator, both of which were provided by Skidmore-Wilhelm. These are the same devices some manufacturers use to test impact tools.

Dynamic torque testing. The T-2000 electronic measuring device consists of a metal beam with a 1/2-inch square socket at the end. When driven by an impact driver with a 1/2-inch socket drive adapter attached, the finely calibrated beam senses the impulses delivered by the tool and transmits a signal to the digital meter, which converts the average peak impulse output into torque (measured in foot-pounds). This dynamic test method is necessary because impact tools don't deliver consistent torque all at once; instead, they are impulse tools that do work with a series of high-energy blows of short duration.

The numbers I recorded with the electronic test unit are best thought of as a relative performance measure and are not intended to supplant the maximum torque values published by the tools' manufacturers.

Force testing. The Model J hydraulic bolt tension calibrator contains a hydraulic load cell that is squeezed between a backing plate and a special test bolt that gets tightened by the tool being tested. When the bolt is driven as tight as the impact tool can manage, the amount of pressure created by the test bolt is displayed on a gauge (measured in pounds of force).

After recording and averaging the force readings for each tool, I used a freshly calibrated Snap-On Techwrench to crank the gauge up to that same number and recorded the torque readout displayed on the torque wrench. This allowed me to convert the force values to inch-pounds of torque and compare them to the manufacturers' specs.

In my testing, the tools produced roughly half as much torque as the manufacturers' maximum torque ratings (see previous page for results). I suspect this is because I used the 5/8-inch test bolt recommended by Skidmore-Wilhelm, and the toolmakers used a larger test bolt and socket. I tried it myself with a 7/8-inch test bolt and was able generate



The author ran each tool for three seconds while it was connected to a digital torque tester cabled to a meter.



The meter converted average peak impulse into dynamic torque and displayed that value on a digital readout.



Tools were operated for three seconds while connected to a bolt tension calibrator. Results were displayed on a gauge in pounds of force, which were converted into inch-pounds with a digital torque wrench.

torque numbers approaching those of the manufacturers, but the socket adapters broke so frequently I went back to the recommended setup for tools of this strength range. As with the values recorded using the electronic tester, these numbers should be considered a measure of relative performance.



A brushless tool motor is controlled by a microprocessor, which makes it possible to add features like variable speed/power ranges, automatic downshifting, and advanced protection and diagnostic functions.



Each impact driver was tested with the brand's highest-capacity battery. For five of the tools, this meant using 3.0-Ah packs like the DeWalt battery shown here. Hilti's top battery is rated at 3.3 Ah, Milwaukee's at 4.0 Ah, and Panasonic's at 4.2 Ah.



Most impact drivers have a single LED light — usually above the trigger, but sometimes on the base. A couple of models have an array of three or four lights around the nose.

Use the right tool. If you are driving bolts and lags routinely, you will be better-served by a cordless impact wrench with a square drive end for sockets rather than an impact driver that fits only 1/4-inch hex shank bits. Besides usually being rated as more powerful than their related driver, wrenches take the weak link out of the equation. When you need to drive plain old screws, there are bit-holder attachments that fit the 1/2-inch square end of an impact wrench, and even sockets that standard screwdriver bits snap into.

The Brushless Difference

How much of these tools' performance can be attributed to their high-efficiency brushless motors? Good question. When their runtime and driving speed are compared with those of the mostly conventional-motor impact drivers in another tool test I did, you can see a noticeable increase across the board.

But for the longest-running models, new beefed-up batteries deserve at least some of the credit. It's certainly no coincidence that the two tools that did best in the runtime test are the only ones with 4.0- and 4.2-amp-hour (Ah) 18-volt batteries. The tools with 3.0-Ah packs were at a distinct runtime disadvantage.

Bottom Line

For me, grip comfort, headlight brightness, and control-panel options take a back seat to the speed and power of driving. Creature comforts can add to the enjoyment of using a tool, but all else being relatively equal, I'm going for the cordless tool with guts — especially since these models can be dialed down when less power is needed.

Runtime may be a consideration for heavy users, but since impacts are fuel-efficient by their very nature, the full-size batteries in this class probably pack a

full day's work for average uses. In fact, to avoid lugging around any more bulk and weight than is necessary, a high-efficiency 18-volt brushless impact driver with a new 2.0-Ah compact battery is probably the most evolved choice for the average user, but compact batteries aren't currently an option for all brands.

My leading picks come right off the top of the speed and torque tables, with the Milwaukee and both Panasonic tools leading the pack. These three tools also took the top four spots in the runtime results. The Milwaukee in particular dominated the charts, distinguishing itself as the strongest and fastest tool in the class. Hilti, DeWalt, and the Makita LXDT01 occupy the second tier.

Michael Springer covers the tool industry from Longmont, Colo. This article was adapted from the winter 2013 issue of Tools of the Trade.

DRIVER DETAILS



DeWalt DCF895L2

Battery: 18 volts; 3.0 Ah
Charging time:* 60 minutes
Rpm: 0-950; 0-1,900; 0-2,850
Max IPM: 3,300
Head length:** 5 1/4 inches
Weight:** 3.69 pounds
Includes: Two batteries, charger, case, belt clip, spare bit holder
Web price: \$340

Features: Three speed ranges; ranges controlled by slide switch; push-button release chuck with one-handed bit loading; three LED lights; lights are trigger-actuated with 20-second delay; fuel gauge on battery; charger also charges 12V Max batteries; case is extremely compact

Comments: Solid second-tier tool; unique recessed bit holder in nose; bit is released by pressing a button above trigger; triple LED around nose provides effective lighting; only tool with onboard bit storage; also available in compact battery kit

* Approx, using supplied charger and battery ** Measured by author

18-Volt Brushless Impact Drivers



Hilti SID18-A

Battery: 21.6 volts; 3.3 Ah
Charging time:* 50 minutes
Rpm: 0-1,000; 0-1,500; 0-2,500
Max IPM: 3,450
Head length:** 5¹⁵/₁₆ inches
Weight:** 3.96 pounds
Includes: Two batteries, charger, soft bag, belt clip
Web price: \$415

Features: Three speed ranges; ranges controlled by push-button switch; one-handed bit loading; four LED lights; lights are trigger-actuated with 10-second delay; fuel gauge on battery; base of battery is rubberized; kit is also available with plastic case
Comments: Capable and strong second-tier tool; large 21.6-volt battery makes this the heaviest model tested; four LEDs surrounding nose provide shadow-free illumination; also available in compact battery kit



Hitachi WH18DBDL

Battery: 18 volts; 3.0 Ah
Charging time:* 45 minutes
Rpm: 0-900; 0-1,400; 0-2,000; 0-2,600
Max IPM: 3,200
Head length:** 6¹/₈ inches
Weight:** 3.75 pounds
Includes: Two batteries, charger, case, belt clip
Web price: \$265

Features: Four speed ranges; ranges controlled by push-button switch; one LED light; light is manually operated, stays lit 15 minutes; battery gauge on tool; two trigger modes — continuous (standard) and limited (three or four impacts only); optical trigger switch said to be more durable than standard mechanical switch; case is very compact
Comments: Bulky; flexed and vibrated under heavy driving loads; lagged behind in speed and runtime testing; small uncomfortable trigger; unique limited-impact mode proved extremely handy for carefully driving screws that last little bit



Makita LXDT01

Battery: 18 volts; 3.0 Ah
Charging time:* 30 minutes
Rpm: 0-1,300; 0-2,000; 0-2,600
Max IPM: 3,400
Head length:** 5¹/₂ inches
Weight:** 3.46 pounds
Includes: Two batteries, 30-minute charger, case, belt clip
Web price: \$295

Features: Three speed ranges; ranges controlled by push-button switch; one-handed bit loading; one LED light with 10-second delay; light can be disabled; warning lights for low battery, overheating, and locked motor; nose of tool glows in the dark; case is very compact
Comments: Solid second-tier tool; felt strong and eager in use and placed quite well in many of the power tests; could benefit from a battery fuel gauge



Makita LXDT06

Battery: 18 volts; 3.0 Ah
Charging time:* 30 minutes
Rpm: 1,400; 2,300; 2,800; T-mode = 2,800
Max IPM: 3,400
Head length:** 5¹/₈ inches
Weight:** 3.42 pounds
Includes: Two batteries, 30-minute charger, case, belt clip
Web price: \$360

Features: Three speed ranges and Quick-Shift mode that automatically downshifts under load; ranges and special mode controlled by push-button switch; one-handed bit loading; one LED light with 10-second delay; light can be disabled; battery gauge on tool; overheat warning light; nose of tool glows in the dark; case is very compact
Comments: Most compact tool in test; in unique T-mode for self-tapping (TEK) screws, driver runs in full speed until screw gets a bite; as load increases tool finishes drive at medium speed to avoid stripping the threads; only Makita model with a battery fuel gauge



Makita LXDT08

Battery: 18 volts; 3.0 Ah
Charging time:* 30 minutes
Rpm: 0-2,500
Max IPM: 3,200
Head length:** 5³/₄ inches
Weight:** 3.56 pounds
Includes: Two batteries, 30-minute charger, case, belt clip
Web price: \$300

