

KNOW THE CODE: DECK POSTS, BEAMS, AND FOUNDATIONS

FineHomebuilding

DESIGN • BUILD • REMODEL

Deck Builder's Tool Kit

24 must-haves
for everything
from demolition
to installing deck
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BRINGING HIS A-GAME: THE PROCESS OF BETTER BUILDING



Jake Bruton has always craved just a little more time to make his projects better. It's that same drive to find a better way of doing things that has since found its way to his construction company, Aarow Building.

"Since taking over Aarow Building 11 years ago, I have strived to set our company apart by using better products and processes," Bruton said. "I take pride in the work I do each day, and I want to provide homeowners with a house that is better built, will last longer, and will be healthier and more comfortable to live in."

Jake brings 20 years of carpentry to the job each day, which starts as early as 4 a.m. and involves constant collaboration.

"We handle problem-solving as a team so everyone involved can learn and take that practice to the next job." For Jake, it's not always about rushing to meet the deadlines. With a consistent focus on quality, he leads his teams to consider the details and be purposeful each step of the way.

"I decided by focusing on quality I needed to allow myself to go, 'well, it's OK it's going to take a little bit longer to go the last five steps.'" Ultimately,

"I decided by focusing on quality I needed to allow myself to go, 'well, it's OK it's going to take a little bit longer to go the last five steps.'"

Jake Bruton, Owner
Aarow Building

Aarow Building is focused on making homeowners happy by bringing its best work to every job, no matter the size.

"Whether it is a bathroom remodel or a newly built custom home, our work brings joy to the homeowner when it's finished," Bruton said. "The only way to ensure that happens is to pay attention to the details and take pride in the work we are doing each day. This is something that varies significantly from old-school methods of construction."

To build better, more durable and energy-efficient homes, Jake spends time developing relationships with

quality subcontractors and product manufacturers so he has a like-minded team he can trust.

"We work with manufacturers like Huber Engineered Woods because they not only provide us with high-quality products, but they also provide us with quality service. Being granted access to reps who help us solve issues is hugely beneficial to us as a company, and it goes above and beyond the type of support we receive from other manufacturers."

A-game builders like Jake Bruton bring their best to every job. Watch his full story at AdvanTechAGame.com or by scanning the QR code below.



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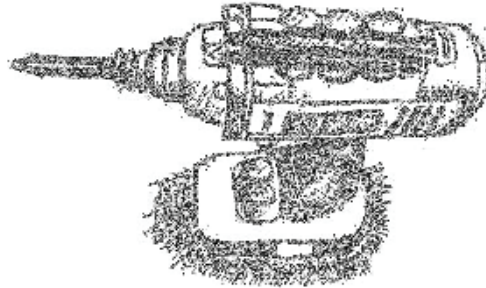
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Learn from a legendary framer

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Watch carpenter Larry Haun demonstrate how to frame floors, walls, and a roof for a modest-size house in this video series from the *Fine Homebuilding* archives. Larry produced this video in 1992 as a companion to his book *The Very Efficient Carpenter*. Some of the details and tools have changed over the years, but there's still plenty to learn from Larry as he walks through the entire process, from material handling, to layout, to cutting and final assembly.



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A pocket-hole jig is a simple alternative to traditional joinery and floating-tenon systems, and doesn't need to be clamped after assembly while glue is drying. Give us a minute and we'll show you how to use it.



Ep. 214: Converting and restoring

The *FHB* crew hears from listeners about two very different projects: restoring a 200-year-old barn and converting a 9000-sq.-ft. house to net-zero energy use.



Concrete-free "slab"-on-grade foundation

Northern Minnesota designer Randy Williams omitted the concrete under the floors in this new house—a growing trend amongst builders of energy-efficient homes.



Renovation book excerpts

Take a look inside one of The Taunton Press's most popular construction books in this blog series by author Michael Litchfield.

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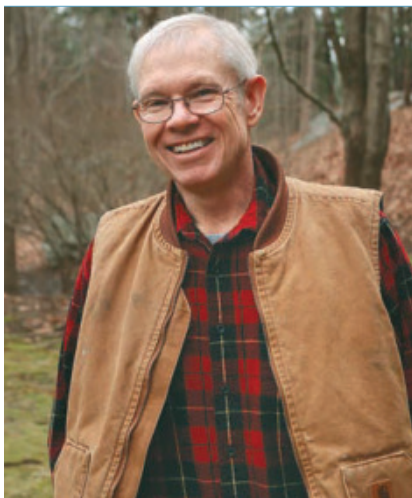
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THE VOICES OF EXPERIENCE



Owner and founder of Hull Historical, **BRENT HULL** is a nationally acclaimed old-house expert. In 1991, he attended North Bennet Street School in Boston, where he studied historical preservation. He has combined his passion for craftsmanship and restoring buildings with his love of historically inspired houses to become a leading industry expert in all things related to this subject matter. In this issue, he writes about books every builder should own (pp. 60-64). He can be found on Instagram @hullmillwork_hullhomes.

In 2002, after trying out some less satisfying occupations, **MARIA KLEMPERER-JOHNSON** ("Scribing Rails to a Round Column," pp. 65-69) followed her passion to become a builder. In 2013, she founded Hammerstone School of Carpentry for Women to share that passion with other nontraditional builders. She now teaches residential construction at SUNY Delhi, and during her summers continues to build and teach carpentry for women in Trumansburg, N.Y., where she lives with her three kids, dog, cats, and chickens.



Since 1979, **ANDY ENGEL** ("A Deck Builder's Tool Kit," pp. 32-37, and "Choosing the Right Concrete Mix," pp. 44-48) has either been a carpenter wishing he was a journalist or a journalist wishing he was a carpenter. A former *FHB* editor, he currently works as a carpenter for HVP Corp., a remodeling company in Kent, Conn., and as a freelance writer. Through his career, Andy has nailed together every part of a house from footing forms to finish stairs. He's also remodeled two houses for his family, and built two others.

write an article

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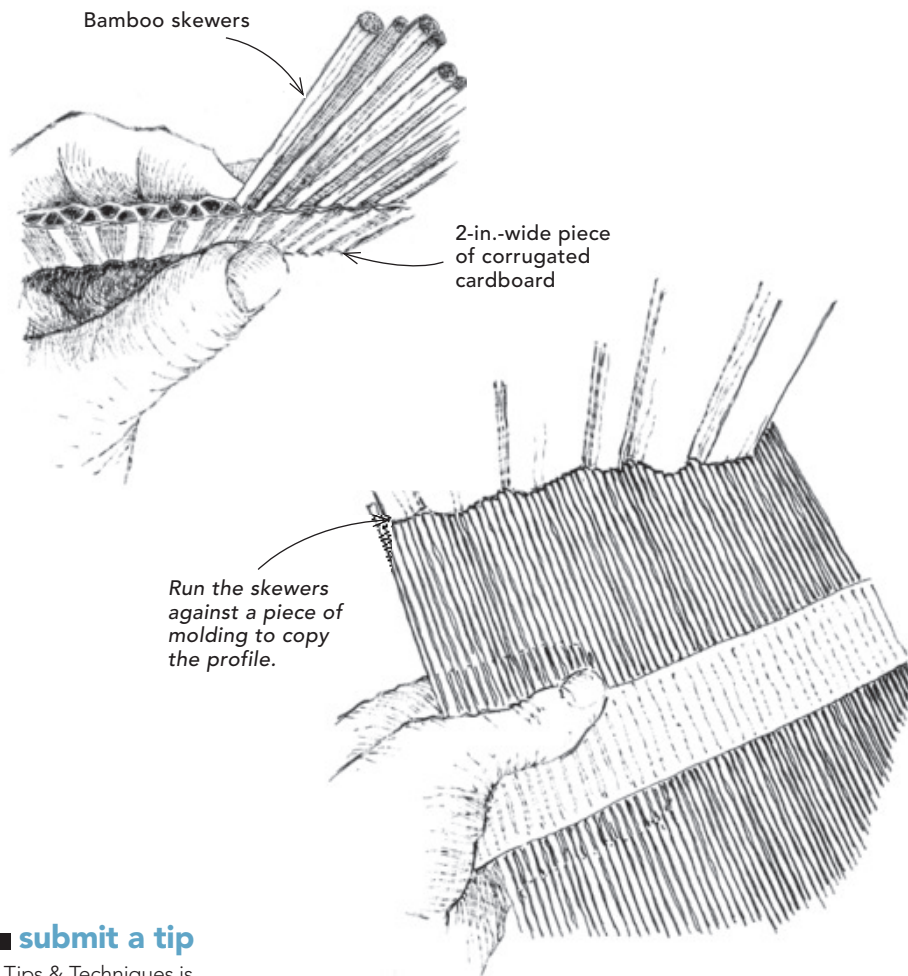
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Copying moldings

I've created an inexpensive tool to copy molding and trim profiles. Starting with a pack of bamboo skewers from the grocery store, I inserted about 50 of them into a 2-in.-wide strip of corrugated cardboard. I push this improvised contour gauge against molding profiles to get a very accurate template of the profile. I can then use the template to check or reproduce the shape. One benefit of this homemade version compared to a commercial version is that it can be made as large or as small as needed for the job at hand.

—ROB FOOTE
New Zealand

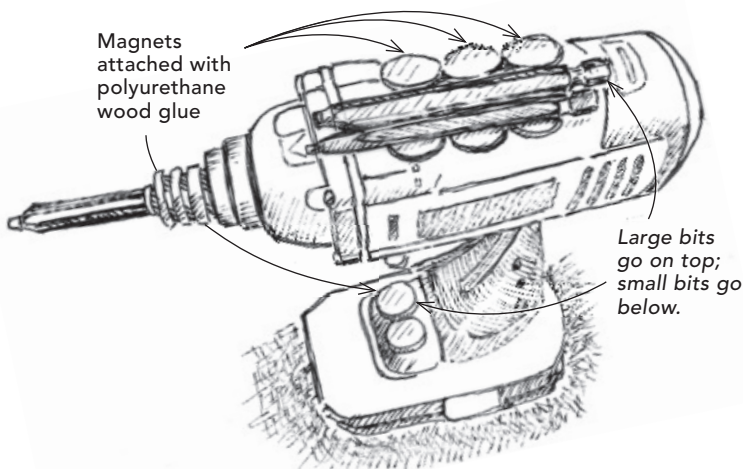
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On-board bit storage

My impact driver is my most-reached-for tool. Unfortunately, I often spend too much time searching my pockets or going to my truck for bits. The drawing (right) shows how I now get around this impasse. I used polyurethane wood glue to attach a number of high-strength neodymium magnets to my driver, keeping my most-used bits secure and easy to find.

—RICHARD PERTZ,
Hopewell, N.J.



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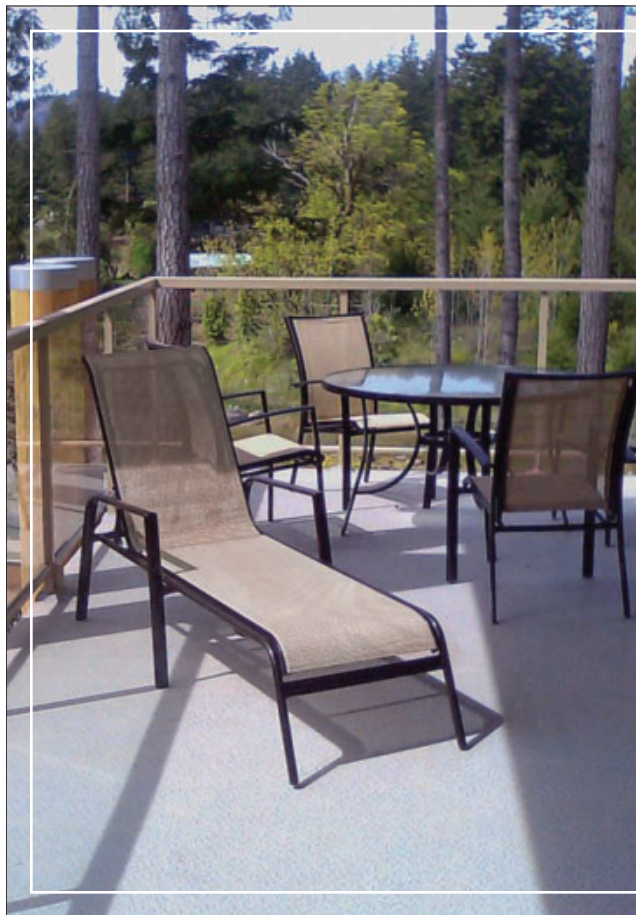
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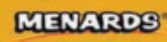


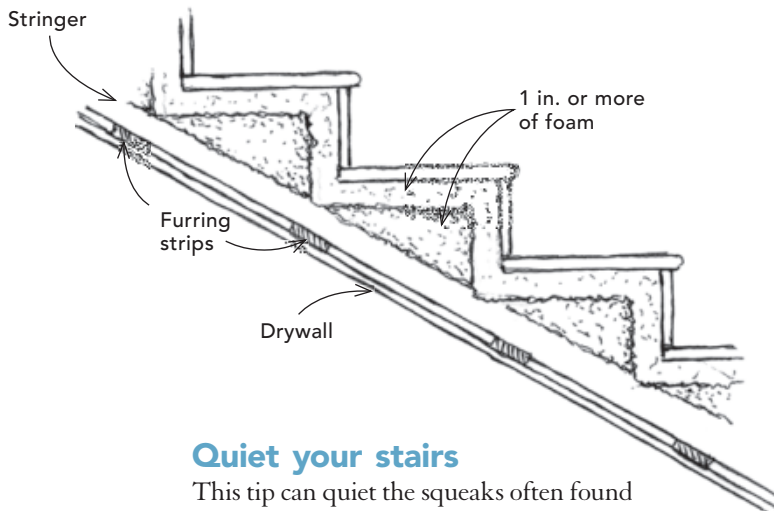

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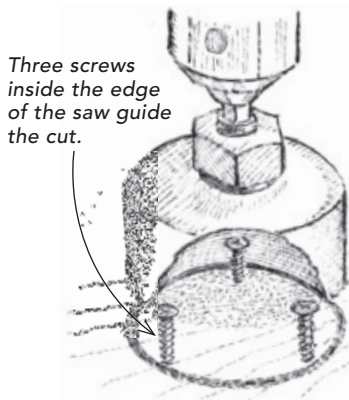
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Quiet your stairs

This tip can quiet the squeaks often found on both new and old stairs. If we're working on an older stairway, we shim the treads and risers from below or drive the existing shims deeper so they're fully seated, and glue them in place with a high-quality construction adhesive (I like Loctite PL 400). Then we apply the same adhesive to all the seams between the treads and risers and tool it into the joints, and add screws to all treads and risers to better secure them to each other and to the stringers. Finally, we spray at least 1 in. of closed-cell foam on the underside of the staircase, which deadens sound and locks the whole assembly together. Doing the same thing on new stairs is cheap insurance against squeaks, and customers love asking their friends, "Did you notice how quiet the stairs are?" Drywall on the underside of the stairs provides the necessary fire protection.

—JARRETT KRAVITZ
Clinton, Conn.



Hole-saw hack

More than once I've found myself using a hole saw with a missing or broken pilot bit. Without the center bit, the hole saw is difficult to control and can skate away, damaging whatever it is you're working on. To solve this problem in a pinch, drive three screws into the material you're cutting, making sure to keep them spaced apart just enough to fit within the area of the hole-saw blade. With these screws in place, the spinning hole saw is held in position until it creates a kerf to guide itself. Once the kerf is established, remove the screws and finish cutting the hole.

—TIM BRENNER
Medina, N.D.

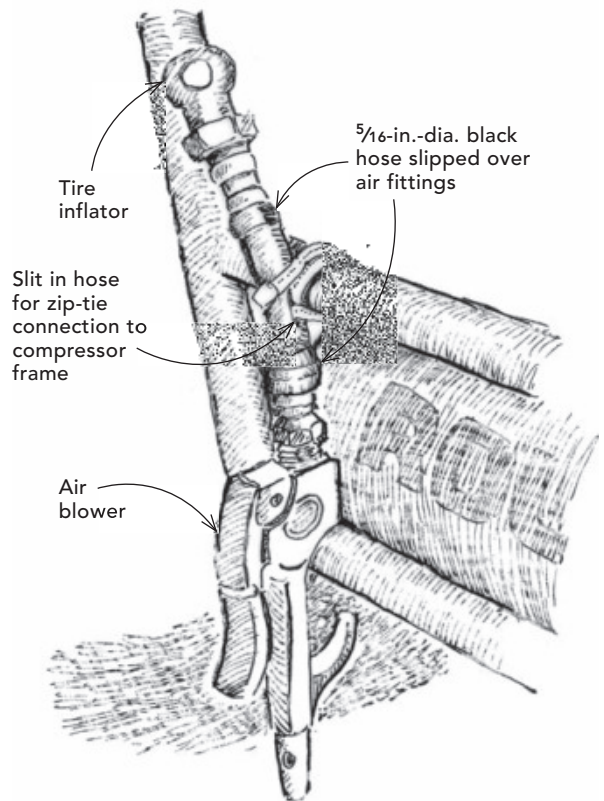
Removing mortar-filled screws

Recently, we had to demo a bathroom with cement-based tile backer beneath the tiles. After removing the tile and tile board, we were faced with dozens of square-drive screws sticking out from the framing. The screwheads were filled with mortar and our driver bits could not get a grip. Using locking pliers to back out all of the screws would have taken forever. Instead, we tightened the chuck of a drill/driver around each screwhead, then put the tool in reverse to back the screws out of the wood.

—ED RIDGIK
Wilmington, Del.

Compressor-tool keeper

A tire inflator and an air blower for my compressor are must-haves on the job, but keeping track of them so I have them when I need them is a struggle. Here's my solution. I use a few inches of 5/16-in.-diameter rubber



fuel line that I slip over the air fittings on the two tools to hold them. A slit in the center of the fuel line allows me to zip-tie the whole thing to my compressor frame. The short length of fuel line keeps the two tools right where I need them, without them rattling or falling off the compressor.

—MORGAN RAWSON WHEELER
Washington, Maine

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The complicated path from decking to dirt

As a collector of vintage code books, I perused my stockpile before I sat down to write this column and picked up the oldest and closest thing I could find related to decks: a 1958 Popular Mechanics hardback titled *Outdoor Living Rooms*. Though chapter five is titled “Floors,” there was no mention of elevated outdoor floors like decks or porches, just paver-type systems. Surprising as it sounds, structural code provisions for decks weren’t introduced in model codes until four decades after that book was published, and even then, it wasn’t until the 2009 edition of the International Residential Code (IRC) that a fastening schedule for deck ledgers was included. Prior to that, the only direction given for their attachment was a prohibition on “nails subject to withdrawal.”

Fast-forward a decade and decks are no longer an afterthought in the IRC, which now provides a nearly complete package of prescriptive structural design. For those who groan at the thought of more codes getting in the way of their plans, this critical quote found in section R104.11 should bring some comfort: “The provisions

of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code.” Instead, the deck code provisions are meant to assist in proper construction and add to the arsenal of potential deck designs, not take away options. Very little of what’s been added are “prohibitions.”

I say the IRC deck provisions are “nearly complete” because there is still a lot of research and work to be done on guards, handrails, and stairs. But from the decking down to the dirt—including everything in between—the IRC provides a clear, albeit evolving, path to follow.

DECKING

Manufactured decking products continue to grow in popularity across the U.S., as does the variety of materials used to make them. ASTM D7032 is the go-to test standard for all manufactured decking products and is referenced by the IRC. The code mandates these products be installed according to the manufacturer’s instructions to ensure they live up to their tested and advertised performance. Span ratings and fasten-



FOOTINGS GONE WILD

The smallest round footing provided in the 2018 IRC is a whopping 14 in. in diameter. This section of the code will see some revision in 2021, but more work needs to be done, as much smaller footings have proven to work well in some regions.

ing requirements vary widely by product. As obvious as this is, many decks still fail inspection and fall short of their expected life spans because of a simple failure to follow instructions.

Spans for wood decking are different. They are standardized through lumber design values and span-rating

analyses put together by engineers. When table R507.7—“Maximum Joist Spacing for Decking”—was developed under this method in 2015, the results were nearly identical to what had long been standard practice for old-school plank subfloors. Just as with those old subfloors, deck boards are often

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laid at an angle to the joists. This lengthens the span that the decking has to bridge compared to a perpendicular layout, so the joist spacing has to be reduced to compensate. As an example, for 5/4-in. decking (measuring about 1 in. thick), joists must be no more than 16 in. on center when the decking is perpendicular to them, but no more than 12 in. on center when the decking is installed diagonally.

A little-known, but long-true detail: The decking spans listed in the code are meant to apply to deck boards supported by at least three joists. But that's not been industry practice. The IRC now makes this point clear. However, because of the increased popularity of ornate decking designs, the 2021 code will include additional maximum joist spacings for single-span decking, all of which will be about 4 in. shorter than what's in the current table.

Fastening for wood decking is also specified (in section R507.7) and requires at least two fasteners in each support.

JOISTS

Building codes have long provided joist-span tables and joist-installation details, but these weren't intended for decks. They were intended for dry, interior floors completely wrapped in braced walls. A deck is quite different. The joist-span tables in section 507—added in the 2015 edition of the IRC—are specifically designed for outdoor decks, and the latest 2021 edition will expand them to 50-psf, 60-psf, and 70-psf snow-load regions.

The lack of deck-specific joist spans wasn't really a sticking point in older versions of the code, but how far joists can can-



DECKING FOR SMALL SPANS

Some decking designs go beyond the limits of the code. Span tables for wood decking have always assumed the boards would bear on three joists, though this wasn't explicitly stated. The 2021 code spells this out, but also provides joist-spacing tables for two-bearing span.

tilever beyond a beam sure was. Beginning in 2000, the IRC allowed floor joists to cantilever upward of 4 ft. while carrying a roof load at their cantilevered end. But until 2015, there was no specific guidance for cantilevering deck joists, which don't tie into the house the way floor joists do. Beginning in 2015, deck joists of solid-sawn lumber at common on-center spacings have been allowed to cantilever up to one-fourth their span in most circumstances (for example, joists spanning 12 ft. can cantilever 3 ft. beyond the beam).

The maximum deck-joist cantilever is dependent on the actual joist span—or, put another way, the backspan from the beam to the ledger. But the maximum joist span is also dependent on whether the joist cantilevers. It's a dynamic relationship that makes simplifying span and cantilever limits difficult. Significant revisions

were made to these limits in recent editions of the code. The engineering didn't change; the spans were simply refined for greater accuracy. And those refinements are ongoing. For example, the IRC's 2018 deck-joist-span table appropriately breaks down maximum joist spans by joist spacing, but it also relates the maximum cantilever to the spacing, not simply to the joist's backspan. This will change again in the 2021 edition, which bases the maximum cantilever on just the backspan.

BEAMS

As you follow the load path from decking to dirt, the analysis of the framing members becomes more complex. Each layer down has to account for all of the variables above.

Nevertheless, table R507.5, "Deck Beam Span Lengths," handles this complexity pretty simplistically, representing the load on the beam as the joist

span. When a joist spans from a ledger to a beam, half the length of the joist is loaded on the beam, and this uniform loading is the basis of the engineering in the table.

There are two critical load assumptions behind this: Only uniformly distributed loads from joists are included in these designs, and those loads only include live and snow loads. This accounts for people and everyday furniture, but not heavy things like hot tubs or thick concrete countertops in outdoor kitchens. Failure to provide supplementary design for such loads could result in anything from excessive deflection to catastrophic failure.

Some deck designs may require a beam to carry another beam that is carrying joists. Other than the small and nearly inconsequential loads of a stair-landing beam at the side of a deck, the IRC does not account for these load-path designs.

Remember those joist cantilevers? The entire load from the cantilevered portion of a joist bears on the beam, yet a joist cantilever length is not a variable in the maximum-beam-span table. The maximum cantilever load for each joist span is already assumed in the beam spans. When joists don't cantilever past a beam, the maximum beam span is nevertheless limited by the assumption that they do. By providing a table of beams designed for the worst-case scenario, the code has led builders to oversize beams. While this provides some flexibility in joist-cantilever design, it adds unnecessary costs for decks without cantilevers.

The 2021 IRC offers a Band-Aid to this problem with a new footnote in the table that allows

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you to modify the joist span used to size a beam based on the ratio of span to cantilever. Though a little complicated, the modifier will allow much more accurate beam sizing without a reduction in safety. The IRC beam-span table includes a variety of lumber species and profiles, such as single-ply, two-ply, and three-ply built-up beams as well as 4-in.-nominal beams.

Section R507.5 complements the beam-span table with provisions that allow all beams to cantilever beyond an end support post by up to one-fourth the beam span. This allowable cantilever does not affect the maximum beam span, but does affect the post and foundation sizing.

Not included in the code tables are spans for exterior-rated engineered lumber, which can greatly increase beam span. However, methods for post and foundation sizing in the 2021 IRC will include loads from beams with spans larger than the IRC tables provide. So even though you'll need alternate design documents to size engineered lumber for decks, you'll be able to use the code to size posts and footings to carry them.

POSTS

The load on a post, its size, and its species are the three variables that should affect the maximum height of a post, but that's not the case in the code (yet). Though what we have now is better than the lack of guidance that existed before, the 2015 and 2018 table R507.4, "Deck Post Height," is extremely conservative and does not account for any variable but post size. The 8-ft. limit of a 4x4 post and the 14-ft. limit of a 6x6 post are

based on the maximum possible load each could receive using the IRC joist- and beam-sizing tables (2x12 joists and multiply 2x12 beams). Discretion could be used in applying these table limits when lighter loads are supported.

This conservative approach won't carry over into the 2021 edition of the IRC, which expands the post-height table to include the missing variables of species, snow loads, and the tributary area loading each post. Beginning in 2021, the IRC will allow a 4x4 post (the corner post

tributary loads carried by individual footings and use that as a variable, along with the bearing capacity of the soil, to size each footing individually. Tributary area, though not a new concept, is a newly included method of IRC design that will carry over to the 2021 edition.

Unfortunately, in the evolution of deck codes, foundation systems still need considerable attention. The IRC has long provided standardized soil-bearing capacities in order to size the bearing area of footings supporting houses, but that

However, none of this is represented in the new design methods in the IRC, where only bearing area is considered. In the 2018 IRC, the smallest tributary area provided is 20 sq. ft., and this results in an absolute minimum 14-in.-diameter footing—a fair bit larger than deck builders in many regions are accustomed to. This table was modified for the 2021 IRC, which will provide for tributary areas as small as 5 sq. ft.

Code playing catch-up

This overview is only an introduction to the wealth of new codes now being adopted and published for deck construction. There are many other details and critical connections that must be considered for a safe deck design. This summer, the International Code Council is releasing a new edition of their deck code book, aimed at putting the exact provisions of the IRC, along with explanations, illustrations, and photos, in the hands of builders. Current and past IRC provisions can also be viewed online at no cost at iccsafe.org. Government building authorities are often a few years behind when it comes to adopting new codes, and it can take longer still for inspectors and building officials to become aware of the changes. With the lack of model codes for decks, building authorities across the nation developed their own requirements. When a new subject is tackled in model codes, it takes time for government regulatory practices to update to them. Be patient and inform others.

Glenn Mathewson is a consultant and educator with buildingcodecollege.com.

By providing a table of beams designed for the worst-case scenario, the code has led builders to oversize beams.

of an 8-ft. by 10-ft. deck) to be up to 14 ft. in height.

FOUNDATIONS

As you walk from a ski mountain parking lot to the fresh powder in the backcountry, your footwear has to broaden from boots to snow shoes to avoid sinking. This is the same concept for sizing footings for houses or decks. The load and the strength of the soil are variables in the minimum diameter of the footing bearing area (the bottom of the footing). A sizing table for deck footings was first introduced in the 2018 IRC, which brought with it two somewhat shocking results.

As a new concept for prescriptive design in the IRC, a code user can now calculate the

hasn't been standard practice for sizing deck foundations, as they get real big, real fast. Decks are generally more lightly loaded than a house, and sizing footings for them hasn't been nearly as strict or scientific. In many parts of the country where frost depths are 3 ft. and greater, slender pier-type footings have been widely used with success in constructing stable decks. These foundations may be only 8 in. to 12 in. in diameter, but the large surface area of these tall piers generates additional load resistance through the friction at their sides. Local building departments have approved them for decades, and their continued use relies on the empirical evidence of their proven efficacy.

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**Metabo HPT
7 1/4-in. Dual Bevel
Sliding Miter Saw
C3607DRAQ4**

Price: \$1250 (tool only)

When I learned Metabo HPT's Japanese-made sliding miter saw was coming to America, I was intrigued. Few tools from Japan are sold here because manufacturers say they're too expensive for the American market. The basics: The new saw is a 36v cordless 7 1/4-in. dual-bevel slider. An AC adapter is also available (\$170) if you'd rather plug in. The saw is light and compact and uses a rail-forward design to maintain a small footprint.

The quality of the materials used, the machining, and the fit and finish are all top notch. I checked the table and fence using machinist straight edges and squares, which showed that the saw had been meticulously set up at the factory—the table and fence were flat and square, and miter and bevel settings were spot on. At full extension there is no deflection of the rails, meaning that cuts in a 2x12 are perfectly square across their length and thickness. The saw has a laser that shows the cutline, and it's both crisp and easily adjusted. Two LED lights illuminate both sides of the blade—a welcome feature.

The motor and belt drive of the saw are smooth and quiet, with plenty of power to handle anything that fits on the saw table. When things get tough,

the saw's electronic speed control makes sure that the blade doesn't bog down.

The only downside is limited capacity. Nobody expects a 7 1/4-in. blade to tackle everything, but it's worth pointing out that the short fence means that cutting all but the smallest crown in the nested position is out of the question without an auxiliary fence. When beveling to the right at 45°, the saw was unable to cut through 1-in.-thick stock because the motor hit the workpiece. Beyond these limitations, I found the saw performed exceptionally well for cutting trim and other general finish-carpentry tasks. Cuts in prefinished hardwood moldings were precise and clean, even with the factory blade.

Not surprisingly, this premium saw comes at a premium price, so is it worth it? If I were solely a finish carpenter working with prefinished or hardwood moldings all day, where cut quality and accuracy are paramount and mobility is valued, this saw would be at the top of my list. But for the average carpenter who's working with a large array of material and doesn't require furniture-maker precision, it might be overkill. All in all, it's a well-made saw that delivers phenomenal cut quality in a compact, cordless package.

Ben Bogie, a lead carpenter for Kolbert Building in Portland, Maine.

Photos: courtesy of Metabo HPT



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Fire in the hole

One of my first responsibilities as an apprentice was nailing joist hangers. Flash forward 20 years and a skilled-labor crisis later, and I'm still hand-driving connector nails. In that time, the number of connectors used on a typical build has exploded, and I'm reminded of this every day by an ever-shrinking carpal tunnel. Given my aching hand, I jumped at the chance to try MAX's SuperLocator metal-connection nailer (SN438J). The nailer uses common 10d, 1½-in. connector nails, and it's the tip of the nail that you use to align the tool to the hole in the metal connector being installed. The tool's slim profile and 34° angle make it easy to squeeze into the tight spaces where this sort of nailing always seems to occur, and when not in use the handy multiposition rafter hook makes it easy to keep the nailer nearby.

The tool performs flawlessly. I've fired a few cases of nails through it without one misfire or jam, and my connector nailing has sped up considerably with far less wear and tear on my body. I've also used a few different brands of nails with no noticeable change in production.

At \$280, the SuperLocator costs more than some other connector nailers, but I have found MAX's tools to be exceptionally reliable. I've never had a problem with my three other MAX nailers (the SuperFramer, SuperRoofer, and SuperSider). Whether you're seeking to boost productivity or need to replace cheap labor with automation, this nailer is a can't-miss.

Andrew Grace, a remodeler in Ligonier, Pa.



Hanger handler. MAX's SuperLocator uses the nail itself to find the holes in framing connectors.

Photo: courtesy of MAX

 The advertisement for CabParts features four photographs of modern kitchen interiors. The top-left photo shows a kitchen with dark cabinetry and a stainless steel refrigerator. The top-right photo shows a kitchen with light wood cabinetry and a window with a decorative curtain. The bottom-left photo shows a kitchen with dark cabinetry and a red cylindrical island. The bottom-right photo shows a kitchen with light wood cabinetry and a granite countertop. In the center of the advertisement is a white text box with the CabParts logo and contact information.


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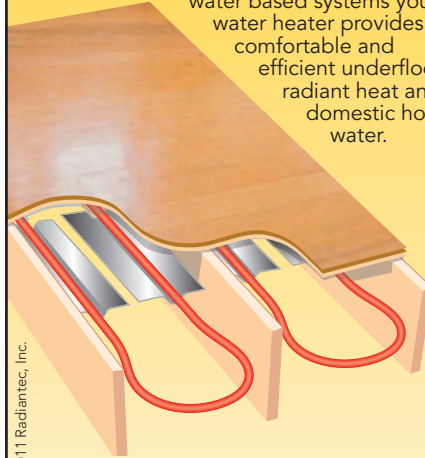
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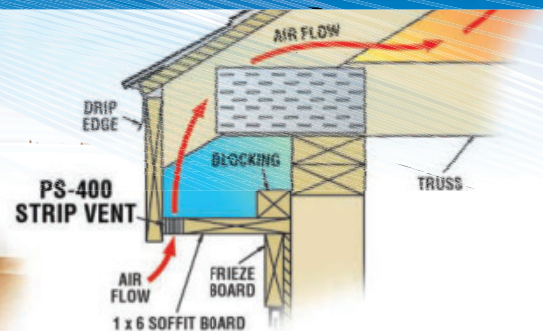


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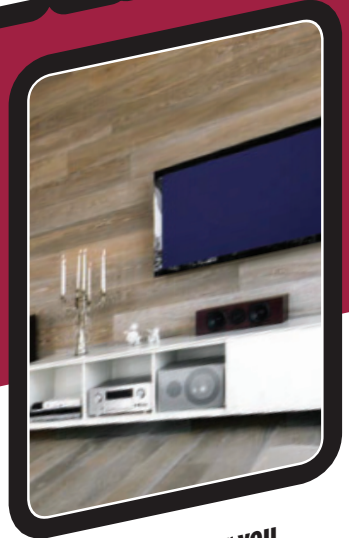
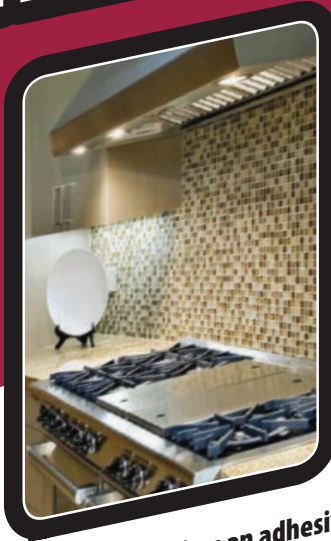
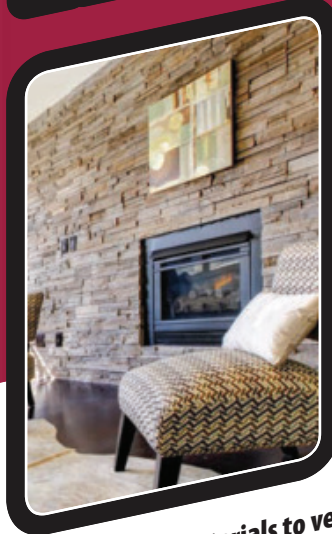
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A Deck Builder's Tool Kit

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BY ANDY ENGEL

I built my first deck in 1986 working out of the back of a Jeep Cherokee. The closest thing to a specialty tool I needed was a ratchet with a $\frac{3}{4}$ -in. socket to tighten the lags holding the ledger in place. Fast forward to 2020, and it seems the average deck contractor needs a $\frac{3}{4}$ -ton pickup to haul a trailer full of tools to even the smallest job. In fairness, decks have become an order of magnitude more complicated since the Reagan administration. Back then, we screwed nothing together, and maybe we used joist hangers, and no matter which of the three decking materials we used (PT, cedar, or redwood), it got nailed down.

Still, it seems like there are more tool options out there today than are strictly needed. In an effort to sort out what's really useful, I talked to a bunch of deck contractors to learn what they haul to the job every day. □

Andy Engel is a former *Fine Homebuilding* editor and a current lead carpenter for HVP Corp. in Kent, Conn.

PULL DECK BOARDS

These days, a lot of deck jobs are deck replacements. If the old framing is headed for the trash, most builders cut the decking between the joists with a circular saw and lever out the joists and decking at once.

But if the existing framing is staying, the trick is to tear off the decking as efficiently as possible. Joe Rogers of Advanced Carpentry & Remodeling in St. Louis, Mo., loves the Duckbill Deck Wrecker. Several contractors mentioned Nestorbars. Both tools work on the same principle: Two prongs slip under the decking, one on each side of the joist.

With the joist acting as the fulcrum, a long handle provides enough leverage to rip up even screwed-down decking.

Nestorbars 32-in. utility wrecking bar with 8-in. rocker claws
\$185

Duckbill Deck Wrecker
\$85



Toro Dingo TXL 2000
\$30,000+
(rent for \$200 per day)

DIG FOOTINGS FASTER

No one likes digging footing holes. Nick Markey of N.G. Markey Custom Woodworks in Charlton, Mass., rents equipment to solve the problem. "Depending on the size of the job," he says, "that can range from a walk-behind Dingo compact utility loader with a bucket and an auger to a compact backhoe. I'll also rent a two-to-three-bag concrete mixer, instead of mixing in a wheelbarrow."

HAUL HEAVY LOADS

Speaking of wheelbarrows, Gary Bruzzese, who owns Craftsman Contracting in Norwalk, Conn., has given up on them. Instead, he uses a Rubbermaid commercial cart. He claims, "It has a bigger capacity than a regular wheelbarrow and is very stable with its two wheels. It's also big enough to flip upside down and cover up hardware or bags of concrete overnight."



Rubbermaid 7½-cu.-ft. Big Wheel Cart
\$160



DeWalt Green Rotary Tough Laser
\$1600 (with battery and charger)

FIND YOUR LINES

One tool that nearly every contractor I spoke with mentioned was a green-light laser. They're great for laying out footings and shooting elevations, among other things, and their green beams are far more visible in daylight than red lasers. Although he's a green-laser fan, Bruzzese still uses his stringline regularly: "Lasers are great, but even the green ones aren't visible in full sun. Plus, it's easy to knock them out of position. I can set up a string and I know it will stay just where I left it."