Features: One speed range; one LED light; light is trigger-actuated with no delay; case is very compact
Comments: Bare-bones model; performed near bottom in most tests



Milwaukee 2653-22

Battery: 18 volts; 4.0 Ah
Charging time:* 60 minutes
Rpm: 0-850; 0-2,100; 0-2,900
Max IPM: 3,600
Head length:** 5¹/₂ inches
Weight:** 3.74 pounds
Includes: Two batteries, charger, case, belt clip
Web price: \$300

Features: Three speed ranges; ranges controlled by push-button switch; one-handed bit loading; one LED light; light is trigger-actuated with 10-second delay; fuel gauge on battery; base of battery is rubberized; charger accepts M18 and M12 batteries; case is very compact
Comments: The strongest, fastest tool — topped all others in speed and torque testing; second-best runtime; came with new high-capacity 4.0-Ah battery; also available in compact battery kit



Panasonic EY7550LR2S

Battery: 18 volts; 3.3 Ah
Charging time:* 65 minutes
Rpm: 0-1,000; 0-1,400; 0-2,500
Max IPM: 3,300
Head length:** 5⁵/₈ inches
Weight:** 3.48 pounds
Includes: Two batteries, charger, case, belt clip
Web price: \$360

Features: Three speed ranges; ranges controlled by push-button switch; one LED light on base; light is manually operated, stays lit five minutes; warning lights for low battery and overheating of motor or battery; tool is IP56-rated for resistance to moisture and dust; case is overly bulky
Comments: A top-tier performer along with its brand mate; felt very strong in use and consistently placed high in speed and power tests; could benefit from a battery fuel gauge



Panasonic EY75A1

Battery: 18 or 14.4 volts; 4.2 Ah
Charging time:* 80 minutes
Rpm: 0-1,000; 0-1,400; 0-2,500
Max IPM: 3,000
Head length:** 5⁵/₈ inches
Weight:** 3.60 pounds (18v); 3.33 pounds (14.4v)
Includes: two 18-volt batteries, charger, case, belt clip
Web price: \$400

Features: Three speed ranges; ranges controlled by push-button switch; one LED light on base; light is manually operated; warning lights for low battery, overheating of motor or battery, and locked motor; tool is IP56-rated for resistance to moisture and dust; case is overly bulky
Comments: A unique flexible-fuel tool that runs on 14.4-volt or 18-volt batteries; a top-tier performer; equally powerful with either battery; with 4.2-Ah 18-volt battery, had best runtime in the test; the lightest tool tested when fitted with 14.4-volt pack; could benefit from a battery fuel gauge

* Approx, using supplied charger and battery ** Measured by author



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Air-Sealing Without Foam

Tape is best, but the right caulk can also provide a tough, reliable seal

by Terry Nordbye

When it comes to air-sealing, canned spray foam is often seen as the perfect material for plugging medium-sized holes and gaps, mostly because it's inexpensive and easy to apply. I've used a lot of canned foam for air-sealing over the years, and I even wrote a *JLC* article that described some of my methods for working with it and other sealants ("Air-Sealing Tips and Tricks," 1/12).

But as time passed, I began to have questions about canned foam's durability. I noticed in particular that pipes and wires would often break loose from the surrounding foam. I dissected foam samples and studied the material's fragile structure under a microscope (see **Figure 1, next page**). My conclusion is that air-sealing a

building with canned foam may provide an initially low blower-door number — but that number may not hold up in the longer term.

I now equate using foam for air-sealing with the now-discredited practice of sealing ducts with duct tape: It builds future air leaks into the system. And because air-sealing is often deeply buried, failed air-sealing will go on leaking for decades. I'd rather do the job just once and use the longest-lasting materials available.

Finding the Best Caulk

Because it's somewhat flexible, caulk is a better bet for long-term air-sealing than canned foam. In theory it should be better able to resist the stresses of thermal

expansion and contraction, structural settling, lumber shrinkage, and — in my seismically active neighborhood — the odd sharp shake from an earthquake.

But because I couldn't find any good data on which caulks perform best in air-sealing applications, I decided to do some rough-and-ready materials tests of my own. The testing I was able to do was necessarily limited, and I didn't have access to a *Consumer Reports*-style laboratory. But in many ways, that was best: The test procedures I used closely reflect actual job-site conditions in my area.

Setting up the test boards. I chose to test the caulks and sealants on simulated wire penetrations, because they typically represent a worst-case situation for air-

Air-Sealing Without Foam

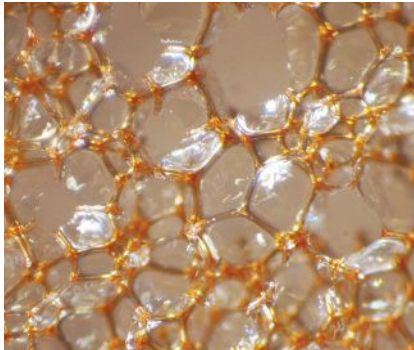


Figure 1. The gas-filled bubbles that give foam its cellular structure are durable if not stressed. But when pipes and wires air-sealed with canned foam are forcibly moved, these bubbles are easily torn apart.

sealing. Wiring is often foamed or caulked after the boxes have been roughed in, but before the electrician has made the connections at the switches and receptacles. When those final connections are made, there's always a lot of bending and yanking on the cable, which puts a lot of stress on the sealant, especially if it's close to the box. I already knew that canned foam won't remain intact under that kind of treatment, so I didn't include it in my tests.

I set up my test boards with #12 and #14 Romex cable passing through $\frac{5}{8}$ - and $\frac{3}{4}$ -inch holes in $\frac{1}{2}$ -inch plywood, fixing the wiring in place by stapling it to scraps of framing lumber screwed to the backs of

the test boards (Figure 2). I then caulked around the wires, with most caulks applied to several different holes, and let the samples set up indoors for 48 hours. Conditions during curing were the same for all the caulks and were typical of this area — sunny, dry, 70°F days and damp, cool nights.

Once the samples had cured, I jiggled the Romex and bent it slightly (up to 45 degrees) right and left to simulate the kind of movement one would create when working a box with new or retrofit wiring.

Outcomes

In evaluating the samples after working them, I looked for any visual separation of the caulk from the cable, or light leaking out around the hole (Figure 3). If that type of separation occurred more or less immediately, I recorded it as a “quick failure.” Failures that took place only after repeated manipulation of the wire were recorded as “numerous movement failures.” Some caulks failed because the material hadn't fully set up within 48 hours, so I tested those products again with a longer setting time. I did not count any failures from improper set times. A complete breakdown of the results appears in the chart on page 54.

Do primers help? Out of curiosity, I repeated the initial tests with two manufactured primers — Siga's Dockskin primer and ProtectoWrap spray-on primer. I applied each to the test boards as directed by the manufacturer. Although both products are formulated for use with the manufacturer's own sealants, it's not unusual for builders to combine different materials in the field, and I wanted to see if the primers would improve performance across the board.

The results suggest that mixing and matching primers and sealants usually doesn't pay off. The Siga Dockskin primer made all connections worse, except in the case of Siga tape. (Siga tape sticks extremely well even without primer, but I

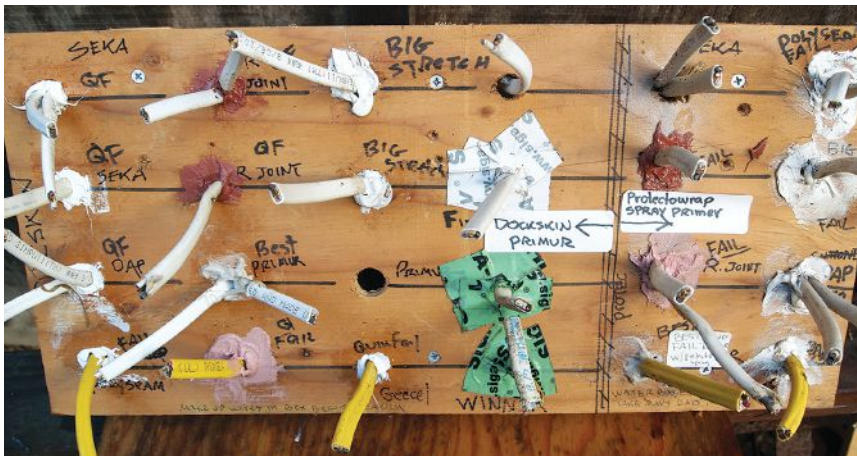


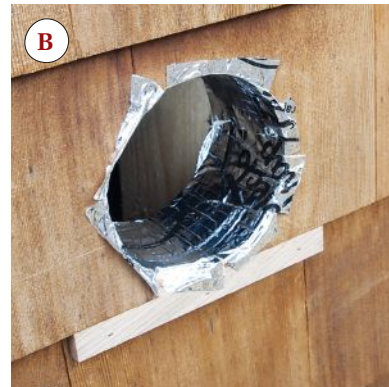
Figure 2. To evaluate the air-sealing effectiveness of two tapes and 22 caulks and sealants, the author applied multiple samples to test boards assembled from plywood, framing lumber, and sections of nonmetallic sheathed cable.

Foam-Free Test Case

Soon after performing the caulk and sealant tests described here, I was hired to do the air-sealing on a new 1,500-square-foot residence, which I decided to make into a test case for foam-free air-sealing. As part of the process, I took pains to seal all air-leakage pathways, not just the obvious ones.

The exterior wall, for example, consisted of half-inch plywood over the framing, followed by two layers of taped polyiso board, an additional plywood nailing base, and cedar shingles. To prevent air from leaking into penetrations along the planes of those varied layers, I sealed edges with Prosoco R-Guard Joint & Seam Filler (A) or tape (B).

After the plumber, electrician, and sprinkler installer had finished making holes in the shell, a helper and I spent two full days sealing the wire and pipe penetrations with more caulk and tape. To prevent air from leaking between the subflooring and the bottom plate, we used a Sawzall to expose the holes in the subfloor, then sealed the pipe or wiring with tape (C). As a reference for future estimates, I timed how long it took to seal each penetration; dealing with the pair of wires pictured here — including cutting the plate — took seven minutes.



It's best to have the electrician drill individual holes for each wire wherever possible, since single wires are much easier to tape-seal than holes with multiple wires. Where closely spaced wire penetrations are unavoidable, another option is something I call "puddle sealing," which I first saw on a tour of a European Passive House. This involves using a 4-inch hole saw to make a hole in the bottom

plate where multiple wires will run through the subfloor, and pouring a fluid sealant around them (D). My preferred material for this is Prosoco R-Guard Cat 5, which is much more liquid than the company's Joint & Seam Filler. The advantage to this approach is that it simplifies communication with the electrician — the plate openings provide well-defined wiring zones that are hard to overlook.

would recommend using the Dockskin primer on concrete or any surface that is dirty, rough, or waxy). The ProtectoWrap primer worked well with Siga's Primur caulk but otherwise didn't seem to affect adhesion one way or the other.

Slippery wiring. Most of the failures I observed in my tests were caused by the inability of the caulks to stick to the Romex cable. Speculating that this might be caused by their friction-reducing coating (designed to make it easier to pull wiring), I called Southwire — which manufactures Romex brand wire — to see what

sort of solvent I could use to remove it.

The representative I spoke with wouldn't provide that information, but after some trial-and-error I found that the anti-friction coating seemed to be soluble in denatured alcohol. After treating a section of the wire, I noticed that it felt appreciably less slick when I passed it through my fingers. I wondered if the alcohol might damage the vinyl cable sheathing itself, so I took the precaution of soaking a piece of Romex cable in a solution of denatured alcohol for two days to see what would happen. When I saw no change in the



Figure 3. Caulks that failed the wire-movement tests typically remained bonded to the plywood but separated visibly from the outer sheathing of the cable.

Wire-Movement Test Results

Sealant	Rating	Comments
Dap Dynaflex 230	DNF	An economical caulk that performed better than most other conventional caulks
Dap Side Winder Advanced	DNF	Withstood stress well
Liquid Nails Heavy-Duty Construction Adhesive	DNF	Surprising, this low-priced adhesive held up well as a sealant, although it is quite stiff when set up
Prosoco R-Guard FastFlash	DNF	Though intended for seam sealing open joints between sheet materials, both this caulk and the similar Prosoco R-Guard Joint & Seam Filler listed below set up quickly and adhered well to cable
Prosoco R-Guard Joint & Seam Filler	DNF	See above
Siga Primur	DNF	This caulk is actually intended to be an adhesive, but it stays very soft and flexible
Siga Rissan Tape	DNF	Time-consuming to apply, but showed no signs of losing adhesion under full flex of wires
Siga Wigluv Tape	DNF	Same as for Rissan, above
Tremco TremPro JS-773	DNF	This acoustic caulk flowed readily into tight spaces and returned to its original cured shape after being flexed
Geocell Water Shield	NMF	Would not stick to cable
Henry 208 Wet Patch Roof Cement	NMF	Performed better than many materials but failed after prolonged movement
Loctite Polyseamseal Muliuso	NMF	Would not stick to cable
OSI Quad Advanced	NMF	Would not stick to cable
Sasco Big Stretch	NMF	Caulk pulled apart and did not stick well to cable
Ace Siliconized Acrylic	QF	Failed immediately
Dap Alex Painter's Caulk	QF	Failed immediately
Dap ElastoPatch	QF	Failed immediately
Dow Corning Silicone	QF	Set up very stiff and would not stick to cable
GE Silicone Window and Door	QF	Very stiff when set up and would not stick to cable
Jaco Firestop Plus	QF	Caulk pulled apart under stress and did not stick to cable
Loctite Polyurethane	QF	Would not stick to cable
Sansco Mor-Flex	QF	Caulk pulled apart and did not stick well to cable
Sikaflex Polyurethane Sealant	QF	Would not stick to cable
White Lightning Bolt Quick Dry Adhesive Caulk	QF	Caulk pulled apart and would not stick to cable

After allowing the tested caulks and sealants to cure for 48 hours, the author pulled the wires from side to side to simulate the effect of wiring a fixture or receptacle. Materials were judged to have failed if they pulled away from the cable sheathing, leaving a visible gap. The three-tiered rating system assigns a DNF (“did not fail”) rating to sealants that remained intact throughout testing; an NMF (“numerous movement failure”) to sealants that eventually lost their grip; and a QF (“quick fail”) to ones that failed immediately.

cable, I decided not to worry about it.

To see whether caulk would adhere better to sections of cable that had been spot-treated with alcohol, I made an additional test board and ran the flex tests again.

Adhesion did seem to improve slightly, but not enough to justify the effort of treating the cable, which would be difficult and time-consuming to do on the job site.

The Bottom Line

I didn't try every caulk on the market, but my testing program did convince me that any caulk will fail if it's stressed before being fully cured. Depending on thickness and weather conditions, a $\frac{3}{8}$ -inch-thick blob of caulk can take many days to set.

The clear winner in my tests was the Swiss-made Siga tapes. (Other European-made tapes designed specifically for air-sealing are beginning to appear on the market, but I wasn't able to test them.) Tape has the huge benefit of sealing on contact without any curing time, and it remains flexible indefinitely. No matter how much I flexed the wires on my test boards, the tape seals remained undamaged.

I'm convinced. Going forward, I'll try to eliminate canned foam altogether, and use a reliable caulk where necessary. But wherever possible, I'll rely on tape for my primary air-seal.

Terry Nordbye is a building contractor in Point Reyes Station, Calif.



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Small Garage Foundation Repair

by Rob Corbo



A mobile concrete mixer solved both budgetary and logistical problems on this two-month project

When I started my remodeling business, I found myself trying to sway clients toward my ideas rather than providing information to help them make their own decisions. I have since changed my ways. These days, I think of myself as more of an adviser than an advocate, and I believe this has helped limit my responsibility when things don't go as expected (always a good thing in this business). So, when a past client asked whether he should salvage an existing garage or tear it down and rebuild, I provided an estimate to do both, gave my opinion, and waited for him to get back to me.

Often, there's more to a decision than dollar amounts, and that was the case here. My estimate was around \$20,000 to repair the existing structure and \$30,000 to demo and rebuild new, but there were also appearance and zoning issues to consider. No doubt my client would have preferred to save money by rehabbing the existing structure, but the garage had shifted and settled over the past 80 years — so much so that we referred to it as the “fun house.” Its sill plates were rotted and almost completely gone, and the heavy, manually operated wooden overhead doors — while still functioning — were not



Figure 1. A teardown would have prompted the relocation of the new garage some 9 feet further into an already-small yard to accommodate the town's side-setback requirement of 12 feet.

Concrete Cost Comparison¹

Type	Labor ²	Material Cost	Total
Mobile Concrete	2 man-hours at \$75/hr = \$150	\$340 ³	\$490
Site Mix	9 man-hours at \$75/hr = \$675	\$210	\$885
Ready-Mix	2 man-hours at \$75/hr = \$150	\$415 ⁴	\$565

¹ Based on 1 cubic yard of concrete (20 feet of 14-inch-by-14-inch footing)

² Based on two-man crew; includes receiving the truck, delivering concrete to forms, scratch-coating to key the block, and cleanup. Labor for site mixing also includes loading and mixing the materials

³ Based on minimum load of 2 cubic yards (\$140 for concrete, \$185 delivery fee, plus tax)

⁴ Based on minimum load of 1½ cubic yards (\$120 for concrete, \$264 delivery fee, \$10 fuel fee, plus tax)



Figure 2. When the author's crew demoed the garage's existing 2-inch-thick slab (above), they discovered that the walls were bearing on cinder blocks placed on their side, with the existing slab keyed into the voids. Even with this thickened edge, the sill plates were 90% gone, due to their proximity to grade (right).



sized for modern cars. This had my client leaning toward building new. However, when he found out that a teardown would require him to either meet his town's side-yard setback ordinance or obtain a variance (a long, difficult process in my neck of the woods), he chose to repair the existing garage in place (see Figure 1).