SNAP WITHOUT STAINS

Instead of marking cuts and fastener lines with red or blue chalk, which can stain or take a long time to wash away, Ethan Biederman of South County Post & Beam in West Kingstown, R.I., uses baby powder, which washes away in the first rain.

Johnson's Baby Powder
\$4 (9-oz. bottle)

DeWalt Cast Aluminum Chalk Reel
\$8



Prazi 12-in. Beam Cutter
\$140 (without saw)

CUT BIG TIMBERS

Although most deck framing is similar to house framing and the basic tools are the same, deck builders routinely cut 6x6s, and a regular 7 $\frac{1}{4}$ -in. circular saw won't get through them in one cut. In fact, they require five cuts—one on each side, and then another with a different saw through the center because the circular sawblade doesn't reach the whole way. East Greenwich, R.I., builder Mike Guertin simply drags out a chainsaw, either gas or battery powered. He says, "For notching posts, the tolerances aren't very tight, and a sharp chain gets close enough very quickly."

Mentioned by multiple deck builders was a hybrid circular saw and chainsaw: the Prazi Beam Cutter. Several mentioned beam saws like the Makita 16 $\frac{5}{16}$ -in. Circular Saw, the Skilsaw Sawsquatch and Super Sawsquatch, and the Big Foot. Jon Blakemore of Rappahannock Building & Remodeling in Fredericksburg, Va., says, "The Big Foot will cut a 4x4 in one pass and a 6x6 in two passes. It's also handy for cutting two-ply headers and double joists."



Big Foot 10 $\frac{1}{4}$ -in. Worm Drive Beam Saw
\$390



Makita 16 $\frac{5}{16}$ -in. Circular Saw
\$680



Skilsaw 16 $\frac{5}{16}$ -in. Super Sawsquatch Worm Drive Saw
\$600

TRIM IN PLACE

Nearly everyone I spoke with is using track saws for decking. The favorites were Makita's 6½-in. Plunge Cut Circular Saw and Festool's HKC 55 track saw (see the cordless version, HKC 55, below). The chief use is for trimming deck boards to length or when using a picture-frame pattern. The field boards are allowed to run long, then the track saw is used to cut them in a straight line.



Makita 6½-in. Plunge Cut Circular Saw
\$420 (with 55-in. guide rail)



Festool HKC 55 Cordless Track Saw
\$770 (kit with two batteries)



MAKE FAST, ACCURATE CROSSCUTS

Festool's HKC 55 cordless track saw came up several times. Although its 160-mm (about 6¼-in.) blade isn't much use on big timbers, it cuts 2x framing lumber just fine. Unlike most track saws, the HKC is meant for crosscuts. It fits Festool's regular track-saw track, but shines when used with its 16½-in. crosscutting track. The saw locks into the track and adjustable stops set the miter angle from 0° to 50°. Bruzzese uses it to cut joists: "I run the joists long and install the rim joist later. I start laying decking boards, and when I get a few boards from the outside edge of the deck, I mark the joist length so there will be a full-width deck board at the end. With the HKC 55, I don't have to draw a square line for each cut. I line up the saw guide with my chalkline and cut the joists to length."

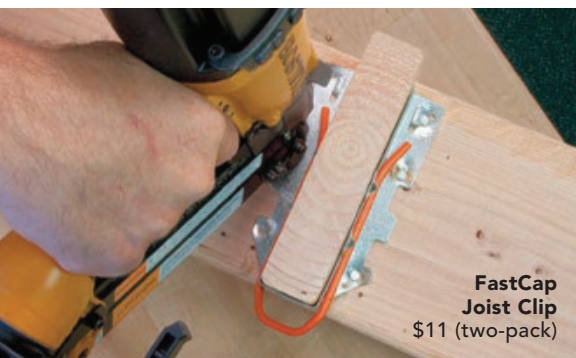


**Bostitch
StrapShot Metal
Connector Nailer**
\$190

NAIL THOSE CONNECTORS

Bruce Verblauw, owner of NJ Decks & Railings in Mahwah, N.J., was the first of several builders to mention metal-connector nailers. "We use both the Senco JoistPro250 and the Bostitch StrapShot. They aren't perfect, though. The Senco is limited to 2½-in. nails, while the Bostitch shoots only 1½-in. The Strapshot is great with 12-in.-on-center framing because its housing is smaller. Trouble is, the shear nails on joist hangers have to be 3 in., so we end up hand-nailing, or using a palm nailer."

When I continued this discussion with Guertin, he mentioned that Bostitch's F21PL framing nailer has interchangeable tips that allow it to be used as both a regular framing nailer and as a connector nailer that shoots 0.168-in.-diameter nails up to 3½ in. in length.



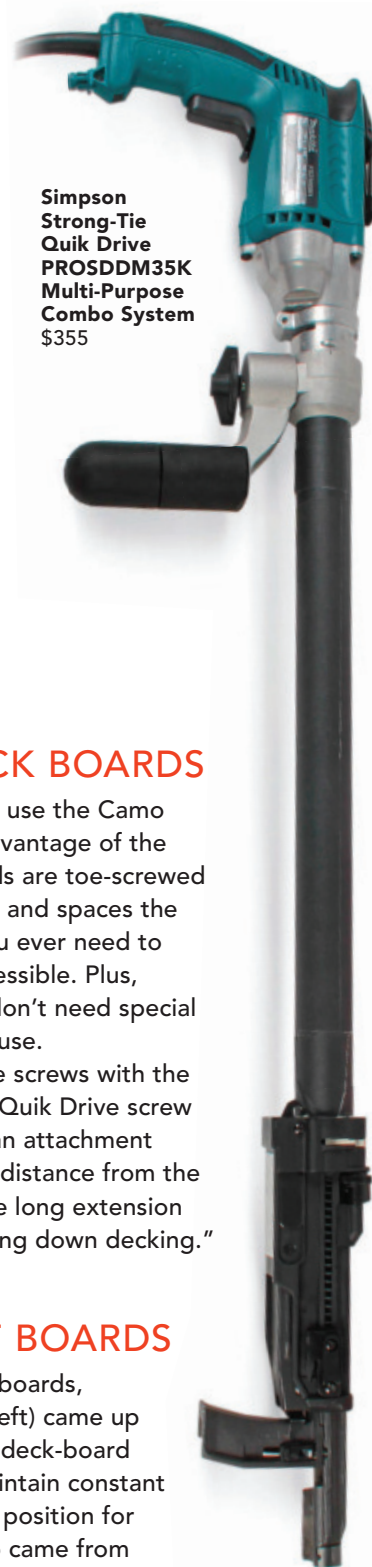
**FastCap
Joist Clip**
\$11 (two-pack)

HOLD HANGERS

Guertin also brought up FastCap's Joist Clip. The Joist Clip is a spring-steel clamp that holds the hanger on the joist while it's being fastened, allowing the carpenter to hold the joist with one hand and the nailer with the other.



Camo Drive
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**Simpson
Strong-Tie
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Combo System**
\$355

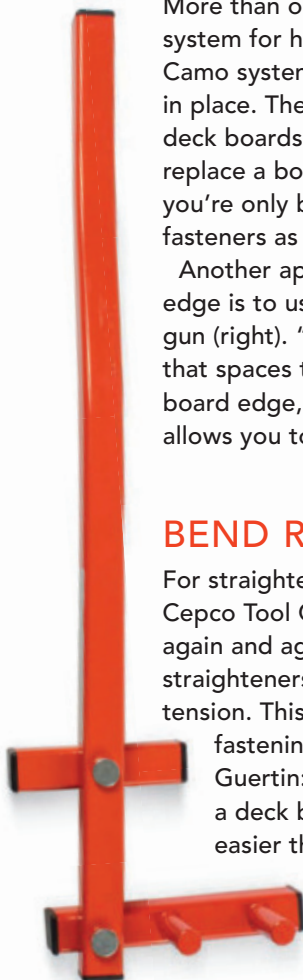
QUICKLY FASTEN DECK BOARDS

More than one builder told me they use the Camo system for hidden fasteners. The advantage of the Camo system is that the deck boards are toe-screwed in place. The tool guides the screws and spaces the deck boards at the same time. If you ever need to replace a board, the screws are accessible. Plus, you're only buying the screws and don't need special fasteners as well, so it's cheaper to use.

Another approach for aligning face screws with the edge is to use Simpson StrongTie's Quik Drive screw gun (right). "The Simpson tool has an attachment that spaces the screws a consistent distance from the board edge," says Guertin, "and the long extension allows you to stand up while fastening down decking."

BEND RECALCITRANT BOARDS

For straightening out bent decking boards, Cepco Tool Company's BoWrench (left) came up again and again. Unlike some other deck-board straighteners, you don't have to maintain constant tension. This one locks the board in position for fastening. One final decking tip came from Guertin: "Use a dead-blow hammer to engage a deck board onto a hidden fastener. It's much easier than using a sledge and a block."



**Cepco Tool Company
BoWrench Decking Tool**
\$60



PULL POSTS INTO LINE

Wood guardrail posts don't always stay exactly square and true, and sometimes a little persuasion is needed to join sections of railing. For this, Guertin cuts the railing to the exact length and brings the posts tight to it with a ratchet strap. "Not only does this get you a tight joint," he says, "but it frees up your hands to drive fasteners."



CONQUER TIGHT QUARTERS

When using manufactured railings, sometimes the baluster spacing leaves little room for drilling posts and fastening railing hardware. Paul Mitchell, who owns Mitchell Restoration in Torrington, Conn., says that, "A flexible extension bit is a must. I use a Ryobi one. My other 'must' tool for railings is a DeWalt right-angle driver. Both let me work in tight spots."



**DeWalt 3/8-in.
Right Angle Drill/
Driver**
\$130 (tool only)

**Ryobi 11-in.
Flexible Shaft
Bit Extension**
\$13

GET SHELTER FROM THE STORM

One tool that doesn't really fit any category—and which may not be a tool, exactly, but is very welcome in northern climes—is a pop-up tent with side panels. Lawrence Winterburn owns GardenStructure.com in Toronto, Ont., and knows a thing or two about working in the cold. "Add a catalytic propane heater inside the pop-up, and you have a warm cut station as well as a comfortable place to bring your fingers back to life in the winter."



Installing Cedar Shakes

Modern methods and materials for creating a timeless roof

BY ANDREW GRACE

Cedar roofs have become pretty rare in my neck of the woods. The rising cost of cedar and the increased popularity of metal have turned what was once a relatively common roof type in the early 20th century into a boutique option. It doesn't help that I'm a few thousand miles from the nearest western red cedar tree. But when my customers' 30-year-old cedar roof started leaking, they were resolute about using cedar again. It was not surprising, since it was the shake roof that drew them to the house in the first place.

Shakes or shingles?

When most people think of roofs, they think of shingles, but that's not the case when it comes to cedar roofs. Cedar shingles are regularly used on walls, but cedar shakes are more common on roofs. So, what's the difference? Shingles are sawn on both sides and thinner than shakes. Shakes are thicker, and split on one or both sides. There are two types of wood used for shakes: western red cedar and Alaskan yellow cedar. Alaskan yellow cedar is actually a kind of cypress and is harder than red cedar. Alaskan yel-

low cedar, although popular on the West Coast, is relatively unheard of in the eastern United States.

The responsibility of deciding the grading standards and installation details for red- and yellow-cedar roofs falls to the Cedar Shake and Shingle Bureau (CSSB). Their manuals for sidewall and roof installations are invaluable resources, and almost everything you

need to know about a bundle of shakes or shingles is clearly printed on its label.

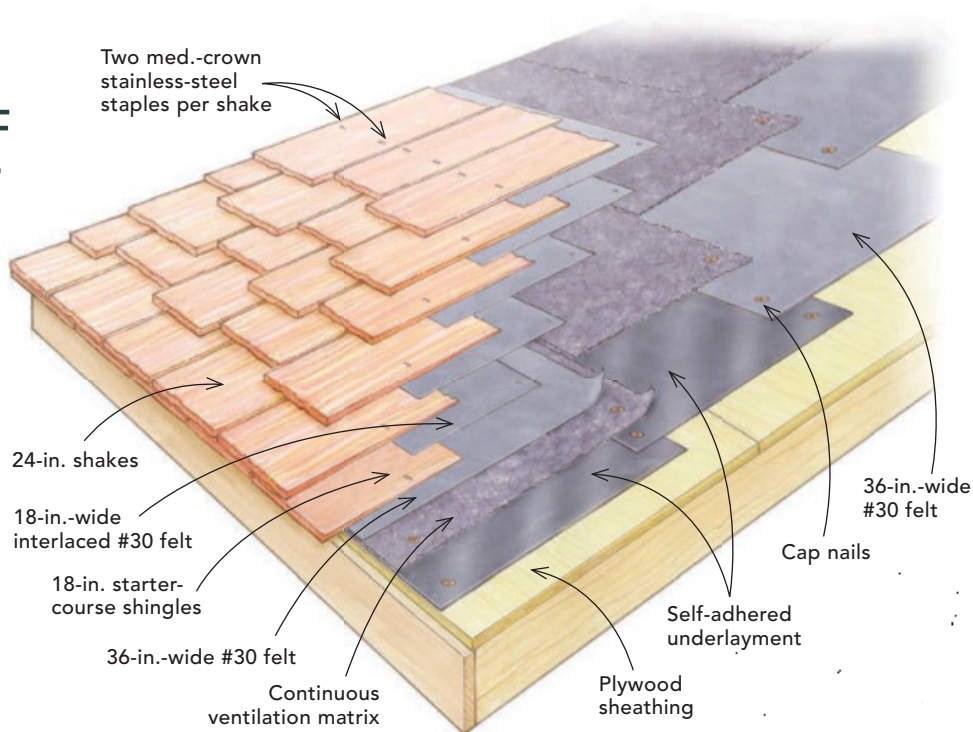
Not all shakes are equal

My customers wanted their new roof to look exactly like their old one. We chose Premium Grade Certi-Split handsplit cedar shakes, and specified 100% vertical grain. These "heavy resaws" are made from a block



MAKING A WOOD ROOF WATERTIGHT

Cedar shakes count on multiple water-shedding layers working together to keep out rain. Both shakes and felt absorb water that must be allowed to dry. A continuous ventilation matrix allows the shakes to dry evenly front and back to prevent cupping.



Peel-and-stick first. In areas with a history of ice dams, code requires an ice barrier to prevent ice dams from causing water damage inside. Our steep roof and wide overhangs meant we needed two courses that we fastened with cap nails. On top of the self-adhered membrane is a roll of continuous ventilation matrix fastened with the same staples that we use to secure the shakes.



Then full-width felt. Over the ventilation matrix we install 36-in.-wide #30 asphalt felt. The felt must comply with ASTM D4869 Type IV or ASTM D226 Type II. This thicker, high-quality felt is specified in the CSSB manual. We fasten it with just enough cap nails to keep it in place while we put on the shakes.



Starters before shakes. Under the first course of shakes is a starter course of underlayment shingles that overhang the fascia $1\frac{1}{2}$ in. (rake ends overhang 1 in.). These are sawn, 18-in.-long., $\frac{1}{2}$ -in.-thick (at the butt) cedar shingles. Their thinner butt end keeps the first row of shakes from flaring up.



Finally, the first course. The first row of shakes lines up with the starter course below. Each shake is fastened with two stainless-steel staples $\frac{3}{4}$ in. from the edges and $1\frac{1}{2}$ in. above the exposure line. Shakes should be spaced $\frac{3}{8}$ in. to $\frac{5}{8}$ in. apart with joints offset by at least $1\frac{1}{2}$ in.

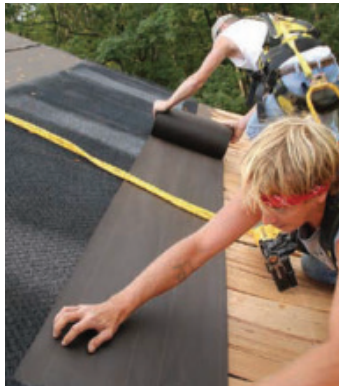
NEXT COURSE, MUCH LIKE THE FIRST

Once the first course is complete, subsequent courses are largely repetitive. Each starts with snapped lines that indicate the location of the felt interlayer and the butt end of the next course. Use only two fasteners, even on the widest shakes.



Snap some lines. The courses of felt and shakes are indicated by three snapped lines. The top one is for the felt interlacing; the bottom two indicate the exposure, which for this roof's saw-tooth design alternates between 9 in. and 10 in.

Roll out the interlacing. Strips of 18-in.-wide felt are stapled on top of the shakes at a distance from the butt that's twice the width of the exposure, which works out to 20 in. on this roof. Like the wider felt used under the first course, it should comply with ASTM D4869 or ASTM D226.



Whole lotta shakin' goin' on. Roofers work from both ends of the course and meet in the middle. Keeping a mix of shake widths close by helps ensure correct overlaps and an aesthetically pleasing layout.



More matrix. Once the shingle courses have reached the top of the ventilation matrix, another row of matrix is butted to the previous course and fastened with stainless staples. Tuck the matrix under step flashing, lap it onto valley flashing, then cut with a utility knife.



Secure footing

Roof jacks designed for slate roofing are best for cedar shakes. They cost about \$75 a pair at supply houses. The sheet-metal construction is thinner than cheaper jacks, so they're easier to remove. They also hold a 12-in.-wide staging plank, which is more comfortable and has more room for shakes and felt.

FLASHING PENETRATIONS

of cedar roughly 1 $\frac{5}{8}$ in. thick handsplit from a 24-in. log round. The block is then resawn corner to corner to create two tapered shakes between $\frac{3}{4}$ in. and $\frac{5}{4}$ in. thick at the butt. “Premium” refers to the percentage of edge grain to flat grain in the shake—Premium is 100% edge grain. There are two types of edge grain that meet the standard: slash grain and vertical grain. Vertical grain is perpendicular to the width of the shake. Slash grain can be at up to a 45° angle at the butt. Vertical grain is more stable, so I specified 100% vertical grain to minimize curling.

Number 1, the next grade down from Premium, is supposed to have a minimum of 80% edge grain and 20% flat grain. Flat-grain shakes are prone to curling, so they’re best avoided. More than one cedar-industry insider told me that there’s some fudge factor involved in the 80:20 ratio, meaning the ratio of flat grain is often higher because it’s hard to inspect. All-vertical grain is harder to fudge, because any flat grain fails the standard. 100% is not subjective. The shakes I specified were also cut from all old-growth trees, which have tighter growth rings and are more stable than newer trees. The upcharge for the best of the best shakes was about \$75 per square (100 sq. ft.), which is cheap insurance against later problems.

Old vs. new

A lot has changed in the few years since I last bought shakes. A major cedar supplier told me that modern production equipment has made the process more accurate, so manufacturers make thinner shakes to stretch raw material. As is common in small markets, all my local lumberyards get their shakes from the same master distributor, making it impossible for me to find the 5/4-in.-thick shakes I wanted locally. After some exhaustive searching, I found a Tennessee company that’s been a national red-cedar wholesaler for more than 45 years. With a brick-and-mortar store and knowledgeable staff, I felt comfortable doing \$30,000 worth of business with them over the phone. They helped me find a mill in Washington State that still produces the “old style” heavy split shakes that my customers wanted. The mill sent me over 20 photos of the 250 bundles of shakes I was ordering and a few sample shakes via UPS for my customers’ approval. I paid with a wire transfer and my order was headed east.