My repair estimate didn't include digging 3-foot-deep frost walls, which are required by code here in New Jersey. They would have been tough to install given the site constraints — not to mention a 21-foot-wide by 20-foot-deep structure hanging overhead — and my partner, Danny DoCouto, and I thought it was possible to avoid putting them in. Our plan called for removing a couple of feet at the bottom of the existing wall, installing new 18-inch-by-18-inch footings at grade, then blocking up to the bottom of the wall. But when I first went to the town with our idea, it was rejected. This changed when we brought in an architect to draw up the construction documents. The architect, Derek Cox, noted an exception to the frost-wall requirement in the code (freestanding light-frame accessory structures less than 600 square feet with an eaves height less than 10 feet, 2009 IRC R403.1.4.1) that applied to the existing garage. While not an optimal solution, installing footings at

Mobile Concrete Mixer



A



B



C



D



E

A mobile concrete mixer, also known as a volumetric mixer, is a portable concrete batching plant that produces concrete to spec in exact amounts on site, using raw materials — cement, sand, stone, water, and admixtures — that are stored separately in individual compartments (see photo on page 57). The ingredients are combined in a mixing auger (A) — a long chute with hinged covers — according to a “recipe” determined from known volumes relationships, such as the ratio of sand and stone to water and cement (B). Independent shutter gates at the base of the sand and stone compartments control the proportion as the materials are delivered onto a chain-driven conveyor. Cement and water pre-mix with the sand and stone as they pass through a funnel-shaped discharge chute at the end of the conveyor (C) and into the mixing auger. From the control panel, located at the rear of the mixer (D), the operator can view all of the materials and make adjustments, as well as start and stop the flow of batched concrete as necessary. Cleanup is easy because only the mixing auger needs to be hosed clean (E); unused materials can go to the next job or be off-loaded individually, cutting down on waste.

grade level was code-compliant, and the owner, the architect, and eventually the town all signed off on our plan. With the permit in hand we were ready to go.

Mobile Concrete

My original thought was to excavate, brace, and build half a wall at a time. But Danny felt we could support an entire side at once because there was so little weight

from above. This sounded like a good plan because fewer concrete pours and inspections would keep the project cost down and help us stay on schedule. So, we planned for five separate pours: first, the gable-end wall footing (along the property line); second, the opposite gable-end footing; third, the rear bearing-wall footing; fourth, the slab; and fifth, the entry apron slab. (The footings for the front

wall returns would be small enough to site-mix.)

With four of these pours requiring around 1 cubic yard of concrete — I estimated the slab as being just under 5 cubic yards — I decided to look into having the concrete supplied by a mobile concrete mixer. I’ve had success using mobile concrete in the past, and have a good working relationship with the sub, Consolidated



Figure 3. The bracing strategy was designed to support one wall at a time (left). To avoid damage to the existing shell, squaring up and leveling was kept to a minimum. New 14-inch-deep footing forms were set at the same height as the existing slab and tied back to the diagonal bracing (right).





Figure 5. With the gable-end walls done, the existing rear wall could be readied for formwork (above). Similar to the gable-end footings, two continuous #5 rebars were placed at the bottom of the footing (right). The rear footing was pinned to the gable ends with two #5 rebar pins drilled and epoxied into place.



Fence, a local fence company that provides this service as a side business. Even with a minimum delivery load of 2 cubic yards, plus a delivery fee based on distance to job site (in this case, about 25 miles on back roads with lots of stoplights — the N.J. parkway doesn't permit commercial truck traffic), mobile concrete still priced out cheaper than ready-mix (see cost-comparison table, page 58). Also, my local ready-mix supplier's minimum delivery is 1½ cubic yards, so it made no sense to pay slightly more for a load and return a

half-yard to the batch plant. Plus, it would take too long for our two-man crew to mix and deliver the concrete to the forms, and uneven curing could reduce the strength of the footing.

One Wall at a Time

When I did my repair estimate, I thought the walls would be bearing on grade or on a thin slab, which is typical of detached garages of this age. But as Danny and a helper started to bust up the existing 2-inch slab, they discovered the walls were bearing on cinder blocks placed on their side with the slab keyed into the voids (Figure 2, page 58). After removing the slab up to the cinder block "footings," they braced the first gable-end wall. Then Danny trimmed the bottoms of the studs (for better access) and they tore out the makeshift footing.

The formwork for the new footing was set at the same height as the existing slab/cinder-block footings (Figure 3). We originally were going to install 18-inch-by-18-inch reinforced footings at grade, but after consulting with the architect, we reduced them to 14 by 14 inches.

About a week passed before the town

inspector was able to check our forms, so we didn't pour the first footing until mid-June. From the time Consolidated Fence showed up on site, it took around 20 minutes to prep the first batch of concrete (see "Mobile Concrete Mixer," page 59). Our crew used wheelbarrows to transport concrete from the discharge chute to the forms, weaving around the bracing. This added some time to the process, but one of the good things about working with a mobile concrete mixer is that time is not as critical as it is with ready-mix. The operator was pretty easygoing; he didn't have to worry about a load of concrete setting up in his rig like the ready-mix guys do.

After the footing cured, we stripped the forms and proceeded to build the block stem wall (Figure 4). A month later (after various inspections and holidays) we built the opposite gable-end wall the same way, then the rear wall a week after that (Figure 5).

We were about to start on the front when the client decided to go with a single 16-foot-wide garage door rather than two narrow ones. This decision didn't affect how the two front return walls were built (Figure 6, next page), but it did involve

Figure 4. Over a couple of hours, the crew wheelbarrowed the concrete around the bracing to the forms (A), then trowelled the scratch-coat finish (B). With the footing in place, they retrimmed the existing studs to allow for two block courses and a 2-by-PT mudsill, then installed the block, filling the cores (C). Tolerances were close (D) — in a few places the mudsill had to be sledge-hammered into place. A pair of Simpson A23Z clip angles on each stud connected the wall to the mudsill, which was connected to the block with wedge anchors placed 2 feet on center (E).



Figure 6. Like the rear footing, the front wall footing returns are pinned to the new gable-end footings with two #5 rebars (above), and the blocks were toothed together at the corner (right).



Figure 7. The wider overhead door required the installation of a double 11⁷/₈-inch-deep Microllam header under the existing 4x4 top plate. A screw jack was used to level the opening and to support the beam until jack and king studs could be installed.



Figure 8. After laying down a layer of 4-inch gravel, reinforced 6-mil poly sheeting, and welded-wire mesh, the crew ran asphalt-impregnated fiberboard around the inside face of the footing (left), then poured the new 4-inch slab flush with the top of the footing (right). The fiberboard serves to isolate the slab from the footing should any frost issues arise.

extra labor and materials to install an LVL header, jack and level the building, and frame the new opening (Figure 7).

Slab Work

Since we didn't have a package deal with Consolidated Fence to do the whole job (it billed separately for each pour), we could have used ready-mix for the slab and saved some money. But we decided to go with mobile concrete here, too (Figure 8). Consolidated was easy to work with, and it had been good about waiting for our guys to wheelbarrow concrete around all the bracing. Plus, we wanted to keep this good relationship going, in case we needed to use the company in the future.

The architect had wanted an apron slab with an integral drainage grate tied into footing drains, but this idea was dropped for budgetary reasons. A few weeks into the project, however, the client asked that the apron be put back in the project. We did it as an extra, which meant our fifth and final pour occurred almost two months after the first footing was done (Figure 9).

Finishing Up

We saved some money by leaving the existing roofing and the siding on the rear and gable-end walls in place. The front, however, received a facelift, with the large automatic garage door taking up most of the façade (Figure 10).

In the end, we pretty much broke even on the project. It brought in around \$26,000 in revenue, but costs came to \$25,000 (the \$5,000 in extras included framing for the new garage door, plus the install from the door sub; a new 3-foot-by-7-foot side door; gutter installation; some electrical work; and labor and materials for the entry apron). This left us with a modest net profit — but more important, it led to the client asking us to price out a kitchen/bump-out addition, which we plan to start in the next few months.

Rob Corbo is a contractor in Elizabeth, N.J.



Figure 9. The apron slab was reinforced with wire mesh and sloped down toward the driveway 1 inch over its 4-foot width.



Figure 10. The bulk of the exterior finishes are on the front wall; new siding flanks a car-and-a-half-wide garage door (above). The exposed block stem wall was parged with mortar, and the driveway was regraded with new gravel. Gutters were added, and a berm was created to help direct runoff away from the entry apron (left).



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The hottest marketing tools out there are in social media.
Think of it as word-of-mouth on steroids

Social Skills

This staff-written article first appeared in the
July 2012 issue of *Remodeling* magazine

Internet marketing used to mean a “business card” website where potential customers could see some project photos, find your company phone number, and maybe fill out a “Contact Us” form. These days, static “brochureware” websites are business tombstones. Most of the action is “interaction” in the social media universe, where the game is short and sweet, fast and frequent. It’s about push more than pull, and whoever pushes themselves into the most conversations wins.