One important thing to keep in mind when buying direct is that you have to be able to



Flashing pipes and penetrations on a cedar-shake roof is similar to flashing asphalt and slate roofs—layers are lapped from the bottom up. Sidewalls get step flashing at every row; wider shakes are used at the wall-to-roof intersection. Headwall details get standard aprons.

Step flashing. On this roof we reused the copper step flashing along chimneys and dormer cheek walls, so we were careful when stripping the old shakes to prevent damage. When reusing existing flashing, it’s good practice to use shakes at least 1 in. wider than the step flashing. If this were a new roof, I’d bend my own step flashing from 10-in. by 12-in. pieces of 16-oz. copper sheet.



Flashing pipes. For the vent stack, place the boot on the ventilation matrix with the downslope edge lapped over the felt and shingle course below. A single shake with a round cutout is then fastened on top. A cordless jigsaw is the perfect tool for cutting the hole.



Rough character. On tight spaces like between this dormer and a neighboring valley, it often takes more than one try to get an arrangement of shakes that provides the minimum offset, maintains the saw-tooth pattern, and has a pleasing look.

FITTING VALLEYS

Valleys have layering similar to the rest of the roof. Under the copper valley is a layer of self-adhered waterproof underlayment for extra protection from water infiltration.

Worth a splurge. This is an expensive, highly visible roof, so we used copper for the valleys, but stainless steel and aluminum are also acceptable. We bend our own W-shaped valley flashing from 16-oz. copper sheet and nail it to the roof deck over self-adhered underlayment with copper slater's nails.



To see a slideshow of how to bend a W-shaped valley like the one shown here, visit FineHomebuilding.com/magazine.



Scribe to fit. Use a scrap of shingle ripped to 2½ in. as a guide for the angled cuts adjacent to the valley. This ensures that the cuts are straight and the sides of the valley are parallel from top to bottom.



Cut on the roof. A cordless circular saw is the fastest way to make straight and angled cuts. For best results, rest the end of the shake on the roof to steady the piece while it's being cut.



unload a tractor trailer on-site. I used my skid steer with forks, but if you hand-unload, they charge a premium for lost truck time. And I bought the underlayment and felt paper from my local lumberyard, but I had to buy full pallets of these non-stock items. I found the best price and fastest delivery of stainless staples on amazon.com.

More layers than an onion

Years ago, in the days before plywood and OSB, cedar shakes were nailed to skip sheathing, a substrate of narrow 1x boards nailed perpendicular to the rafters and spaced 4 in. to 8 in. apart. The spacing allowed both sides of the wet shakes to dry. This is an important detail. If a shake can't dry from the bottom, the top (weather-facing) side will dry faster than the underside, causing the shake to cup. Because skip sheathing is so labor-intensive to install, modern shake installations use a plastic matrix that allows drainage and promotes drying. The product we used, CedAir-Mat from Advanced Building Products, comes in 2-square rolls and costs about \$0.90 per sq. ft.

Although I use synthetic underlayments on asphalt-shingle and metal roofs, traditional asphalt felt is a must with cedar. Felt's permeability increases when it gets wet, allowing more drying when you need it most. Cedar shakes require 18-in.-wide layers of #30 roof felt over every row. You can cut standard rolls of felt in half, but you can also find 18-in. rolls, known as "split rolls." They cost 50% more per square foot, which is a negligible cost for their convenience.

Depending on roof pitch and local code, the CSSB recommends felt that meets either ASTM D226 Type II or ASTM D4869 Type IV, which are heavier, higher-quality felts. Although the CSSB details show the felt interlaced with rows of shakes and not applied to the roof sheathing, we put felt in both places. The layer over the roof sheathing protects the house from the elements while we're working on the roof, and it won't affect the shakes' ability to dry.

The first step when installing a shake roof is to strip the existing wood shakes, which creates a lot of debris. This 5000-sq.-ft. roof produced 90 yd. of waste, compared to about 20 yd. if we'd been stripping asphalt. When it comes time to start laying shakes, teams of two—with one roofer picking and staging shakes, and another placing and nailing—works best. Even when we were completely

CAPPING HIPS AND RIDGES

Hips and ridges are capped with pairs of shakes stapled together with the joints alternating from one pair to the next. The exposure on hips and ridges should not exceed the field exposure.



Peak performance. Preassemble pairs of shakes on the ground, angling the staples slightly to prevent splitting. Often the shake edges are beveled before nailing to match the roof pitch, but we left them square to continue this roof's rustic look.



up to speed and in rhythm, we only averaged about 6 squares a day with four installers.

Tooling up

The only specialty tools I need for cedar roofing are medium-crown staplers and some slater-style roof jacks. Purists will insist that wood shakes be hand-nailed—that's easy to say when you don't have to pay my bills. The

CSSB allows pneumatic fastening, but the nail head or staple must be driven flush without being overdriven, which would crush the wood fibers. Remote manifolds are helpful because you can tune the pressure while you're on the roof.

Although technical, this was a really rewarding job. There is something about installing a wood roof that really makes you

feel like a carpenter. There's also a sense of pride that comes with the opportunity to work with such a beautiful, natural product. This roof looks amazing, and with a little routine maintenance, should last 30 to 40 years or more. □

Andrew Grace is a remodeler in Ligonier, Pa. Photos by Patrick McCombe.

Choosing the Right Concrete Mix

Dozens of bagged concrete options allow builders to match the mix to the task—but only if chosen wisely

BY ANDY ENGEL

It may be a personality flaw, but I love concrete. I will take the snarl of a loaded ready-mix truck turning into the driveway over the whine of a 737 flying me away on vacation any day of the year. But as much as I relish the prospect of 20 tons of wet concrete being delivered for me to shape into a slab or a building footing, the fact is that most of my concrete work has been too small for a ready-mix order.

Consequently, I've mixed up a fair number of bags of concrete mix for deck footings, for stair landings, and to repair a variety of slab cuts and miscellaneous damage. It used to be that lumberyards and home centers would have three choices: concrete mix, sand mix, and mortar mix. Now they have at least three choices of concrete mix alone.

What's changed? Like most things in our lives, technology has affected bagged concrete. Frank Owens, Quikrete's VP of marketing, says, "Bagged concrete mixes today are designed for specific purposes." This is largely down to the development of admixtures—natural or manufactured chemicals that improve certain properties of fresh or hardened concrete, such as work-



THREE-PART FORMULA

Concrete is composed of three main ingredients: Portland cement, water, and aggregate (both fine and coarse). The proportioning of those ingredients is the main factor that determines the concrete's strength, durability, workability, and cost.



CEMENT

Cement is the glue in a concrete mix. Combined with water, it forms a paste that coats the aggregate and binds together the mixture.



WATER

Water is what sets off the chemical reaction that turns the dry components into concrete. Known as hydration, this reaction is what makes the cement turn back into rock.



AGGREGATE

Think of aggregate as bricks in a wall and cement as the mortar. Aggregate makes up most of the structure in concrete, adding strength and reducing its cost. The individual stones in the coarse aggregate interlock, and the sand fills the voids.



IT'S IN THE BAG

The name on a bag mix may not tell the whole story. Here's a quick breakdown to help guide your selection.

EVERYDAY CONCRETE MIXES are highly versatile and inexpensive, good for everything from slabs and footings to walkways and stairs. Minimum thickness is 2 in.



Quikrete
High Strength
Concrete Mix
• 4000 psi



Sakrete
High-Strength
Concrete Mix
• 4000 psi

HIGH-EARLY-STRENGTH MIXES are good for footings, but particularly useful for slabs that need to be placed in service quickly, and for cold-weather placement. Minimum thickness is 2 in.



Quikrete 5000
High Early Strength
Concrete Mix
• 5000 psi



Sakrete High-Strength
5000 Plus Concrete Mix
• 5000 psi

CRACK-RESISTANT MIXES contain fibers to increase tensile strength and reduce (but not eliminate) the need for steel reinforcement. Minimum thickness is 2 in.



Quikrete Crack
Resistant Concrete Mix
• 4000 psi



Sakrete Crack Resistant
Fiber Reinforced
Concrete Mix
• 4000 psi

ability or strength. “All the components are carefully weighed and computer-batched. This allows admixes to be added correctly.” Which, in turn, allows for mixes aimed at specific purposes.

Stronger together

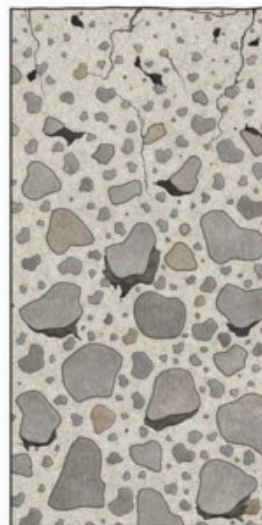
Concrete choice is largely about strength. While other additives are often used to achieve specific ends, all concrete contains five chief ingredients: coarse aggregate (gravel) and fine aggregate (sand), which compose 60% to 75% by volume of the mix; 7% to 15% Portland cement, 14% to 21% water, and up to 8% air. The ratios of these components affect strength and hardening time, as well as workability and longevity. The most expensive ingredient is the Portland cement, and it's also the one that has the most obvious effects: The more Portland, the stronger the concrete and the faster it sets.

Concrete sets because of a chemical reaction between the Portland cement (there are other compounds that act similarly, but they're outside the scope of this article) and water. That reaction takes time, and concrete's ultimate strength is measured at 28 days. That said, the initial hardening of concrete depends on the temperature: The warmer the weather, the faster the reaction. The reaction is exothermic, meaning it gives off heat. That's what keeps concrete from freezing when poured in below-freezing temperatures, though you can't go too far below freezing without insulating the pour (bagged mixes typically include temperature recommendations). If the water in the mix freezes, the reaction stops, and the ice crystals wreak havoc on the structure of the weak, new concrete.

The strength of a concrete mix is determined by measuring the pressure required to

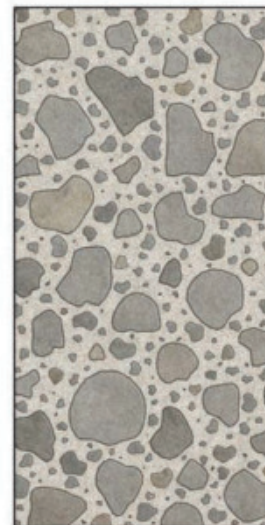
HYDRATION

The key to achieving the psi strength labeled on a bag of concrete is keeping the water-to-cement ratio as low as possible without sacrificing workability. Adding too much water can cause a host of problems. As wet concrete compacts, water—the least-dense component of the mix—gets displaced upward. If there's a lot of excess water, it can create vertical channels and get trapped below the coarse aggregate as it rises, creating voids.



TOO WET

Adding too much water can leave voids and cause uneven distribution of aggregate.



JUST RIGHT

Mixing in the right amount of water creates a homogenous mass without voids.

crush a sampling of test cylinders cast from that mix and allowed to harden for 28 days. Obviously, each bag of concrete mix isn't tested in this way, but samples have been evaluated. The minimum strength used in residential concrete work is a 2500-psi mix. All the bag mixes I know of are claimed to be at least 4000 psi, and some specialty mixes yield more than double that strength.

Conditions can affect product choice

The two most important conditions to consider when working with concrete are weather and time. These factors become especially notable when you're pouring a

slab, because the concrete has to set partially before it can be finished. In hot weather, concrete sets more quickly, and you want to be sure there's time to finish placing the last of the mix before you have to finish the first sections that you placed. Conversely, in cold weather, a slow-setting mix can have you finishing a slab by headlight when you'd really like to be home having dinner.

I'm also including with conditions the speed with which the concrete needs to enter service. For slabs that will likely see traffic in a short period of time—sidewalks and driveways, mainly—it's worthwhile to spring for high-early-strength concrete.

Finally, there's budget. Concrete mixes containing more Portland cement and other additives will cost more per bag. In my area, standard concrete mix costs \$4.90 for 80 lb., while the high-early-strength mix costs \$6.80 for the same amount. There are times when you'll want to spend the extra for it, but it's not always worthwhile.

Stay hydrated, but not too hydrated

Cory Olson, Senior Vice President of Sakrete, says that, “Overwatering is a common error.” Theoretically, only enough water to fully react with the amount of Portland cement in concrete mix is needed. Any water added beyond this results in weaker concrete. That

WET ENOUGH TO WORK

Save for water, bagged mixes come with just the right amount of each ingredient carefully proportioned. But you can still mess it up by adding too little or too much water. Don't just pull out the garden hose and spray and pray to get it right. Use a graduated measuring container to portion out the amount of water the manufacturer recommends on the bag.



TOO LITTLE



TOO MUCH



JUST RIGHT

excess water expands the volume of the wet concrete, and some of it remains in place for a time after the concrete sets. But eventually the excess water will evaporate, leaving concrete that's less dense and not as strong.

However, adding only the chemically necessary amount of water yields a mix that's too stiff to mix and work by hand. More water is almost always needed to create a workable mix. That said, modern bagged concrete mixes usually contain some form of plasticizer, a chemical that makes the mix more workable with less water. The directions on the bag will tell you how much water to use. Start there, and only add more water if absolutely necessary. If you find you still need to add water, Olson suggests using a high-strength mix where some loss of strength may be acceptable.

Additionally, adding too much water can create a workability problem, particularly in slabs. As the concrete sets, much of the excess water makes its way to the surface, and you can't finish the concrete until that water goes away. That can be a particular problem in hot, humid weather, because the underlying concrete can become too hard to work before the surface water evaporates. In these conditions, I have literally mopped water off the top of a slab with my wife's ShamWow. (Yes, we're still married.)

All of that said, it's important to keep concrete wet as it sets. Concrete should be kept wet for 5 to 7 days after it's poured. Common approaches are to cover the concrete with plastic and flood the space between or cover it with burlap and keep that wet. This isn't done very often in residential work, but keeping freshly finished concrete wet for the first week makes a difference in its long-term strength.

Concrete for footings

In most cases, you can use regular, garden-variety concrete mix for footings. It's least expensive, and there aren't usually special finishing requirements. And even in below-freezing weather, the surrounding ground is usually warm enough to allow the concrete to set with just some hay or straw to insulate the very top.

There are two exceptions. If you want to, say, build a deck on the footing in the next day, it's worth your while to spring for high-early-strength concrete. And if the footings are just posts in the ground that get back-filled with concrete, such as for fences or

pole barns, some fast-setting mixes are an attractive option, because they can be dumped into a water-filled hole around the braced post, and the post will be secure within half an hour.

Concrete for slabs

In most cases, standard concrete mix works fine for slabs, but in cold weather it's worth using a high-early-strength mix because it sets faster. Conversely, high-early-strength mixes can set too fast for proper finishing in hot weather. However, these mixes do allow the slab to be placed in service more quickly. That can be useful for sidewalks, driveways, and even air-conditioner slabs if you're in a hurry.

I don't recommend a fast-setting mixture for any but the smallest slabs—the setting time of 15 to 45 minutes doesn't provide anywhere near enough time to finish the surface of the concrete.

Another option for slabs is crack-resistant mixes. These contain fibers that help prevent surface cracking, which is more visible in smooth, steel-troweled finishes than in broom-finished work. Keep in mind that these fibers are not a substitute for steel mesh or rebar when greater structural strength is required.

Air-entrained concrete was once something you could only get from a ready-mix truck. The purpose of air entrainment is to make concrete less susceptible to damage from freeze-thaw cycles, and it's a useful amendment to outdoor concrete slabs in cold climates. Air entrainment requires special additives, and used to also require several minutes of mixing with the drum of the truck spinning at a high rpm to fold in a bunch of air bubbles. Today, there

FAST-SETTING MIXES are great for setting posts in the ground. There's no need to premix; just add water to the hole, followed by the concrete mix—or vice versa depending on instructions. Minimum thickness is 2 in.



Quikrete Fast-Setting Concrete Mix
• 4000 psi



Sakrete Fast Setting Concrete Mix
• 4000 psi

FAST-SETTING STRUCTURAL MIXES

work well for small patches in high-traffic areas. With a setting time of about half an hour, they aren't for larger pours. Minimum thickness is 1½ in.



Quikrete FastSet Concrete Mix
• 7000 psi (3000 psi in 3 hours)

AIR-ENTRAINING MIXES use an admixture to incorporate tiny air bubbles, increasing freeze-thaw resistance. Minimum thickness is 1½ in.



Sakrete Pro-X180 Concrete Mix
• 6000 psi

Silica safety

Respirable silica has become the construction safety concern of this decade, with good reason. Silica is a crystalline mineral found in rock and sand. Inhaled, it can scar lung tissue and make breathing difficult. Dry concrete mixes (as well as dust from concrete demolition) contain respirable silica.

The National Institute for Occupational Safety and Health (NIOSH) recommends (and OSHA requires) the use of respirators with N-95 particle filters when working around silica dust.





When to order ready-mix

I recently did a job and had my two apprentices mix 40 bags of concrete in a wheelbarrow by hand. I think they hated me by the end of the day. Now, if we'd had a mixer, 40 bags wouldn't have been as big a deal. Nonetheless, that was a mistake on my part. Forty 80-lb. bags of concrete mix is almost a yard of concrete. The bag mix cost about \$250. A yard of ready-mix, with the short-load charge, would have cost about \$500 and saved many hours of labor.

For any job of a yard or more, ready-mix is the way to go, so long as there's access for a concrete truck and a batch plant nearby. Just be ready to go when the truck shows up, because it costs extra if they have to wait around, and there's only so much time before they have to get the mixed concrete out of the truck—once it's wet, the chemistry that makes it hard won't stop.

are air-entraining additives available in bag mixes that don't require the high-speed spin-cycle of a concrete truck, and which work with regular hand-mixing.

Concrete for repairs

Products for use in repairs often have to work in thinner applications than standard concrete mixes (most standard mixes require a depth of at least 2 in.). Typically, you'll want a product that sets quickly so the area can be used as soon as possible, and you'll want to work a small enough area that you're able to finish the concrete before it sets.

When you have at least 2 in. of depth, fast-setting concrete mix is a good choice. Non-shrink grout is a better choice in situations where the edges of the repair need to feather

into an existing surface. Non-shrink grout can also be applied using a grout bag to fill cracks, and its high compressive strength (up to 8000 psi) makes it a good choice for structural repairs. Cracks that are caused by ongoing concrete movement are best repaired with flexible products, such as Watco Concrex Flex.

There are also polymer-modified mixes that are particularly sticky, and these are useful for overhead and vertical repairs. Finally, for slabs that have pitted and spalled over time, resurfacing mixes are available that are poured onto the slab and squeegeed flat. □

Andy Engel is a lead carpenter with HVP Corp. in Kent, Conn. Photos by Melinda Sonido, except where noted.

REPAIR MIXES are for patching existing concrete and can often be feathered out to a thin edge. Some are fast-setting, while some are stickier and work well on vertical surfaces.



Quikrete FastSet Repair Mortar

- For vertical and overhead surfaces
- Thickness: up to 1½ in.
- Set time: 20 to 40 minutes
- 6000 psi



Quikrete FastSet Non-Shrink Grout

- For anchoring and structural repair
- Thickness: ¼ in. to 24 in.
- Set time: 30 minutes
- 8000 psi



Quikrete Sand/Topping Mix

- For overlays, leveling, and patching
- Thickness: less than 2 in.
- 5000 psi



Sakrete Sand Mix Topping & Bedding

- For overlays and large-crack repair
- Thickness: ½ in. to 2 in.
- 5000 psi



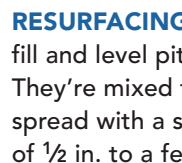
Sakrete Top 'N Bond Concrete Patcher

- For overlays, leveling, and crack repair
- Thickness: feather edge to ½ in.
- 5000 psi



Sakrete Fast Setting Cement Patcher

- For vertical and horizontal surfaces
- Thickness: ¼ in. to 2 in.
- Set time: 20 minutes
- 5000 psi



RESURFACING MIXES

are meant to fill and level pitted and spalled slabs. They're mixed to a thin consistency and spread with a squeegee to a thickness of ½ in. to a feather edge.



Quikrete Re-Cap Concrete Resurfacer

- 5000 psi



Sakrete Flo-Coat Concrete Resurfacer

- 4500 psi

Protect Your Outdoor Outlets

What you need to know when selecting weatherproof boxes and covers

BY MATTHEW MILLHAM

If you ever need to plug in a saw or compressor for an outdoor building project, having a receptacle available outside, rather than running an extension cord into the house or garage, is a great convenience. It's also safer, so model building and electrical codes require receptacles outside of new homes. But because codes are constantly changing, many older receptacles are not up to current standards. If you want to replace one that's broken or outdated or add more, you can't rely on what's there as a template for what right looks like.

My house is a great example. My wife and I bought it a few years ago, not long after the previous owners added a new deck. The deck had a code-required receptacle with a ground-fault circuit interrupter (GFCI), but it wasn't a weather-resistant type. On top of that, it had the wrong kind of cover installed in the wrong orientation, so water had probably been streaming in from day one. The receptacle never had a chance.

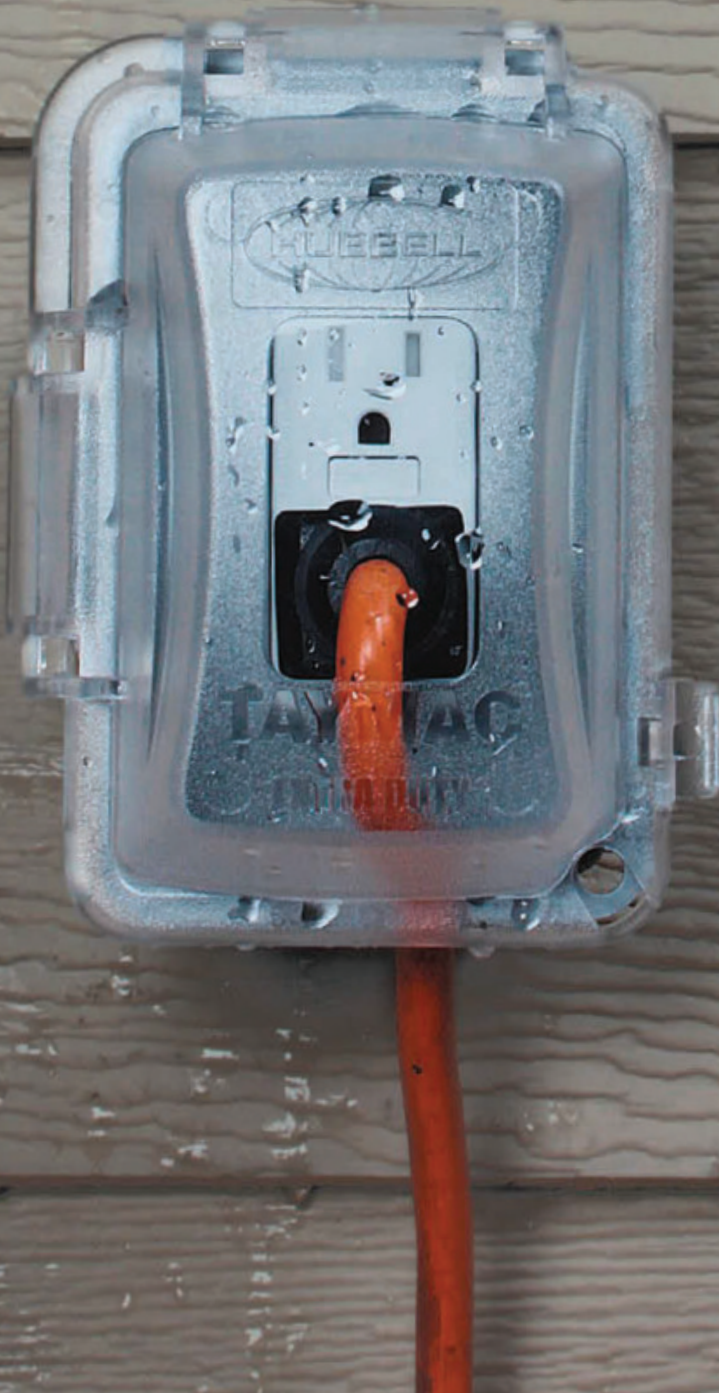
That this happened isn't particularly surprising. For a novice, figuring out the right boxes and covers for outdoor electrical outlets can be a head-scratcher, which explains why many jurisdictions require that electrical

work be left to the pros. With that in mind, what we're discussing in this article is meant to provide an understanding of what goes into selecting boxes and covers for outdoor receptacles, and is not a substitute for local code requirements.

Before getting into specifics, it's important to understand the intent of the National Electrical Code (NEC) with regard to outdoor receptacles. The two biggest threats to the safety of outdoor electrical installations are water and physical damage. To stand up to them, code and common sense require that exposed boxes and covers be sturdy and able to shed water. But these installations don't need to be totally waterproof; like the rest of the house, they just need to be weatherproof. The NEC defines this as: "Constructed or protected so that exposure to the weather will not interfere with successful operation." What's required to achieve that intent varies depending on where you put the device.

Yes, the rules are more complicated than they used to be, but they make things safer and longer-lasting so that power is there when you need it. □

Matthew Millham is deputy editor. Photos by Melinda Sonido.



BOXES ON THE WALL, OR IN IT?



TayMac
MKG420CS
Complete In-Use
Cover Kit (with
box and GFCI)
\$23

SURFACE MOUNTED

Surface-mounting, as the name implies, means attaching the box to the surface, which leaves it exposed. This requires the use of listed weatherproof boxes, which are labeled to indicate their weathertightness, often with the words “suitable for wet locations” somewhere on the box. In addition, weatherproof covers are needed to keep water from getting in through the front.

Surface-mounted boxes are typically screwed to the siding or trim through external lugs that are either cast or molded into the boxes or screwed on prior to installation. Additionally, some metallic boxes have “knockouts” in the back that can be drilled through to mount the box without visible fasteners, though there are caveats to this approach. First, any holes other than approved weep holes must be waterproofed. Second, these may not pass muster in some jurisdictions because the holes fundamentally compromise the weatherproof integrity of the box—even the best sealants can fail. And just because the knockouts—or what look like knockouts—are there doesn’t mean the manufacturer intends for them to be used. Many nonmetallic boxes, for example, have what look like knockouts molded in, but metal fasteners are generally prohibited in these boxes. Check the printed instructions or call the manufacturer to find out what they allow.

FLUSH MOUNTED

Flush-mounted installations are a different animal. A hole is cut so the box can be recessed, leaving the front of the box flush with the surface. Because it’s protected, a flush-mount box doesn’t need to be weatherproof itself if it’s in a location that would be dry but for the hole cut for the box; only the covers must be weatherproof and must seal against the finished surface to keep water out. In these kinds of installations, it’s common to use the same kind of box that’s used inside the house, but that’s not always a great idea. Interior boxes tend to leak a lot of air and are difficult if not impossible to properly integrate with water and air control layers on exterior walls, particularly when there’s an air gap behind the siding. Luckily, there are purpose-built exterior flush-mount boxes that are far easier to integrate and seal.

Purpose-built flush-mount boxes

Purpose-built flush-mount boxes are in a class all their own. The versions I’m familiar with—from Arlington Industries and TayMac—are superior to the type of flush-mount installations mentioned above because they can easily be flashed to integrate with water-resistive barriers on exterior walls. While they seem expensive compared to the standard way of doing things, they include integral in-use covers, so there’s one less thing to buy and separately install.

Arlington has a wider selection for a range of conditions, including exterior rigid foam, but both companies’ products work with various exterior claddings and wall systems, and can be used in new work or retrofit applications. Most of these boxes are made entirely of UV-resistant plastic, though Arlington makes versions with metal inserts for compatibility with metallic conduit.



Arlington
DBVM1C
Low Profile
IN BOX
\$23

Better flush-mount boxes. Preventing air and water infiltration is key to any wall’s performance. Purpose-built boxes like this one are easy to flash and seal to keep out the elements, while also protecting electrical devices.

WEATHERPROOF-BOX BASICS

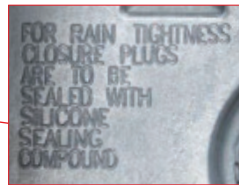
Weatherproof boxes—the type required for surface-mounting—come in both metallic and nonmetallic versions, in a range of colors, depths, materials, and gang sizes—gang number being the industry term for how many devices the box can hold. A one-gang rectangular box can hold a single device, such as a duplex receptacle. The limiting factor

in the number of gangs for rectangular boxes serving outdoor locations is often the cover. While you can find three- and four-gang boxes, weatherproof covers for anything bigger than two-gang is usually a custom order. Round boxes are typically 4 in. in diameter and, while generally used for lighting, can also serve as receptacle boxes with the use of adapter plates.

All of these boxes have hubs—the equivalent of knockouts on metallic boxes used indoors—to attach conduit and run wires or cables. Most of these hubs are threaded to accept various fittings and conduit, but there are also PVC boxes with smooth hubs designed to be cemented to PVC conduit or fittings.



Weatherproof metallic boxes typically come with a **GROUND SCREW** either preinstalled or in the package.



Many weatherproof boxes and covers include sealing instructions that must be followed for code compliance.

Sigma Electric
14251-5
Metal Box
\$6

Don't use Teflon tape on metal conduit; seal on the outside with silicone, or use conductive sealants to maintain bonding.

METALLIC VS. NONMETALLIC

An important difference between metallic and nonmetallic boxes is their compatibility with conduit, which is required for some outdoor wiring projects (and indoors in some jurisdictions). With rare exceptions, metallic conduit can only connect to metallic boxes; nonmetallic conduit can be used with either metallic or nonmetallic boxes. Metallic boxes also need to be grounded, while nonmetallic boxes, which aren't electrically conductive, don't.

Compatibility with existing wiring is another issue, especially in retrofits. If the new outdoor box is tapped into an existing circuit, it's generally simpler to use a box that easily integrates with what's already there. If the house is wired with armored or metal-clad cable, metallic boxes will make the job easier; if the wiring is nonmetallic sheathed cable, nonmetallic boxes will require fewer fittings and less time to install. Cables and wires rated for interior use can't be used in conduit, but they can enter through the back of weatherproof boxes attached to walls.



PVC boxes with smooth hubs are designed to be cemented to PVC conduit and fittings.

TAP AN EXISTING CIRCUIT, OR ADD A NEW ONE?

If you're running a new circuit to power your outdoor electrical installation, your options for where to put a new exterior receptacle, switch, or light are almost endless. A new circuit is optimal if you plan to plug in power-hungry tools, but probably isn't necessary for lower-draw electronics like radios and battery chargers. In many cases, you may be able to tap an existing circuit with unused capacity rather than run a whole new cable back to the service panel. There are some circuits you cannot tap into, though: Circuits serving kitchens and bathrooms, and dedicated circuits for single appliances, are all off limits. Any new cables and receptacles that tap into existing interior outlet boxes should have the same gauge and ampere ratings as the cables and receptacles already on that circuit.

If you tap into an existing receptacle at the end of a circuit, there should be enough room inside the box to bring a cable to feed the new outdoor receptacle. However, if there are already two cables in the box—incoming and outgoing—you may need to replace the existing box with a larger one.

Weatherproof cover

Gasket

Incoming cable (from power source)

New cable to outdoor receptacle

GFCI receptacles are larger than standard duplex receptacles, so there may not be enough room in a single-gang box if you also need to splice an outgoing cable to feed another outdoor outlet downstream. In that case, install a deep box or an extension to the single-gang box.

GROUND-FAULT PROTECTION

Receptacles installed outdoors must be rated for weather resistance (listed and labeled as "WR"), and have ground-fault-circuit-interrupter (GFCI) protection. GFCIs monitor current on the hot and neutral legs of the circuit for imbalances that may be caused by contact with water. When they sense such an imbalance, they trip, shutting off the power.

There are a few different ways to get GFCI protection for receptacles. The first is to use a GFCI breaker in the service panel. This provides GFCI protection to the entire circuit, and can be a good option when all of the receptacles on that circuit require GFCI protection, such as a circuit dedicated to an outdoor deck or patio. But they're more expensive than GFCI receptacles, and they need to be reset at the panel when they trip.

The second option is to use GFCI receptacles where GFCI protection is needed. The nice thing about GFCI receptacles is they can be reset individually, and they can be wired to provide GFCI protection to all devices connected downstream on the same circuit, including regular receptacles. A single GFCI receptacle installed first in line on the circuit can provide the same whole-circuit protection as a GFCI breaker at a fraction of the cost.

It's worth noting that most receptacles inside and outside homes are nonlocking, with two slots to receive the blades and, in grounded versions, a round hole to receive the ground pin of standard plug caps. In most cases, these receptacles must be tamper resistant as a safeguard to protect children, both inside and outside the home.



A remedy for old outlets. Standard weather-resistant receptacles can get GFCI protection from GFCI devices—either breakers or receptacles—upstream.



GE THQL1115GFTP
15-amp GFCI breaker
\$50



Legrand 1597TRW
15-amp GFCI receptacle
\$24

COVERS WEATHERPROOF VS. IN-USE

All outdoor outlets need some kind of weatherproof cover. There are two main classes of these: weatherproof, and weatherproof while-in-use. Covers that are simply weatherproof keep water out only when there's nothing plugged into the receptacle and the cover is closed. Weatherproof while-in-use covers (commonly called "in-use covers") are able to close and keep water out even when an electrical cord is plugged into the receptacle.

The type of cover you need depends on whether the location is considered "damp" or "wet." Everything outdoors falls into one of those categories. If you're unsure whether the location you're installing a receptacle in is wet or just damp, err on the side of wet. Anything that's good enough for a wet location is suitable for damp locations as well.

Damp locations are those that are exposed to moderate amounts of moisture—say from fog or morning dew—but are protected from the weather and aren't subject to beating rain or runoff, such as under the protection of a porch roof. In damp locations, a weatherproof cover is generally all that's required. These usually have little spring-loaded doors that snap tight over the receptacles when there's nothing plugged into them, but are open when the receptacle is in use.

Wet locations are places likely to get saturated with water or other liquids and typically have no protection from the weather, such as on decks, walkways, or pergolas. With one exception, receptacles in wet locations must have in-use covers. There are some boxes, like the Arlington IN BOX shown at the bottom of page 50, that include integral in-use covers. But the most common type is an in-use outlet box hood, also known as a bubble cover (photo above, left), and these covers must be labeled "Extra Duty."

As for the exception mentioned earlier: Receptacles in areas routinely subjected to high-pressure spray-washing (and thus considered "wet") are exempt from the Extra Duty in-use cover requirement. Here, a cover that's weatherproof when closed is permitted, so long as it's actually closed when spray-washing occurs.

In-use and standard weatherproof covers are available in both metallic and



TayMac
MX4280S
Weatherproof
In-Use Cover,
Extra Duty
\$13



Commercial Electric
Weatherproof Cover
\$4

Two levels of protection. Weatherproof while-in-use covers (left) can be closed even when something is plugged into them to protect outdoor outlets from precipitation, and are generally required in wet locations. Weatherproof covers that remain open when something is plugged into them (right) are mostly for damp areas.

nonmetallic versions, and either can be used with either metallic or nonmetallic boxes. All have hinged lids that should be installed so they open upward. Many in-use covers have removable inserts to make space for electrical cords when they're in use and keep critters out when they're not.

This should go without saying, but for flush-mount installations, the covers should sit flat on the surface, not bridge courses of siding or other irregularities. And while covers typically come with gaskets to help seal them to whatever they're attached to, they need backup (see below).

SEALING BOXES AND COVERS

Sealants are almost always needed to truly weatherproof outdoor receptacles. Most weatherproof boxes and covers note this in their instructions, which need to be followed for a code-compliant installation. Still, some instructions lack enough detail to do the job right. For surface-mounted boxes that don't come with explicit instructions to the contrary, cap all unused threaded hubs with closure plugs, and use nonhardening silicone to seal the joints around them. Use the same sealant around the top and sides of surface-mounted boxes where they meet the surface, but leave the bottoms unsealed so water that does get back there can drain out. Covers should also be installed with non-hardening silicone applied around the entire perimeter of the gasket to prevent water from wicking behind it through capillary action. The gaskets included with these covers can bridge only tiny irregularities.

Second line of defense. Even when installed on weatherproof boxes, a bead of nonhardening silicone is good insurance to back up the wafer-thin gaskets that come with weatherproof and in-use covers.