Websites and SEO (search engine optimization) are as important as ever, maybe more so, but the ways remodelers are enticing potential customers to visit are changing. People of all ages are using more and more mobile devices and the social media apps made to run on them. Search engines are still in the picture, but it’s increasingly likely that your next customer will find your company in a tweet or Facebook posting while using a smartphone app.

In what follows, we take a closer look at how social media works and how remodelers are starting to build it into their day-to-day business. And we provide some insight into how you can start putting it all together in your business.

Social Media Possibilities

Used wisely, social media is a bullhorn — otherwise, it's just bull

90% of online consumers say they trust recommendations from people they know

Ecoconsultancy,
July 2009

Social Media Can

- **Let people know what you do:** By showing videos of your company in action on YouTube or highlighting projects on Houzz or Pinterest.
- **Help you meet clients and prospects:** This is where consumers — and their friends — hang out. And you can engage with “your existing customer base that might form an affinity group,” says consultant and *Remodeling* columnist Joe Stoddard. “You can gain new customers through testimonials from that group if you’ve created positive relationships with them.”
- **Raise brand awareness:** “It can provide a non-salesy, informal, friendly place for people to learn about your business personality,” says Dave Alpert of Continuum Marketing, but don’t push sales. You need to offer something of value, such as free information.
- **Boost website traffic:** Promote your site with links and keywords when using social media. Check out AddThis.com, which offers an easy button for people to click to share your information.
- **Help you manage your reputation:** Use Angie’s

List, Yelp, and other local sites to respond to reviews, show how you deal with problems, and create links to testimonials.

Social Media Can’t

- **Do what you do best:** “Social media makes it easier for happy and unhappy customers to share their experiences. But for a remodeler to develop a good social media strategy without making a concerted effort to deliver exceptional customer service is a waste of time,” says Geoff Graham, president of GuildQuality.
- **Quash criticism:** There’s always someone who’s unhappy. But at least you can join the dialog early.
- **Provide free marketing:** Many sites may be free to use, but it takes a lot of time and effort to properly feed and care for social media. If you’re going to set it and forget it, well just forget it.
- **Be your only marketing method:** Social media can only support a larger marketing program.
- **Promise a following:** You must create a narrative for consumers to see what’s in it for them — and be patient.

Sharing Menu

Quick and easy ways to share content you’re interested in with a broader audience

Have you just read an interesting article online? Use the Share menu, usually displayed near the article title, to post article links to your favorite social media sites.

Post to your **Facebook** page so friends and followers can “like” or comment on the article, too. Tweet the link to your **Twitter** feed, or post it as an update for your **LinkedIn** connections. **Google+** shares the article publicly on your page or just with those in your chosen circles.

At sites such as **Delicious** you can save your

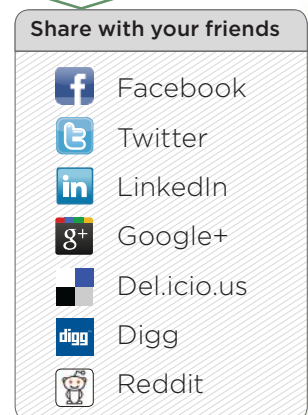
links in themed interest categories, called “stacks,” that you create and can share with others. In a similar way, **Digg** promotes articles on topic pages (e.g., Business, Lifestyle, etc.) and can rank them according to how much interest they attract. **Reddit** does something similar and allows users to subscribe to topic feeds.

For some of these sites, you can load a widget into your browser menu so it’s always available. However you do it, sharing is a fast and easy way to tell others what you’re thinking about.

Market shares

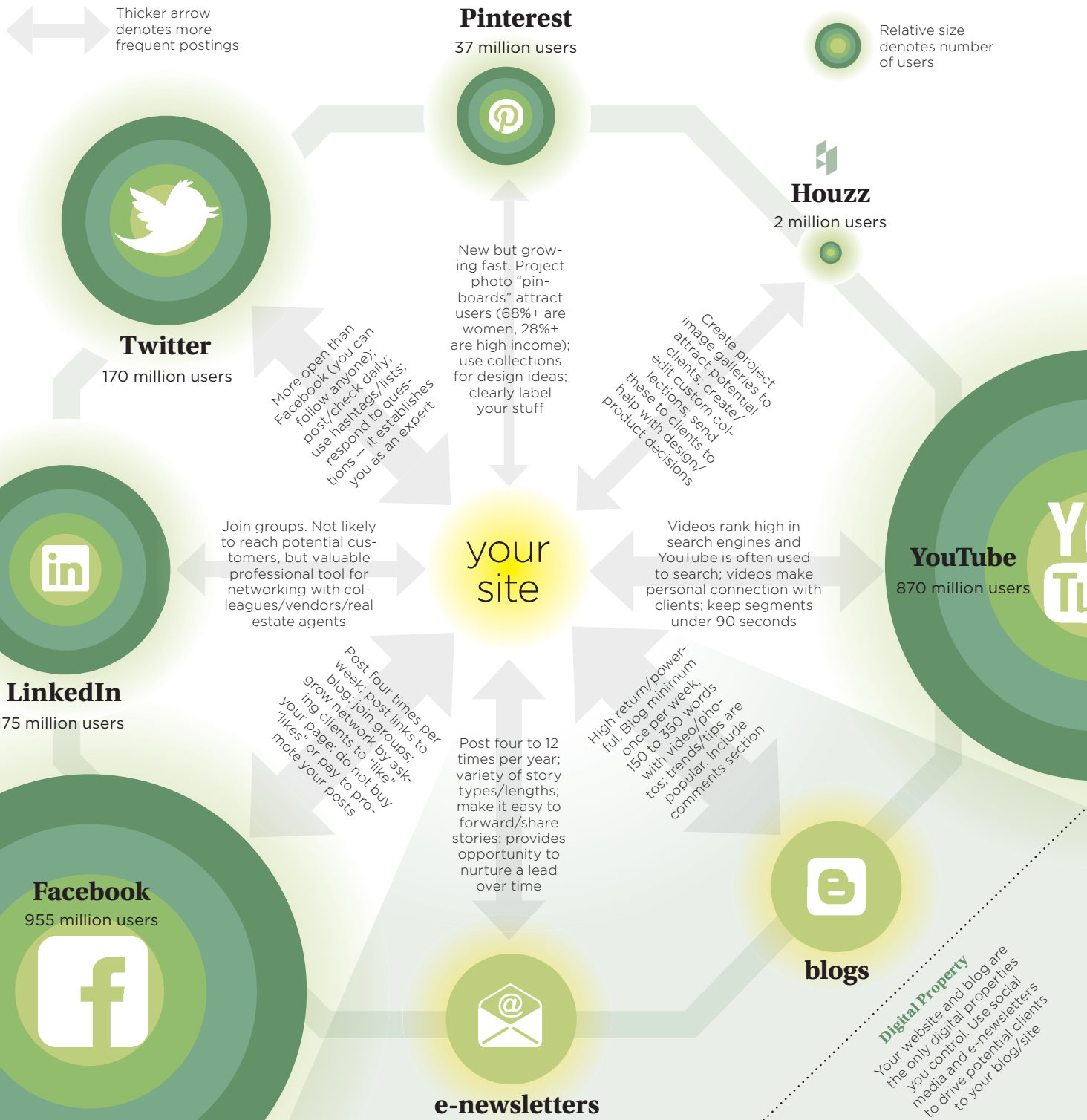
43% of all online consumers are social media fans or followers.

Hubspot Blog



8 Ways to Build Your Audience

One advantage of using social media to educate homeowners about your brand is that you can engage with them at the websites or mobile apps they prefer. The goal is to translate visibility into leads. That means increased traffic to your website or blog, so make sure those digital properties are in good shape before using these other sites.

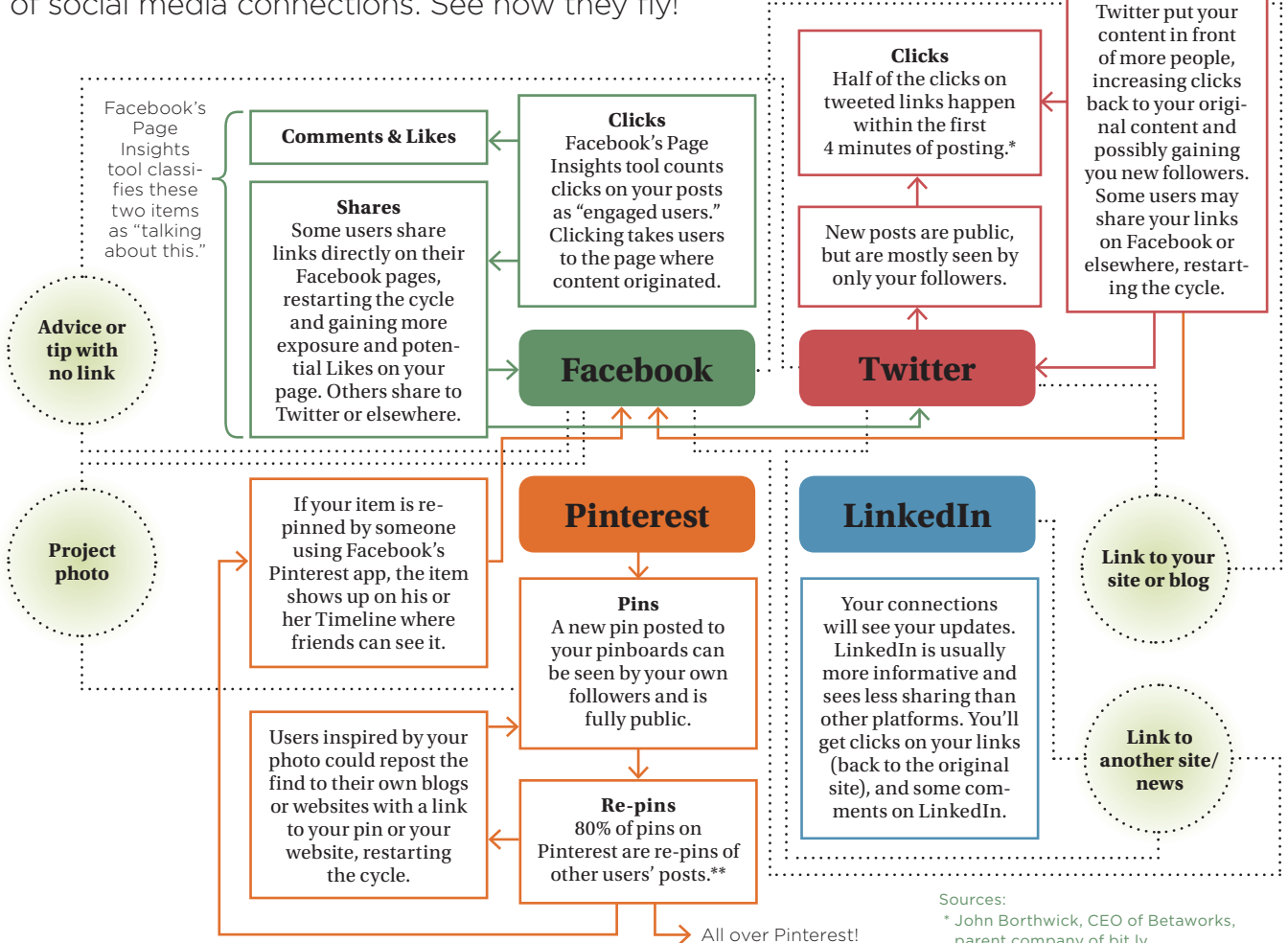




To the Twitterverse!

Follow That Bird!

A simple tweet (or pin or Facebook post) can mean dozens of social media connections. See how they fly!



Anatomy of a Tweet

1. Mention

To bring a tweet to someone's attention, use @ (username) within the body of the tweet.

2. Hashtag

Place a # symbol before any word or phrase to create a searchable keyword. Hashtags are great for tracking events or topics you cite frequently.

3. Links

Short URL services such as those built in to Twitter will reduce a link of any length to about 20 characters or fewer.

4. Reply

Hitting "Reply" will put the original Twitterer's @ (username) at the beginning of the tweet. When you reply, your response is public.

5. Retweet

Share someone's tweet by retweeting it. Use the "Retweet" button, or add RT @ (username) to send the message to your followers.

Source: Twitter

Finders Keepers

Make it easy for your customers to find you

The days of potential customers finding you by leafing through the Yellow Pages is gone. Now they just log on and search, and you'd better make sure you're there!

The first place they are likely to search is Google, specifically **Google Places**, which is now part of the company's new social networking site **Google+**, according to Corey Perlman, president of eBoot Camp, an educational firm that guides businesses on the Internet.

"Google+ is an opportunity for consumers to learn about your business prior to going to your website," he explains. "And they will often decide who they will do business with based on what they see." A customer may even make a decision based on your proximity to his or her home, also revealed on Google+.

Yelp.com is strictly a review site rather than just a business listing like Google+ or Yahoo Local. However, while all these sites host reviews, Yelp is

by far the leader simply due to its prevalence and a popular mobile app.

Regardless, you have to brace yourself for the possibility — more likely, the probability — of some negative reviews. The only way to counteract them is to make sure the positive reviews outnumber the bad ones, according to Larry Green, CEO of System Pavers, in Santa Ana, Calif.

"Bad reviews won't go away, they just get moved lower," he says. "So you have to put your neck on the line and ask your customers to post an honest review about you. This is literally the only way to do it. The process never stops. Customer satisfaction is raised to a whole new level due to the transparency out there."

Perlman likens these sites to alcohol: "When people drink, they say things they wouldn't normally say sober," he explains. "Likewise, when people get behind a computer screen, they say things online they wouldn't normally say to your face."

Yelp had
71 million
unique
monthly
visitors in
Q1 2012

Google Analytics

Site for Sore Eyes

Respect your user's time: Don't create barriers to finding information

What makes a good website? To judge, you need to know the site's objective. "The goal for most remodelers is ... to drive qualified sales traffic into [their] sales pipeline. Secondarily, it will support [their] core vision and mission," says Joe Stoddard, a remodeling industry consultant and *Remodeling* columnist.

To drive traffic to your site, all marketing should have your company's URL. All posted photos should have a watermark with your company name and URL. Engage with other relevant sites to create links for better search engine optimization. Once they're at your site, offer viewers a rapid call to action and value-added material.



My Name Is URL
Your URL should be short and based on your company name, but buy and register other similar URLs to avoid losing traffic to a typo.

Crystal Clear
Visitors should immediately know what you do. Make contact information visible in many places. On this site it's at the bottom of every page.

Social Hub
Create easy access to social media.

Lead Me On
Information such as blog posts and videos should peek "above the fold" so viewers will scroll down.

Immediate Action
Distribute calls to action throughout the site. Ask for email addresses and offer some value in return. Respond to visitors right away.

Products



Dry Veneer

Versetta Stone is a nonstructural stamped concrete veneer that's installed without mortar. It comes in 8-inch by 36-inch panels that interlock with the panels below and have 26-gauge galvanized nailing strips at the top. The strips are fastened to the wall with a nail gun or drill. Inside and outside corners and a wainscot cap are also available. The panels are made from a lightweight fiber-reinforced concrete that requires no structural reinforcement. Cost is \$12 to \$14 per square foot.

Boral, 800/255-1727, boralna.com.



Formwork for Carpenters

The *Spider Tie* system was developed by a Utah contractor who had trouble getting small foundations done. Its intended market is builders and remodelers who want to do their own formwork. The system uses the open-web internal frame supports found in ICFs to support site-built plywood. The ties can be used to form flat or curved walls (the latter have two or more layers of thin plywood facing), or even lightweight concrete roofs. Cost is \$135 for a box of 100 ties, or a little over \$17 per running foot of 8-foot-high wall.

Spider Tie, 866/752-3950, spidertie.com.



Rubber Roof

EuroSlate and *EuroShake* rubber roofing products contain 95% recycled content (mostly old tires), says the maker. They mimic slate tile and sawn cedar shakes, come in 36-inch and 40-inch-wide panels, and are held in place with standard roofing nails. An adhesive strip bonds successive courses to one another, and built-in tabs ensure correct exposure. The reported cost to the contractor is just under \$300 per square.

G.E.M., 877/387-7667, euroshieldroofing.com.



Fast Patch

Quikrete's *Zip & Mix* products can be mixed in the bag for small patching jobs. The line includes Vinyl Concrete Patcher, Hydraulic Water-Stop Cement, Anchoring Cement, and Mortar Mix. Unzip the pouch, add water, and knead the mixture to the desired consistency. Specific instructions — including how much water to use — are on the package. The products come in three-pound pouches that retail for \$6 to \$7.

Quikrete, 800/282-5828, quikrete.com.



Deck Brightener

Accent lighting is a hot trend in deck design right now, thanks largely to the availability of affordable low-voltage LEDs. Fiberon's *Accent Lights* are recessed into the deck surface. Installation doesn't require an electrician; the lights are wired to a transformer, which is plugged into a standard outlet. A kit containing 10 lights, a transformer, the needed wire, and a remote-control dimmer costs \$230.

Fiberon, 800/573-8841, fiberondecking.com.



Bulblike LED

Not only does the *Advanced Light* LED look like a traditional incandescent bulb, but it has a nearly identical light temperature. We tried it in a standard fixture, and had we not known better, we wouldn't have guessed it was an LED. The 13.5-watt bulb has a screw-in base and a lumen output equivalent to that of a 60-watt incandescent. It costs \$25, with a projected service life of 25 years if used three hours per day.

3M, 800/430-5000, 3m.com/led.