Simple, Elegant

Although clean and unadorned, this revival of a Shaker trim package is more complex than it appears

BY JUSTIN FINK

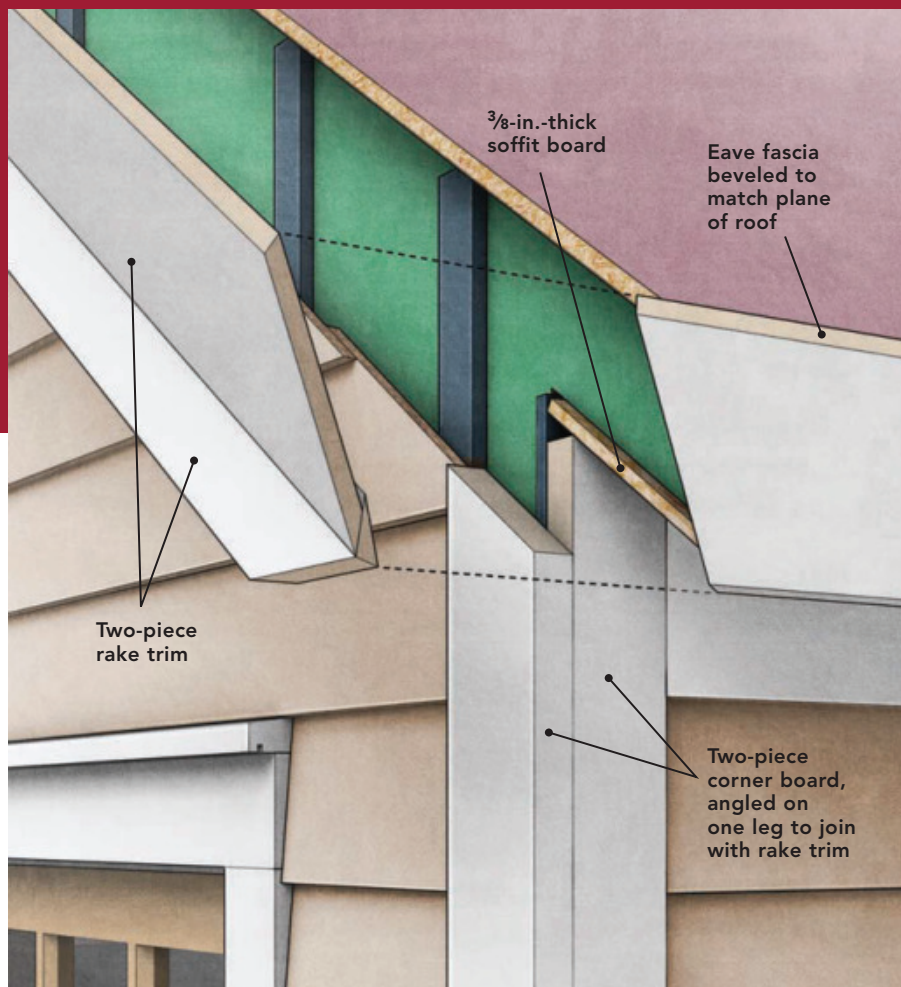
I'm a big fan of the beauty and simplicity of Shaker-style furniture and buildings, so when a client approached me wanting to build a small backyard workshop inspired by one of the outbuildings at Hancock Shaker Village in Massachusetts, I not only happily agreed, but already knew the exact building he was in love with from my own past visit to that museum.

The structure, originally built in 1922 as a screened summer house, later became a ticket booth for the museum, and then was at some point converted into a garden-tool shed, with aesthetic changes along the way (inset photo, p. 55). Although we don't know who designed and completed the latest "remodel" that brought the structure to its current version, it is itself possibly a tribute to the earlier Shaker-style forms.

The first priority was deciding on materials

We agreed up front that we wouldn't be building a replica of the original building—in terms of actual measurements, materials, or assemblies—but rather an homage, updated and modernized with regard to materials, durability, assembly techniques, and size.

Unconditioned and exposed to the New England elements for nearly a hundred years, the all-wood shed showed signs of deterioration. Part of my plan was to make sure this didn't happen to the new version



AN ELEGANT ASSEMBLY

Although simple in appearance, each corner of the building's wall and roof trim is made up of six parts, which all come together in about 1 sq. ft. of space.

we were building, and that mostly comes down to a matter of managing moisture. So, other than the pine window sash protected by primer and paint, our version has no solid wood anywhere on the outside. We chose Boral TruExterior trim, a fly-ash-based product that is impervious to water, is extremely stable, and works a lot like wood. For siding, we used LP SmartSide clapboards, chosen for their crisp lines and inherent durability. All of these finishes were installed over a ventilated rainscreen assem-

bly, created with Cor-a-Vent Sturdi-Strips applied over Zip System sheathing.

The trim was a humbling challenge

One of the quirks of the Shaker style is that it's not actually a set style. There were Shaker communities in various parts of the country, and they all built things in a slightly different way. The same was true of this outbuilding, in which the assembly details varied from one side of the building to the other, and all were clearly cut using hand tools. My first

Roof Trim



THE INSPIRATION

Working from the original structure, we measured trim details, studied their construction (which varied from one side of the building to another), and then recreated the assembly for our own outbuilding.



WORK OUT THE DETAILS WITH MOCKUPS

3D-modeling software like SketchUp is invaluable for working out how different pieces of trim will come together and the angles where they meet. But just because you can draw it doesn't mean you can build it, which became painfully obvious when I took each iteration of the design to the tablesaw and miter saw and discovered the limitations of the miter and bevel settings, maximum depth of cut, pitfalls of getting the sequence wrong, and overall acrobatics of cutting each piece. But after you land on a process that works, you can mark all of the saw settings and stock orientations right on the mockup, and then use it as a road map when you're on-site.

EAVE FASCIA

After beveling the top edge of the fascia trim so it matches the angle of the roof (in this case, about 34°), cut the angled ends on a miter saw, with the piece set on the flat and the saw set to a 20° miter and a 45° bevel.



FASCIA



Inside of the right-hand gable

UPPER RAKE

LOWER RAKE

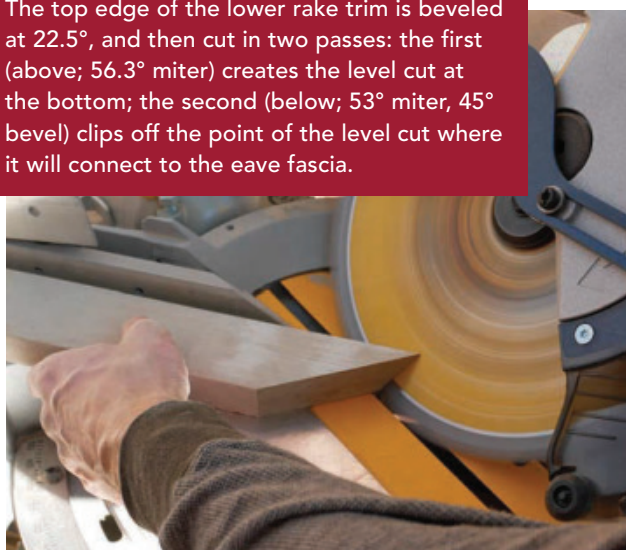
Mock up and mark

Keeping track of the cuts by labeling the bevels, miters, and orientations on the inside of the mockups makes cutting in the field relatively easy.



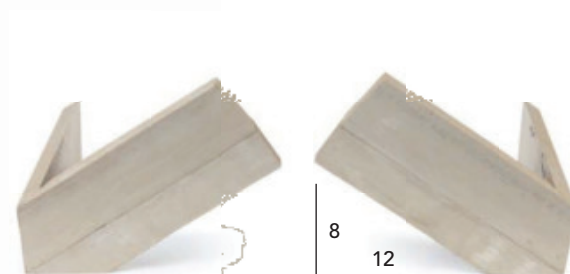
LOWER RAKE

The top edge of the lower rake trim is beveled at 22.5°, and then cut in two passes: the first (above; 56.3° miter) creates the level cut at the bottom; the second (below; 53° miter, 45° bevel) clips off the point of the level cut where it will connect to the eave fascia.





Inside of the left-hand gable



Angles for an 8-pitch

These bevel and miter angles are specifically for an 8-in-12-pitch roof, but can be adjusted for a roof with a different slope.



UPPER RAKE

Joining the eave fascia and upper rake trim requires a steep miter; in this case, about 62°. My saw maxes out at a 60° miter, so after making the cut (with the stock on edge and the saw set to a 60° miter and a 17° bevel) I used a block plane to finish the job. For saws with even less miter capacity, it may be easier to shim between the trim and the fence to achieve the desired angle. The top edge of this piece also needs to be beveled to plane out with the roof sheathing.



To see a video of this Shaker-style roof trim coming together, visit FineHomebuilding.com/magazine.

challenge was to figure out how to recreate the assemblies using power tools, which I felt would be the most accessible path toward sharing the details of this build.

The skirtboard and corner boards are relatively standard fare, but the roof trim is anything but. Despite looking very simple, the intersection of the eave and rake trim

proved to be mind-bending (photos above). I'm known to be bullheaded in my desire to figure out building details, but after hours of modeling the roof trim several different ways in SketchUp, then attempting to make mockups with the necessary cuts in my shop, ending in failure day after day, I was close to admitting defeat.

After about a week of this cycle of designing and mocking up, I managed to land on a sequence and assembly that works—and aside from a few swipes of a block plane on one piece, it all can be done using only a tablesaw and miter saw.

To keep all the bevels, miters, and orientations straight, I made mockups for both sides

TAKE IT ONE PIECE AT A TIME

When it came time to graduate from mockups to the actual building, I was expecting another round of humbling trial and error. But what I found was that installing the real pieces was easier than the shop mockups, because with the sequence and cuts already established, I only had to focus my attention on one piece of trim at a time, just like any other job. To make this work, you need to have measured drawings worked out ahead of time.



1. SOFFITS COME FIRST

Start the roof trim by attaching the soffit boards, which should be flush with the front edge of the rafter tails (or front edge of the subfascia, if present).



2. PREASSEMBLE AND PLUMB

Preassemble corner boards, plumb in both directions, and fasten. One half of the corner board should be straight at the top so it butts into the soffit board, and the other half angled to match the slope of the roof and set down the height of the planned rake trim.



3. ALIGN THE FASCIA

These angled fascia boards extend beyond the gable so they can later receive the rake trim. Alignment is key; the heel of the miter should meet the butt end of the soffit board. When working solo, attach a temporary support to the side of the building to hold up the far end of the board while you focus on the miter.

4. START AT THE BOTTOM

The narrow lower rake trim rests on the angled corner board and extends all the way to the roof peak. If working alone, drive hand nails into the sheathing farther up the gable to support the trim while you focus on getting tight joints at the bottom.



5. MEET IN THE MIDDLE

At the peak of the gable, align the pieces and mark a plumb line where they overlap. Cut just outside the line on each piece, and then sneak up on a tight fit using a sharp block plane. When satisfied with the joint, add glue and pin it together using opposing finish nails.



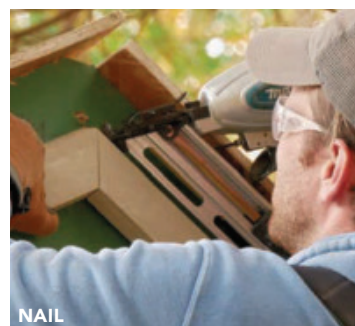
CUT



FIT



GLUE



NAIL



6. TURN THE CORNER

The upper part of the gable rake trim is the trickiest part of this job. Unlike the eave trim, which is installed plumb, the upper rake trim projects out like a piece of crown. The necessary joint, a compound miter, may take some trial and error to get a good fit.



7. BISECT AND CONNECT

Join the two pieces of upper rake together at the peak, using glue and one or two nails to tack the miter together. Again, if the joint needs to be finessed, a sharp block plane works very well with fly-ash trim.



Go with polyurethane glue

Although not my favorite to work with, polyurethane glue is the best choice for joining pieces of fly-ash-based products. Water-based glues, although technically acceptable, don't soak into the material very well. Plus, the foaming action of polyurethane helps fill the inevitable small gaps at complicated joints, and can be shaved off later with a sharp chisel.



8. CLAMP FOR A TIGHT JOINT

At this point, the trim is only attached with 15-ga. finish nails, mostly to tack it together and still allow room for readjustment. Once you're happy with how all the joints are fitting, apply glue and place some clamps on the two-piece rake to help pull it together and keep it tight while the glue sets up and foams. Later, fasten with siding nails and/or solid backing where desired.

of the roof, and marked all of the necessary cutting information right on each piece (photos pp. 56-57). These became my on-site road map for assembling the real thing.

If you use these details on one of your own projects, I think you will come to respect the proportions, restraint, and overall aesthetic of the Shaker style, but most of all the crafts-

manship. My guess is that the work will have you scratching your head during the process, and when you're done, you'll stand back and look at the completed assembly and say, just as I did, "What was so hard about that?" □

Justin Fink is editorial director. Photos by Rodney Diaz, except where noted.

Materials made to last



LP SmartSide Soffit Panel

Boral TruExterior 5/4 trim

While the original structure was made with solid-wood trim and clapboards, we opted for engineered materials because of their inherent resistance to the elements. Crisp edges and wood-like surfaces were still a priority, but we avoided egregious faux wood grains that often, ironically, make the materials look especially fake.

We chose Boral TruExterior for the trim, installed smooth-side out, because it cuts like butter, installs like wood, and allows for sharp miters—as long as you're careful with the edges during assembly. A respirator is a good idea when cutting this material, and I suggest having a cordless leaf blower on-site—the gritty fly-ash dust gets everywhere, and can wreak havoc on the inner workings of power tools.

For the clapboards and soffit boards we chose LP SmartSide products, which are a sort of über-OSB that cut and fasten like real wood—but with no worries about cups, splits, or crooked boards. Good out-feed support is a must for these products, which aren't fragile despite their thinness, but are very floppy.

BOOKS

Every Builder Should Own

How to build is only one part of the equation—
a true craftsman must also understand design



If you trace the word “architect” back to its mid-16th-century roots, its meaning is literally “chief builder.” Back then, and for hundreds of years after, a builder was not just expected to be skilled at the manual aspects of the craft, but also knowledgeable in the design side of the process.

That’s why Asher Benjamin, a master builder and author who lived from 1773 until 1845, is one of my heroes. To me, he was the model for what a craftsman should strive for today. He is known for being the first American-born pattern-book author, whose works teach craftsmen the finer points of building design.

Today, many builders are more specialized in their work compared to those generalists of the past, and architects have become solely focused on design. It doesn’t have to be like this. With a bit of self-motivated studying, we can gain a broader education and better understand all of the moving parts that influence what we produce on a day-to-day basis.

Builders have the how-to down pat, but don’t know why they are building what they are building. We know how to frame a house, but aren’t as good with which style is appropriate, or how to keep that style consistent. What we have lost is a deeper awareness of the subtleties of building style, house design, and construction methods, all of which make the difference between a good project and one that is truly excellent.

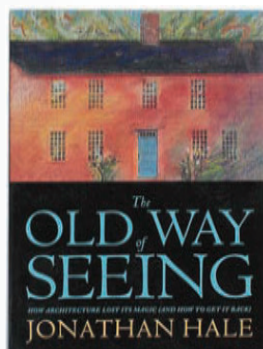
I believe, like Benjamin, that the lost arts of building are found in books—many of them old ones. I think every builder worth his or her salt should have a library of at least 100 books, and to help, I’ve put together this list. Many of the titles that follow are out of print and can only be purchased from secondhand sellers; a quick search will show some of them available for viewing online. You can choose the titles that most interest you, but what follows is organized into a guided curriculum of sorts.

The journey starts with a basic understanding of how housing has changed over the last 100-plus years. From there, dig deeper into the variety of architectural styles by studying historic examples, because how else can builders be confident they aren’t just muddying the waters? Next, I suggest studying historical construction details, which inform remodeling and reproduction work as well as new construction. Of course, there’s always good reason to expand on how-to skills—I’d wager that the previous generation of carpenters forgot more building knowledge than most of today’s carpenters even bothered to learn in the first place. □

Brent Hull is an old-house expert and owner of both Hull Millwork and Hull Homes in Fort Worth, Texas. Photos by Melinda Sonido.

A HISTORY OF HOW WE GOT HERE

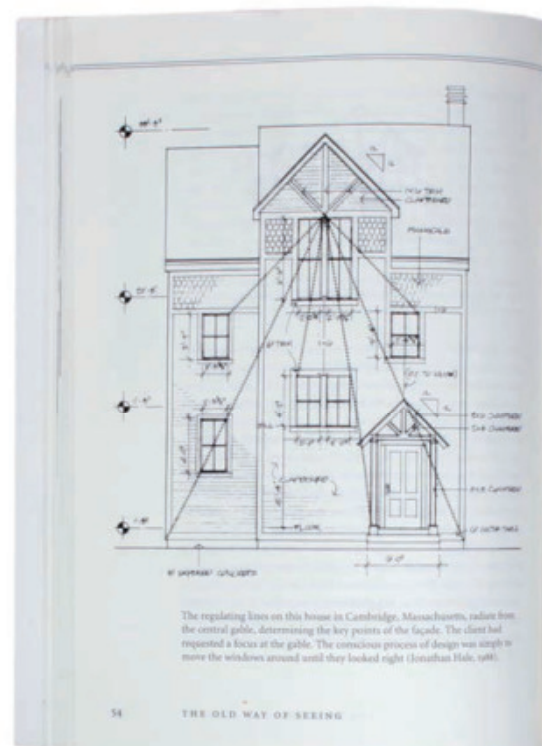
If you’ve ever driven through a historic neighborhood and wondered why new neighborhoods don’t look as charming, you’ve identified the problem with new-home design: It’s no longer cohesive. I think this started with the post-WWII boom of production building, and much of that legacy lives on today. But there’s a renewed interest in old-fashioned neighborhoods lately, thanks in part to New Urbanism, and history can be a great teacher to help us along.



THE OLD WAY OF SEEING

by Jonathan Hale

This was a very important book to me when I read it 15 years ago. I had been studying historic houses, but didn’t understand the concept of regulating lines in architecture. Hale compares historic buildings to modern structures to pinpoint exactly why old houses look and feel better than new houses, and what we can do to bring the “magic” back to today’s designs.



SUBURBAN NATION

By Andres Duany, Elizabeth Plater-Zyberk, and Jeff Speck

This book describes how our neighborhoods have changed since the 1950s—for the worse. It details old neighborhoods from the 1920s, with a focus on how they effectively combined houses, schools, and shops into cohesive communities. By contrast, new cities are split up by quadrants: housing in gated communities, industrial complexes, schools, and shopping malls. They require a car to go from place to place, meaning more parking lots and wider roads, which leads to uglier developments. The book’s focus on how our neighborhoods work, and why they are designed the way they are, is enlightening.

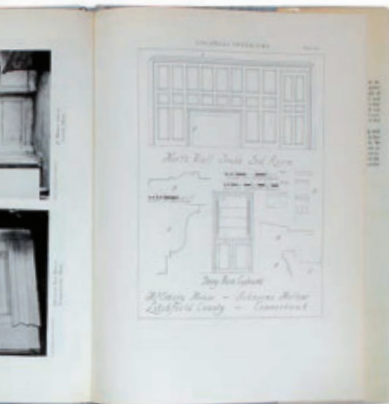
HOUSES FROM BOOKS

by Daniel D. Reiff

I’ve mentioned the pattern books and design treatises that historically led house design and construction, many of them written by Asher Benjamin. Reiff’s comprehensive book includes these titles, giving a history of design publications in America from 1738 to 1950, with a focus on how they influenced our design landscape. He chronicles not only the historic titles, but also how trade magazines and others treated house design at different tumultuous periods in history.

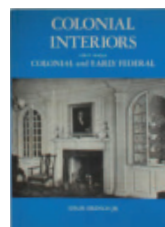
ANALYSES OF ARCHITECTURAL STYLES

When it comes to education surrounding design, the journey starts with a basic understanding of overarching house styles and how to differentiate one from another. While one of the titles on this list has a more modern focus (by comparison), the rest of this category includes older books about houses from the late 1890s into the late 1930s, which I find to be the time period with the greatest depth of resource material.



COLONIAL INTERIORS by Leigh French Jr.

Many architectural books from the early 1920s highlight the exterior of a home, but it's important not to overlook the interiors, which pinpoint features such as the differences between a Georgian-style and a Federal-style stair. This three-volume set is, in my opinion, the best resource for studying these period interiors. The first volume is focused on colonial and early Federal work dealing mostly with New England properties, the second covers more of the southern states, and the third focuses on Federal and Greek-revival architecture. With all three books in hand, you can analyze room layout, fireplace mantels, and other aspects of historical interiors.



GREAT GEORGIAN HOUSES OF AMERICA

by Architects' Emergency Committee

You can't go wrong with this two-volume set written during the 1930s as part of the Architects' Emergency Relief Fund that put architects to work detailing and studying significant historic American homes. The books highlight individual homes—homes that should influence your work—and dig into the architectural details of each. For instance, the collection includes the Hammond-Harwood house in Annapolis, Maryland, which was built by William Buckland and praised by Thomas Jefferson as having most beautiful entry in America.

A FIELD GUIDE TO AMERICAN HOUSES

by Virginia Savage McAlester

In order to work on and repair old houses, you need to understand their key components—otherwise you might take out or ruin the wrong thing. This detailed guide to house styles and their key differences is a great book to start your library. The first edition, published in 1984, was one of my textbooks when I was a student at North Bennet Street School studying preservation carpentry. A second, expanded (and much-improved) edition with a section on neighborhoods was released in 2013. I recommend it to all of my employees as an indispensable tool for understanding the makeup of house styles in America.



WHITE PINE SERIES OF ARCHITECTURAL MONOGRAPHS edited by Russell F. Whitehead

This series started as an advertising supplement for the White Pine Bureau, meant to promote early American buildings constructed from white pine, and is a detailed collection and study of period houses and buildings. The series launched in 1914 and continued into the 1930s, and can now be bought as individual copies or bound collections, or viewed on the Northeastern Lumber Manufacturers Association (NELMA) website.

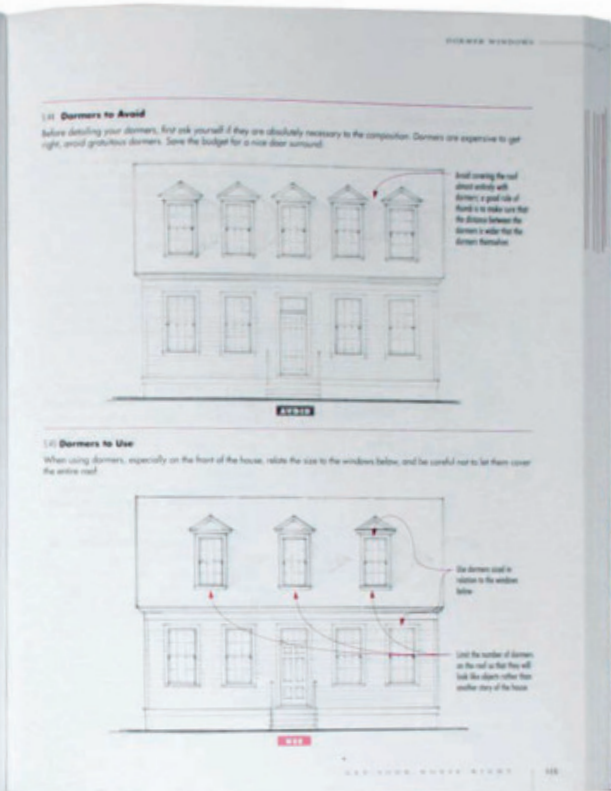
OTHERS TO CONSIDER

From here, consider other books in this genre that focus on a certain region, such as **Early Architecture of Western Pennsylvania** by Charles Morse Stotz and **Early Connecticut Architecture** by John Frederick Kelly. I also recommend specialty-focus books, which provide deeper dives into more specific architectural topics. An excellent example is **Early American Doorways** by I.T. Frary. It provides a comprehensive study of historic doorways and how they were put together.

I always like looking at historic-house plan books, especially those from 1900 to 1930. Dover publications has reprinted dozens, and I think one of the best is **The Books of a Thousand Homes**, edited by distinguished architect Henry Atterbury Smith. This book (listed as volume I, though it appears a second was never released) might be hard to find, but is worth keeping an eye out for in used bookshops and online resellers. It's a charming collection of house plans and ideas, each starting with a floor plan and a picture of the home. A variety of house styles are included, all with appropriate scale and inspiring charm. Though the floor plans may not work today, the exterior details do.

DETAILS IN DANGER OF BEING FORGOTTEN

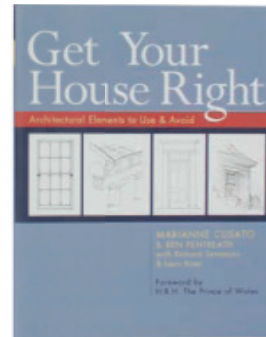
To build on the foundation of architectural design and style books, a craftsman must also study construction details. It's important to keep up with modern practices, but there are also building methods from 100 years ago that we have completely forgotten, and that are still useful today. In fact, some of my company's best building details are ideas we have found in these historic books.



GET YOUR HOUSE RIGHT

by Marianne Cusato

This is a newer book compared to others on this list, but it belongs here because Cusato references traditional and historical building patterns that were once common knowledge. From start to finish, this book lays out proper details for the exterior of a home and offers explanation for why these traditional elements work. In the spirit of Mouzon's book (below), Cusato shows hundreds of examples of what to do and what to avoid, making it easy to learn from side-by-side comparisons of good and not-so-good design details. This book is second to none when it comes to explaining classical elements in plain and clear terms—from the orders of architecture to styles of windows and doors to details for brick arches and keystones.



RADFORD'S PORTFOLIO OF DETAILS OF BUILDING CONSTRUCTION

by William A. Radford

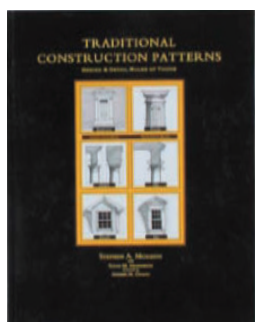
Although most of Radford's publications are worth a look, *Details of Building Construction* (published in 1911) and *Architectural Details for Every Type of Building* (which followed in 1925) are two of my favorites. In both books, there are a slew of important house elements and interesting methods for building. One detail—the shelf stays shown in his cabinet construction—we borrowed for a job and then made our standard for mounting shelves in cabinets. Another priceless find is the traditional methods and details shown for building porches. If there is one area builders get wrong most often, it is porches, particularly how to place the porch beam onto a column. Radford reminds us how it all should go together with clear construction drawings and blueprints.



TRADITIONAL CONSTRUCTION PATTERNS

by Stephen A. Mouzon

I consider Mouzon to be one of today's great thinkers in building design. Trained as a modernist architect, he learned the beauty and rationality of traditional design and has since become an influential speaker and author. I like this book because on each page he addresses a design element—eaves, stucco, dormers, chimneys, even dentil size and proportion—and uses visuals to highlight what works and what doesn't.



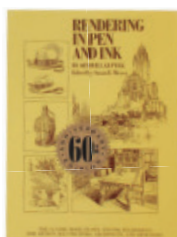
OTHERS TO CONSIDER

There are a few others to consider when rounding out this category of your collection. **Building Details** by Frank M. Snyder includes historic details from distinguished architecture firms from the early 20th century, such as McKim, Mead & White. This 12-part serial, released between 1904 and 1914, highlights some of the best period construction elements. Another, **Traditional Details**, is a collection of architectural details from the 1932 to 1951 editions of *Architectural Graphic Standards* written by Charles George Ramsey and Harold Reeve Sleeper. It includes hundreds of architectural illustrations and covers standards of construction from foundations to furnishings. Consider, also, **Comparative Architectural Details**, edited by Milton Wilford Grenfell, which is a collection of writings from *Pencil Points*, an architecture and design magazine first released in 1920. This is one of my favorites because it highlights "stylish" house elements such as chimneys, porches, and dormers, but also less glamorous areas such as radiator enclosures. Photos are often accompanied with detailed drawings, making this an inspirational idea book.



HOW-TO THAT STILL HOLDS UP

No builder's library would be complete without a selection of books about working with wood and hand tools. Don't make the mistake of thinking that this old-world knowledge has no relevance in today's power-tool world. A good excavation contractor knows when it's actually more efficient to get off the backhoe and grab a shovel, and builder's should learn to recognize those moments in their work as well.



RENDERING IN PEN AND INK

by Arthur L. Guptill

This isn't a book on design or building, but rather on drafting and drawing, because one thing every master

builder should be able to do is draw—if not formally, at least to create quality sketches for clients and subcontractors. There are many good books on drawing in perspective, but this 1928 text, regarded as the most comprehensive book ever published on the subject of ink drawing, is a great starting point.

ENCYCLOPEDIA OF FURNITURE MAKING

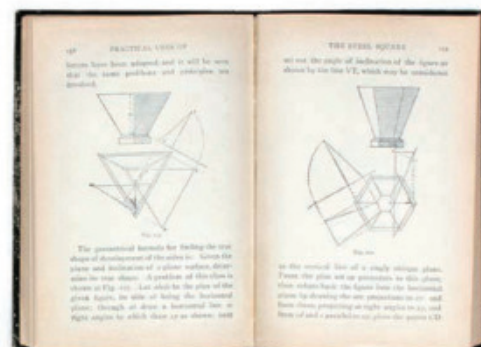
by Ernest Joyce

This is a comprehensive book on furniture design and construction. The first half covers hand tools and joinery, and is perfectly adaptable to home building and trimwork. The rest of the book covers techniques and processes that we don't often see in home construction, but that can provide great solutions for a talented craftsman or cabinetmaker. Builders should be craftsmen, and the most accomplished craftsmen I know have built furniture for themselves or clients.

A PRACTICAL TREATISE ON THE STEEL SQUARE

by Fred T. Hodgson

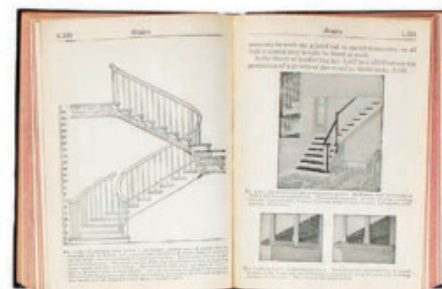
This two-volume set, written in the 1870s, was a best-seller at the time and can be found reprinted by various publishers into the 1930s. The subject is geometry and basic building theory, and I think every builder or carpenter, especially framers, should own a copy. With this set, a craftsman will learn the countless tricks to using a framing square in day-to-day work, constructing anything from stairs to roofs and complex dormers.



AUDELS CARPENTERS AND BUILDERS GUIDE

by Frank D. Graham and Thomas J. Emery

This small, four-volume, must-have set is designed to be carried in a toolbox or work apron. Each book is filled with all kinds of useful information. The first book covers tools, steel squares, saw filing, joinery, and furniture. The second volume includes builder's math, drawing plans, specifications, and estimating. The third covers house and roof framing, layout, and foundations. The fourth finishes with doors, windows, stair building, millwork, and painting. The breadth of the material gives insight into the types of things a carpenter or builder in the '20s was expected to know and understand—hopefully, it will push you to learn the same things.





Scribing Rails to a Round Column

A router jig helps
create a smooth
transition for this
tricky connection

BY MARIA KLEMPERER-JOHNSON

When I was approached to rebuild a porch in the Fall Creek neighborhood of Ithaca, N.Y., I knew it would be a rewarding project. The clients—both landscape architects—care about aesthetics and construction details. Their porch was barely hanging on, but its original character was visible beneath the peeling paint and rotting boards.

The most gratifying part of the project was designing and building the railing—the original was undersize both in terms of code and appearance, and the connections to the columns were a cobbled mess of rusty toe screws and brackets. The challenge lay with cleanly attaching the railings—particularly the sloped stair rails—to three tapered round columns.

I've seen myriad awkward solutions to this tricky detail. Sometimes the column is “flattened” with an applied block; other times handrails are hung off brackets on the side of the column, or they land on an extra newel post. I wanted a more elegant connection, so I built a jig that allowed me to cut the curve of the column on the sloped handrail. I started by making a radial template sized for the diameter of the columns—this took care of the level railings. Then I built a scaffold to hold that template at the slope of the stair. It turned out to be a lot of work—work I didn't anticipate when bidding the job. But the fun of solving a challenging carpentry problem made it worthwhile. □

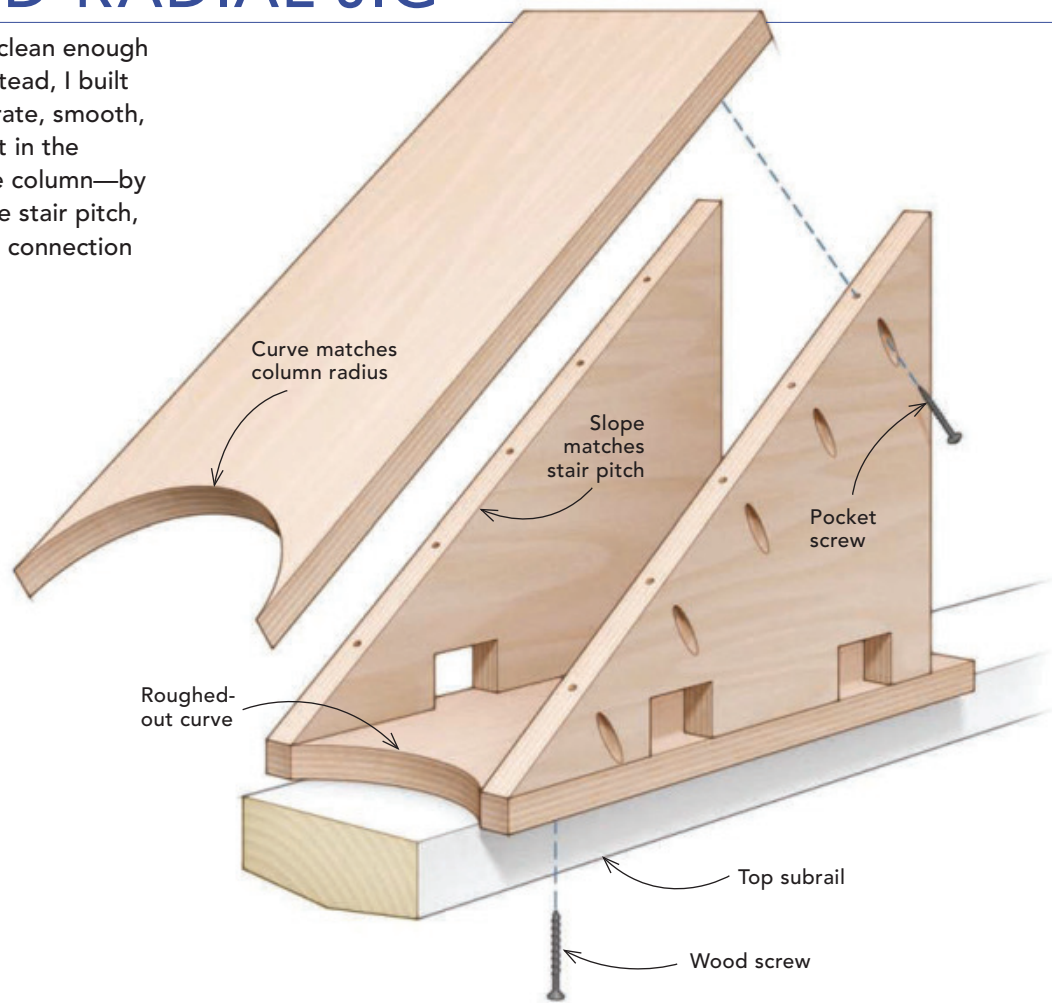
Maria Klemperer-Johnson is a carpenter and residential-construction instructor at SUNY Delhi. Photos by Kiley Jacques, except where noted.

BUILD A SLOPED RADIAL JIG

Even a steady hand won't produce curves clean enough for such a visible location as a stair rail. Instead, I built a router jig, which allowed me to get accurate, smooth, repeatable results. The radius of the cutout in the sloped top piece matches the radius of the column—by setting that piece on an angle matching the stair pitch, that radius is elongated, creating a perfect connection from sloped rail to plumb column.



Get the radius. Measure the diameter of the column at the railing connection using a pair of framing squares. Where the tongue and the blade of the squares meet is the diameter of the column; divide that number in half to establish the radius.



Transfer the radius. Use a compass to mark the curve on a piece of plywood from a pivot point located 1 in. in from the edge (this will be the top board of the jig). Secure the board to your bench with countersunk screws on both sides of the curve to be sure all parts of the piece remain immobile as they are cut free.



Add the pivot pin. To cut the curve, I use my router's edge guide as a trammel (my router's guide has a pivot point built in; you can also build a trammel jig). Drive a 1/4-in. drill bit into the pivot point on the board and into the support below, and leave the bit in place to act as the pivot pin.



Cut and trim. Slide the edge guide onto the pivot pin and cut the radius, starting the router off the board and moving in a clockwise motion. After cutting the curve, trim the extra width at the tablesaw so the board is only as wide as the curve.



Test it out. Check the fit against the column. This radial template can be used alone to copy the curve onto the horizontal railings before it's incorporated into the sloped jig to make the cuts for the pitched handrail.



Measure and cut jig sides. The pitch of the jig should match the angle of the stairs. For stairs with 7-in. risers and 10-in. treads, lay out two 7:10 triangles on a piece of plywood and cut them with a track saw.



Make space for clamps. Cut clearance notches in the runs (bottom legs) of these triangles to make room for clamps to hold the jig to the railing stock.



Secure the sides. Assemble the jig upside down, fastening the sides to the radial template with pocket screws.



Add the base. With the jig right-side up, add a piece of plywood to the base. Use the curve cutout on the top piece to transfer the arc to this bottom piece, then rough out the curve with a jigsaw (this will keep it out of the way of the router bit).



Finish the assembly. Realign the bottom piece, lay the jig face down, and face-screw the bottom piece to the sides.

CUT THE RAILS

The curved cut is made using a pattern bit. Because of the jig's slope, there will be a varying depth of cut across the arc. You could start with a 1-in. bit, or even a 1/2-in. bit, then switch to a longer bit in as many increments as you want. But that's time-consuming. You could use a longer bit, but that would make too deep a cut

at the edges where the router enters the workpiece. Plus, a single bearing would force you to make the whole cut in a single pass, which is aggressive. I prefer to stack a few extra bearings on a 1-in.-long top-bearing flush-cut bit and make multiple light passes, lowering the bit incrementally.

Whiteside 3020 template bit, \$32; B19 ball bearings, \$13 each



Trace the arc. Using centerlines, place the jig square on the end of the railing stock and trace where the router will cut.



Rough-cut the rail. Use a jigsaw to rough out the curve, then realign and clamp the jig. Even though the jigsaw cuts square to the face of the stock and the router will cut at an angle, it's helpful to get this material out of the way.



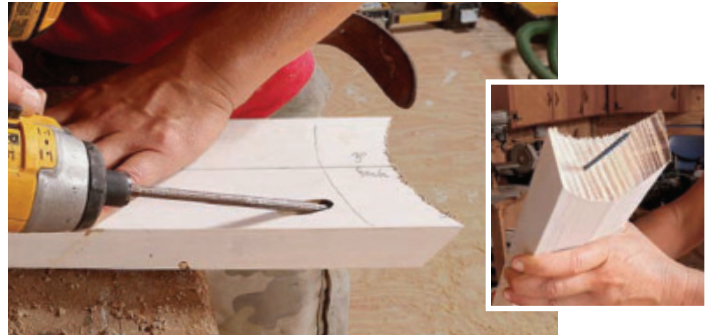
Take the plunge. Use a plunge router to make the cut in multiple passes. The bit's bearing will ride along the jig's curve for the first few passes (photo above), but as the cut goes deeper, the router will bottom out. To finish the last few passes, slide the jig back on the railing stock a few inches so the leading corners of the cut are just below the top surface of the jig, then use the previously cut surface of the workpiece as a guide for the bearing (photo left).