Recycled Pavers

Made mostly of recycled rubber and a little plastic, *Azek Pavers* feel firm but have some give. (The company claims ceramic plates didn't break when dropped on them as a test.) They fit into a 16-inch-square grid; pavers overlap from grid to grid to tie the system together. Three styles are available. Permeable and Standard Landscape pavers are for patios, walkways, and driveways, and install over compacted sand; Resurface pavers have a thinner profile for use over existing slabs and roofs. Cost is \$8 to \$9 per square foot, which includes the grid.

Azek, 877/275-2935, azek.com.



Wood-Grain Vinyl

We have to admit to being impressed by our sample of Harvey's *Better Grain* finish — it really does look like stained wood. Available for select vinyl windows in pine, red cedar, and dark oak, *Better Grain* is applied to the vinyl in a two-step process — color first, then a grain-pattern overlay. Double-hung prices start at \$150; accessory windows range from \$115 to \$225. The company also charges a \$225 setup fee for each order, so this option is most cost-effective when ordering multiple windows.

Harvey Building Products, 800/598-5400, harveybp.com.

Products



PEX Alternative

Zurn Pex hy-PE-RTube polyethylene raised temperature resistance (PE-RT) tubing is an alternative to cross-linked polyethylene (PEX). Its main advantage for installers is greater flexibility, which allows it to lay flat during installation. It also has a five-layer construction — inner and outer PE-RT layers and an ethylene vinyl alcohol core surrounded by two adhesive layers — that prevents air infiltration, protecting cast-iron boiler elements from rust. Cost is competitive with PEX, or around \$26 to \$31 per foot for 1/2-inch tubing.

Zurn Engineered Water Solutions, 800/872-7277, zurn.com.



Markable Coating

Sherwin-Williams' *Dry Erase Coating* is a clear, glossy coating that can be written on with a dry-erase marker, then wiped clean with a rag. The two-component product is meant for professional application, as it must be agitated at low power for two minutes after mixing. It can be applied over any painted surface in good condition, has a 1 1/2-hour pot life, and takes three or more days to dry. Coverage depends on surface porosity but ranges from 200 to 400 square feet per gallon. A one-gallon kit costs \$500 and a quart kit \$150, which works out to \$1.25 to \$2.50 per square foot.

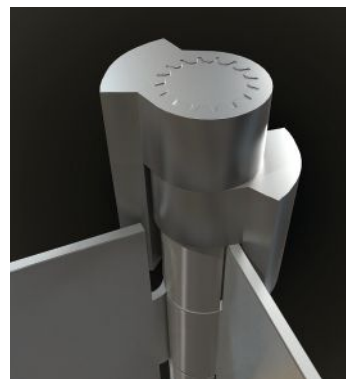
Sherwin-Williams, 800/474-3794, sherwin-williams.com/home-builders.



Residential Condensing Tank

Rheem says its *High-Efficiency Condensing PDV Water Heater* represents the first use of high-efficiency condensing technology in a residential-class tank heater. (Residential models fire at a maximum 75,000 Btu and must have a safety feature called flammable vapor ignition resistance.) The unit has an energy factor of 0.80 and comes in 40,000-Btu gas and 36,000-Btu propane versions. Its high efficiency is achieved in part by heat-exchanger coils that route exhaust gas through the tank twice. The unit costs \$1,400 to \$1,600, not including installation; estimating operating cost is \$228 per year.

Rheem, 800/621-5622, rheem.com.



Bumperless Doorstop

The *Door Saver II* hinge pin serves as a doorstop. It has two interlocking cams at the top that engage the hinge leaves. Since the distance between the two cams is adjustable, you can set different opening angles. The device eliminates the rubber bumper, so it works even if there is no casing (such as for a door recessed in an opening). It installs like a standard hinge pin and works with 3 1/2-inch or 4-inch hinges (though the pin protrudes past the bottom of a 3 1/2-inch hinge). It costs \$6.

Perfect Products, 877/366-7728, doorsaver.com.

Milwaukee M18 Fuel Drill/Driver

by Bruce Greenlaw



2603-22 Specs

Weight (with/without side handle): 5.62/5.03 pounds

Length: 7⁷/₈ inches

Rpm: 0-550/0-1,850

Price: \$280 (includes two 4-Ah batteries, charger, side handle, plastic case)

Milwaukee
800/729-3878
milwaukeetool.com

Weigh In!

Think you're a good candidate to test a new tool? Want to share a tool-related testimonial, gripe, usage tip, or news flash? Take a minute and contact us at JLCTools@hanleywood.com or 707/951-9471.

A year and a half ago, I pitted the Milwaukee M18 model 2610-24 drill/driver kit against eight powerful competitors for *JLC* ("Heavy-Duty 18-Volt Drill/Drivers," 1/12). Right after that, Milwaukee introduced the M18 Fuel drill/driver, which is its first version with a brushless motor. Brushless motors are more compact than standard brushed ones, and they're supposed to be more durable and efficient. The brushless 2603-22 kit originally included the same 3-amp-hour batteries packed with the 2610-24, but it's now shipping with Milwaukee's new 4-amp-hour ones. You can also buy the new batteries separately to upgrade any M18 cordless tool.

Runtime. On paper, the brushless motor and 4-amp-hour battery yield dramatically better runtime. To find out if they do in real life, I tested the new combo the



In the runtime test, the tool drilled more than 200 one-inch-diameter holes in 2-by Douglas fir.

same way I tested the other 18-volt models: by counting the number of holes it could drill through 2-by Douglas fir per charge in low gear with a new one-inch Irwin Speedbor solid-center auger bit. To ensure reasonable consistency, I once again avoided knots, stopped drilling when the drill bit's screw point punched through, and kept the bit clean with Blade & Bit pitch remover. The result? The M18 Fuel drilled an amazing 217 holes compared with 104 for the M18, and would have easily blown away the rest of the competition in my original test (top score at the time was 149 holes).

Power and features. There's more to like about the M18 Fuel. Like the other models, it easily powered 1¹/₂-inch spade bits, bored 2¹/₈-inch lockset holes with a hole saw, chewed through 2-by Douglas fir with a nail-eating 1³/₄-inch ship-auger bit with no apparent ill effects, and sank Simpson Strong-Tie's .22-inch by 10-inch multipurpose structural wood screws into an LVL/LSL/PSL sandwich without pilot holes.

It weighs a half-pound less, is 1³/₈ inches shorter, and is a bit faster than the M18. Its LED headlight now has a 10-second afterglow, and the new battery retains the helpful battery gauge. If I were shopping, I'd strongly consider buying the 2603-22 kit, checking to make sure it has the new 4-amp-hour batteries.

Milwaukee also offers the compact 2603-22CT kit, which originally paired the M18 Fuel drill/driver with 1.5-amp-hour batteries but is now replacing those with 2-amp-hour ones.

Bruce Greenlaw is a JLC contributing editor.

Chappell Master Framing Square

by William Dillon



Elizabeth Ceci



The tongue on the Chappell framing square is 2 inches longer than normal.

I've cut hundreds of irregular hip and valley roofs during my 35-year carpentry career. Although I use a framing square for drawing and layout, I rarely use the rafter table imprinted on it because it only applies to regular plans and pitches and a calculator is faster. So when veteran timber-framer Steve Chappell recently introduced the Chappell Master Framing square, I was pleased to try one out to see if its unique decimal scales and patented rafter tables might change my approach.

Heirloom Build

The Chappell square (\$118 at chappell-square.com) is made in the U.S. of 304 stainless steel, with deeply etched and blackened markings. It has the usual 2-inch by 24-inch blade, but the tongue is 1½ inches by 18 inches, which is two inches longer than normal. The extra length helps on extra-steep rafters, forms a 3-4-5 triangle, and holds more information. So far I've found the longer tongue to

be useful in stick framing for bringing up layout lines between floors, but overall a standard 16-inch tongue works fine for me.

The tool is guaranteed to be square to within .003 inches, and the one I tried was perfect.

Scales and Tables

Unlike traditional framing squares, whose edge scales are broken into 8ths, 10ths, 12ths, or 16ths of an inch, the Chappell square is laid out in 20ths of an inch and in ¼-inch increments. The decimal scales make it easier to do mental math, are compatible with common calculators, and mesh with the decimal rafter tables on the square. They also allow you to use your choice of imperial or metric units without conversions. The distinct ¼-inch graduations help you measure fractions (there's a decimal/fraction conversion chart on the square if you need it).

The rafter table has enough information in it to build a timber-frame roof complete



Tool Tune-Up and Maintenance App

The new Power Tool Tune-Up iPad app from *Woodworker's Journal* (woodworkersjournal.com) costs \$4.99 and offers step-by-step coaching by Sandor Nagyszalanczy and Chris Marshall on how to tune and maintain table saws, compressors, pneumatic nailers, moisture meters, band saws, jointers, planers, drill presses, and sawdust-collection systems.

Werner Ladder Tech Support

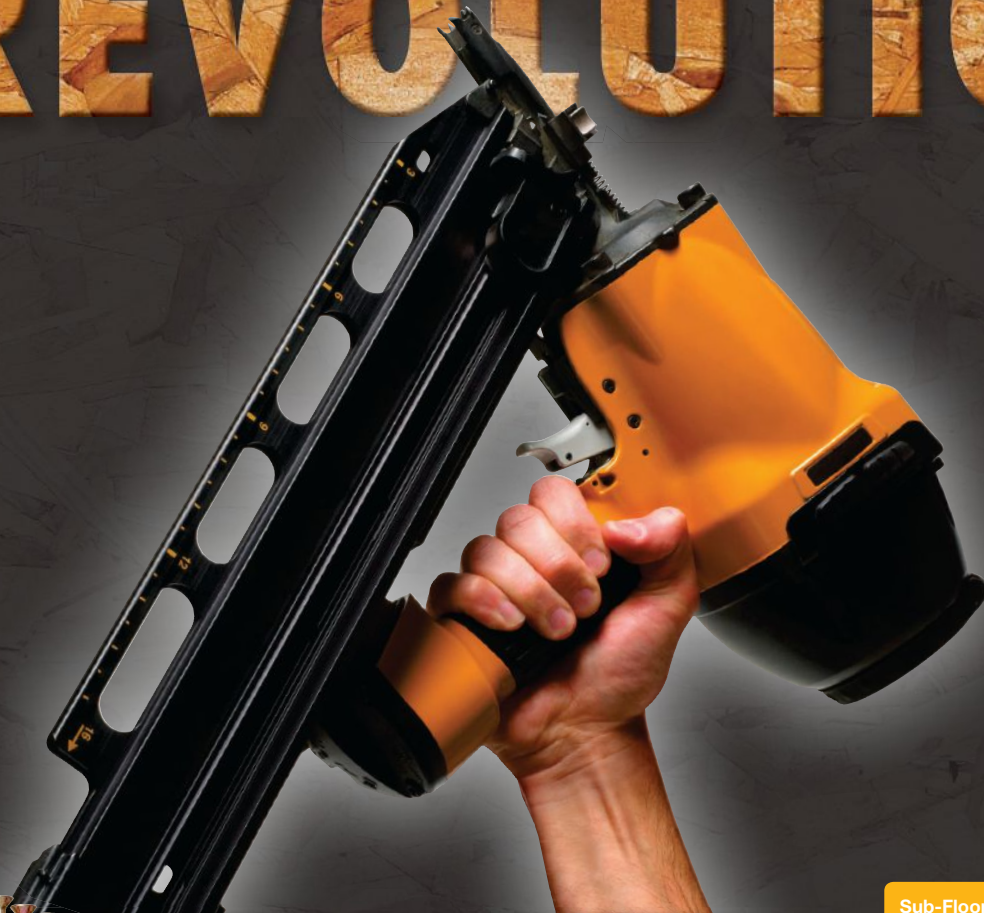
As of last February, you can post a technical question about any of Werner's ladders, fall-protection equipment, or other products at wernerco.com or at certain retail websites such as homedepot.com. Werner says it will post the answer within 48 hours. Besides getting your own question answered, you can view any of the other posted questions and answers, which can be far more useful than the typical FAQ. To date, Werner says it has already answered more than 1,000 questions with an average response time of less than 24 hours.

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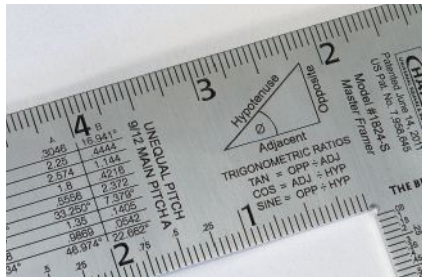
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Unique features include unequal-pitch rafter tables (left) and miter and bevel angles for applying fascias to square-cut rafter tails on hip and valley roofs (right). Edge scales are laid out in 20ths of an inch and in 1/4-inch increments for ease of use.

with purlins and other components. It also gives the miter and bevel angles to use when applying fascias to square-cut rafter tails on hip and valley roofs. Plus, this is the first square to add tables for irregular-pitch hip and valley roofs, and a table for octagonal and hexagonal roofs.

A Game-Changer?

The square comes with a manual that thoroughly explains the tables, has clear illustrations, and gives a nice history of framing squares. But the fact is, I can solve a complex roof much faster using geometry, drawings, a calculator with trig functions, and Hawkindale Angles. I've talked with several other timber and stick fram-

ers who feel the same way. Even so, some of them are buying the square because it's a precise, American-made, stainless-steel layout instrument that will probably last for generations. Also, the information is there if you need it in a pinch or want to use it as a teaching tool, as one California framing contractor I know is doing. The square comes with a 90-day guarantee; you can send it back for a complete refund, no questions asked.

William Dillon is a job supervisor, co-owner, and member of the Management Committee with South Mountain Co., an employee-owned design-build firm on Martha's Vineyard, Mass.

Copemaster Update

On April 6, 2013, in the *JLC Tools & Equipment* forum, a regular contributor asked if the Copemaster production coping machine was still available after he searched for it and drew a blank. The machine he's referring to was introduced about 10 years ago by former Connecticut millwork manufacturer Bill Shaw, and it was an instant classic. It weighed 65 pounds (so you could carry it around a job site), could cope crown up to 7⁵/₈ inches wide at least twice as fast as coping by hand, and cost \$2,295. I talked with a finish-carpentry contractor in 2007 who bought three of the machines to cope baseboards and crown moldings for the new Trump International Hotel in Las Vegas. After running them hard for more than a year, he said the machines were his company's most durable power tools by far. Well, I just called Bill Shaw for a heads-up. The bad news? He stopped making the tool when the economy crashed. The good news? He still sells parts for it, and late this year he hopes to introduce a new model that weighs 10 pounds less, copes wider crown, and costs about the same. You can reach him at 800/630-1104. — B.G.



Second Look

Hilti Autofeed Drywall Screw Magazine

With the help of his teammates, Josh Overlin — who owns Chetco Drywall in Brookings, Ore. — field-tested two Hilti SD 4500-A18 18-volt drywall screw guns with Hilti SMD 50 autofeed magazines for six months before writing about them in our April 2012 issue. He reported that the cordless freedom was “wonderful” and the tools were trouble-free. Although complete kits cost a hefty \$380 or \$500 depending on battery size, the tools were so efficient he figured they would pay for themselves in labor savings in less than two months.

The tools have now been out there for another year, and the crew has had only one problem — a broken spring in one of the magazines. Unfortunately, Hilti charges \$12 for a new spring, plus a minimum shipping charge of \$18, so the guys at Chetco improvised by coupling part of the broken spring with a spring out of an old Senco autofeed attachment. Works great so far.



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When the College of Cardinals assembled at the Vatican's Sistine Chapel this March to choose a new pope, there was no clear front-runner and the outcome was very much in doubt. But the method that would be used to communicate the result was not: The cardinals would rely on a much-adapted system of ductwork and solid-fuel combustion equipment that has been evolving at least since the papal conclave of 1903.

Maintaining proper clearance between stovepipe and combustibles is especially important in the Sistine Chapel (right). The Vatican fire brigade installs the guy-wired vent stack on the centuries-old tile roof (below). The cylindrical metal stove in the photo at bottom right was first used to signal the 1939 election of Pope Pius XII; the boxier high-tech appliance to its left was added in 2005.



Traditionally, just-counted ballots from each inconclusive round of papal voting are burned with damp straw, which limits combustion and produces thick black smoke. The announcement of a successful vote — and of the elevation of a new pope — is made by burning the ballots without straw, which is supposed to yield clean-burning white smoke.

In practice, though, the result of both kinds of combustion has often been an unreadable shade of gray, plunging onlookers into confusion. After two embarrassing false alarms during the 1958 conclave that elected Pope John XXIII, Vatican experts began experimenting with methods of generating reliably black or white smoke.

At the 1963 and 1978 conclaves, technicians tried tinting the smoke with military flares and chemical additives. The results were mixed — spilled fumes from the chemicals used at one of the two 1978 conclaves reportedly left the cardinals coughing and choking — but a breakthrough came in 2005, when the two-stove system used this year was introduced: Completed ballots are burned in the original cylindrical cast-iron stove, while a boxier satellite appliance — which joins the main copper vent stack at a wye fitting several feet above the ballot burner — supplies additional smoke from electrically ignited colorant cartridges. (The black cartridges, the Vatican disclosed this year, are compounded from potassium perchlorate, sulphur, and a coal-tar-based black dye called anthracene; the white from potassium chlorate, lactose, and pine rosin.)

Some commissioning problems cropped up during the system's 2005 debut. At one point the main stove backdrafted when opened, sending smoke swirling over Michelangelo's priceless frescoes, although it's not clear whether the mishap resulted from improper system design or operator error. (As church historian Christopher Bellito observed to NBC News, "These cardinals are not exactly handymen.")

Perhaps in response to the spillage problem, the Vatican confirmed that the 2013 system included an electrical resistance heating unit for warming the flue and a backup blower. The adjustments worked: The black smoke from this year's conclave was unmistakably dark, and its white smoke brilliantly so. — *Jon Vara*

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