CONNECT THE RAILS TO THE COLUMN

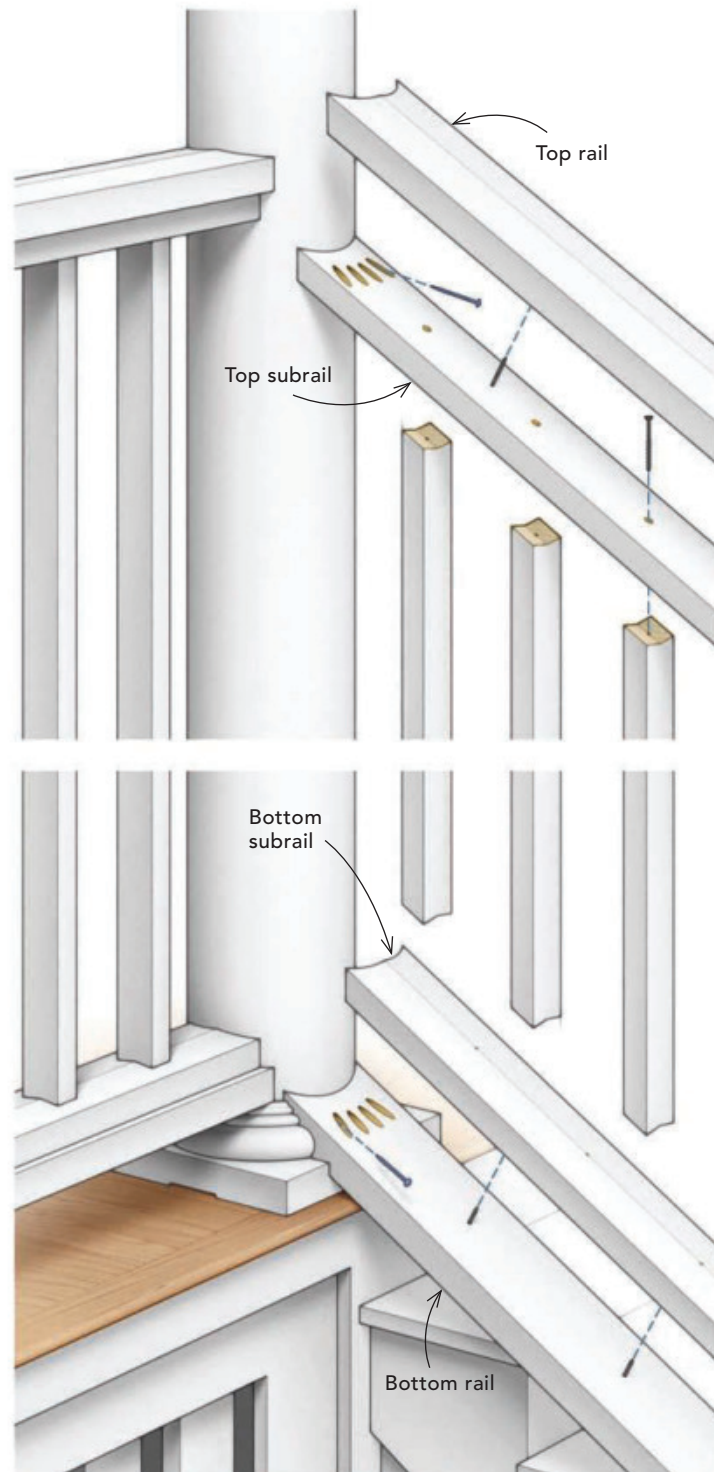
Part of the beauty of this railing design is the hidden connections. On this project, I notched out the column base molding to receive the bottom rail, which is then pocket-screwed from the top into the column. The bottom subrail is set on top, and hides the connection. The top rail works the same way—the top subrail is pocket-screwed from above, and the top rail hides the column connection as well as the screws that connect that subrail to each baluster.



Position pocket holes. Lay out lines where the pocket-hole jig should sit, then secure the jig to the railing stock with a quick-release clamp. The jig should be positioned so the screws will fan toward the middle of the curve (this angle can be eyeballed).



Test a screw. Drill a test pocket hole and drive a test screw to be sure it emerges at approximately the midpoint, thickness-wise, of the workpiece end. Then drill four pocket holes and drive four 2½-in. exterior-grade pocket screws through the top subrail and the bottom rail into the columns.



HOUSES

ARCHITECTURAL CHALLENGES AND SOLUTIONS

BY DESIGN

CURATED BY KILEY JACQUES



HIDDEN IN PLAIN SIGHT

The design-build team at Polhemus Savery DaSilva was asked to create a home in keeping with the surrounding village's Cape Cod character. Because the lot abuts a designated historic district built before the introduction of cars, housing the clients' vehicles required special consideration. Facing the garage toward the front would have been contextually inappropriate, while positioning it toward the side yard would have been restrictive due to the narrow site. On the other hand, orienting it to the backyard would have inhibited indoor-outdoor living opportunities. The side street running perpendicular to the front elevation was



the only viable option, but it posed the problem of how to create an inviting facade in harmony with the streetscape.

The solution was to mask the garage behind a porch featuring a double-column portico with a fanlight-style pediment. The treatment has the look of a traditional entry, but is centered on the garage windows rather than the front door as is typical. The door is tucked at an angle to one side and opens into a large projecting bay. The functional role of the facade in this historical context is intact, the cars are conveniently accessed, and the homeowners have a front-row seat to passing parades.



Designer/builder Polhemus Savery DaSilva Architects Builders, psdab.com

Location Cape Cod, Mass.

Photos Brian Vanden Brink



PROTECTION FROM SOLAR GAIN

Situated in an open field, this simple gable structure is oriented due south toward a pastoral view. The form is reminiscent of the homes common in northeastern Pennsylvania, which is dotted with hardscrabble farms. Staying true to the vernacular farmhouse style meant leaving off deep overhangs that would otherwise protect from summertime heat gain; eaves in this region are rarely more than 8 in. Instead, Cutler Anderson Architects designed sliding-shade screens on barn-door hardware that act like a straw hat, while six custom-built swinging doors on the south side and two on the north side support passive cross ventilation. The inspiration for the approach came from a previous project by the same firm, namely the 18-story Edith Green–Wendell Wyatt Federal Building in Portland, Oregon (photo left). That transformation of a 1970s concrete commercial building included re-cladding the entire structure in a curtainwall that hangs 22 in. beyond the perimeter of the existing structure. Fixed sunshades on the south side and vertical aluminum rods on the west elevation create an elaborate shading system. In this residential application, a pleasant degree of daylight is maintained, yet the screens yield a 15° temperature differential.



Designer Cutler Anderson Architects, cutler-anderson.com

Builder Frank Truncali of Breig Bros.

Location Northeastern Pa.

Photos David Sundberg@ESTO, except where noted





LET'S TALK DESIGN

For all things related to design, including our design blog and an opportunity to submit your own projects to be considered for publication, visit FineHomebuilding.com/design.

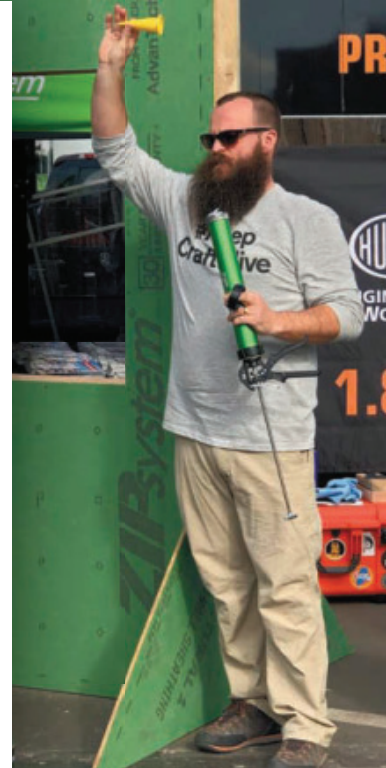


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SPEC

NEW AND NOTABLE PRODUCTS

STREAMLINED ELECTRONIC ENTRY

Touch-sensitive keyless entry has become a popular feature in modern cars, but now similar technology can open your front door. Although smart locks have been around for a while, style has often taken a back seat, with bulky keypads and other hardware taking up a lot of space on the door. In response to the call for a more streamlined door-hardware solution, Baldwin has introduced the Evolved series of handlesets and deadbolts, with touch-to-open technology seamlessly integrated into the hardware itself. The sleek electronic pad located directly under the traditional keyport uses Bluetooth technology to connect with an optional key fob or with the Kevo mobile app. To open, simply touch the sensor while your smartphone or key fob is in your hand, pocket, or bag, and the door unlocks. The app provides an assortment of features, including the ability to grant eKey access to guests, remote locking and unlocking, and a real-time log of previous access.

The Evolved series is truly customizable, with 19 handleset styles, three deadbolts, and 16 finishes. Each Evolved electronic lock takes four AA batteries and uses LED status lights to display locking, searching, low-battery, and error messages. The locks also have standard keyports if you feel the need to unlock your door the old-fashioned way. Prices for handlesets start at \$420 and deadbolts start at \$280. —*Jessica Chaloux, associate content producer*



ADAPTABLE RECESSED LIGHTING

As electrical contractors, we get a lot of questions about what recessed lights we prefer. Lately we have been a big fan of Nora Lighting's Iolite LED downlights, particularly because of how customizable they are. The trims are available in 10 finishes—the one seen here is their “natural metal” option. Each light comes with three interchangeable optics: spot, narrow flood, and wide flood. We also really like that they come in different sizes: 1 in., 2 in., and 4 in. The fact that several



trim styles are available for the same rough housings make trim-out easy, as you can decide to go with round or square even after rough-in. Directional gimbal and deep-regress trims make sloped ceilings and general adjustability a snap. There's even a sleek trimless version which we are excited to use on an upcoming project. All lights come in five different color-temperature choices, and the larger reflectors produce 800 or 1000 lumens.

The price point is also appealing, with a rough-housing and trim combo costing less than \$120. While there are obviously much cheaper options to be found at big box stores, none compete with these for quality and style. And with most high-end lights costing more money and offering less flexibility, the Nora Iolite series is a no-brainer for all of our custom lighting projects. —CJ Nielsen, electrician



STEEL GARAGE STORAGE

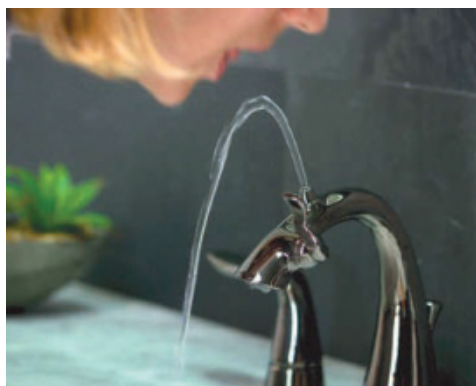
You wouldn't settle for cabinets and shelves in your kitchen made out of rough plywood and 2x4s, so why should you in your garage? In many of today's houses, the garage is the first thing anyone sees when they come home, so it makes sense to give it the same attention you would any other room you spend a lot of time in. The Bold 3.0 Series cabinet collection by NewAge Products might be just the solution for converting your neglected garage into a tidy storage space, workspace, or both.

The modular steel cabinets come in a variety of shapes and sizes, and can be ordered as individual pieces or complete sets to perfectly match the amount of wall space you have and the type of stuff you intend to store in them. The base cabinets are the most versatile components, available with just drawers, just doors, or a combination of both. You can add more functionality with a matching stainless-steel or bamboo countertop, a slatwall backsplash, and a wide array of hooks, racks, and other accessories. All of the steel surfaces are powder-coated for durability—cabinet cases in black, slatwall in silver, and a choice of either deep red or charcoal gray for the doors and drawers.

NewAge offers several cabinet lines with a range of price points, but the Bold 3.0 Series appears to have the perfect balance of style and value to make it a welcome addition to nearly any garage. Individual cabinets can be had for as low as \$95, and full collections run from several hundred to several thousand dollars. A modest but complete setup for a small garage will run somewhere between \$1000 and \$2000. —Rob Wotzak, digital brand manager

EASY-SIPPING FAUCET

We've all bent down over the bathroom sink to sip from the faucet when brushing our teeth, but with the Nasoni Da Vinci fountain faucet, that process just became a lot simpler. The faucet redirects the water from the downspout to a discrete fountain port with the simple flip of a switch. The sleek design provides an easier way to access water for common bathroom



routines such as washing your face, taking pills, or shaving. This is especially beneficial for people with back or neck pain or medical issues that limit mobility. Aside from being more convenient, it also reduces your exposure to germs found on bathroom surfaces.

When in fountain mode, this bathroom fixture has the added benefit of conserving water, reportedly using 88% less water than the average faucet. For extra-pure drinking water, Nasoni also offers undercounter filters that connect with standard water supply lines.

The faucets are available as 4-in. centerset units or three-piece 8-in. widespread sets. There's a choice of three finishes—polished chrome, brushed nickel, and gloss black nickel—plus the special PVD (physical vapor deposition) metallic coating makes the fixtures corrosion and stain resistant. Centerset models range from \$480 to \$500 while widespreads run \$580 to \$600. —J.C.



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YOUR QUESTIONS—PRO ANSWERS

Alternative patio base

Despite the joists being half-buried in the ground, our grade-level deck has managed to last more than a couple of decades. A patio replacement sounds appealing, but this is a townhouse, and we can't get an excavator or truck in there to remove soil or bring in the stone for the base, and there's no room to build up—it's already nearly level with the interior floor. We'd like to replace what's there with an eye toward increased longevity. We were thinking of digging down a few inches by hand, then laying down landscape fabric and some crushed stone, installing new 2x PT joists, and topping it with composite decking. Do you think we could get another 20 years or more out of that assembly?

—PETER EGGERS
via email

Tony Blue, owner of Squared Away Contracting (@squaredawaycontracting) in Greenwich, N.Y., responds: The primary concern with another ground-level deck is the new pressure-treated lumber: Like your grandfather would say, it just isn't what it used to be. The preservatives used in today's residential-grade PT lumber aren't as good at resisting decay as the old stuff, so the wood rots more quickly. And not all composite decking is equal, either—some products require lots of airflow to avoid becoming a breeding ground for mushrooms, and some can't be used on decks that aren't firmly anchored to ground footings and/or the building. Unlike wood, composite decking tends to be a bit floppy. As you noted, though, townhouses often don't

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PANELS FOR PAVERS

Made of high-density foam, interlocking Gator Base panels provide a stable base for concrete pavers without the need to lug several tons of gravel to the site.

allow access for heavy equipment without damaging neighboring properties.

With all this in mind, I'd recommend concrete pavers, which can be brought around the back of the property in a wheelbarrow. The standard patio base you know of—6 in. of compacted gravel—can amount to several tons of material that would have to be moved without a truck. There's a smarter way to accomplish this.

A handful of manufacturers make paver-base products out of high-density foam panels that lock together. They take the place of the gravel to provide a stable base for the pavers, but they're light enough to carry around the house in your arms—in one trip for a modest-size patio. Gator Base is one I've installed, and it works well. It has built-in channels for drainage and is frost resistant. For the most part, the process is the same as a traditional paver installation, except for the substitution of the stone base.

First, excavate the top layer of soil by shovel and rake as needed. In your case, after removing the old deck, the area should already be free of vegetation, and it should be easy to move the soil. Use a laser

level or stringline to pitch the area away from the house. Then use a plate compactor to tamp the soil firm and flat. A layer of drainable geotextile landscape fabric goes on top of that, followed by $\frac{3}{4}$ in. of screeded and compacted sand. The Gator Base panels come next, and lock together with a tongue-and-groove system. Although not in the instructions, I've found that tamping again at this stage helps even everything out. Then install the pavers, followed by plastic edging. After filling the joints between the pavers with polymeric sand, compact the whole thing one more time and wet the area to activate the sand. This doesn't eliminate all the heavy moving, but it's a practical way to get an affordable patio without ruining your back or the neighbors' lawns.

Widening deck stairs

I'm looking at upgrading my 20-year-old deck. I want to widen the 30-in., 14-tread stairs and replace the decking and treads with composite material. That said, I've never built deck stairs with more than four treads. I have cut 2x12s for stringers in the past, but I am leery of a stringer this long

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and high with so many cuts. The existing stringers are solid 2x material with 2x4 cleats as tread supports. The new treads will be 4 ft. wide, so I know I'll need more stringers, but I'm wondering what the best approach is. Are there exterior-rated LVLs? If the lumber seems good on the existing stringers, can I reuse them? I also thought a post and new concrete pier might be a good addition to support where the stairs connect to the deck beam, but I'm not sure if this is overkill.

—CURT LYONS
via email

Ian Schwandt, a lead carpenter at HVP Corp. in Kent, Conn., responds: Based on the specifications you mentioned, I think your best option is to build a completely new set of stairs (your existing stringers could be used as finish stringers if that is the desired finished appearance). The driving factor in needing new stringers is your plan to change to composite decking for the treads; that material is typically about 1 in. thick, while the existing 2x treads are about 1½ in. thick. When stair stringers are laid out, the bottom riser is shortened or dropped by the thickness of the stair tread to ensure an even rise for each step in the staircase. Because your stringers have been cut to accommodate 2x treads, changing the treads out for thinner material would result in a shorter rise for the bottom step (and a larger rise for the last if you were simply swapping out decking of equal thicknesses). This kind of variance in riser heights is a tripping hazard, so code doesn't allow it.

I'm not aware of any exterior-grade LVL material, but pressure-treated 2x12 material could be a viable option depending on the span of the stairs. The Prescriptive Residential Wood Deck Construction Guide (DCA 6) limits the span of cut stringers to 6 ft. measured horizontally from the building. Solid stringers can span up to 13 ft. 3 in., though you'd need either additional stringers or solid 2x subreads and sub-risers between them to support the composite decking. One good option for strengthening the stringers is to sister additional lengths of 2x material to each side.



LIFT IT UP

Material lifts—commonly used to move HVAC equipment and other heavy items—make it possible to raise a deck in a controlled, safe, and pain-free way.

Manufacturer specs for the composite decking you choose will largely dictate the spacing of stringers or other supports. Trex, for example, requires 9-in.-on-center stringer spacing for some of its products, and 12 in. for others. So you'd need at least five stringers for adequate support without subreads. Some other manufacturers allow wider stringer spacing.

As for the post and pier, that probably is overkill. An easier-to-install Simpson Strong-Tie ZMAX stringer connector will provide a strong connection at the deck rim joist. But you could add two posts and a header under the stringers at the midpoint of the stairs to eliminate any bounce and add strength.

Raising a deck

We made a mistake and hired an inexperienced builder to construct a 5-ft. by 8-ft. deck, and they built it so there's a 10-in. step down from inside the house to the deck. We need to raise it for obvious reasons, but would prefer not to take it completely apart to rebuild. The new carpenter we hired doesn't seem to have any creative ideas for how to accomplish this. Can't we just take the main frame off the ledger board and raise the whole thing?

—KASEYLYNN
via FHB.com

Editorial advisor Mike Guertin responds:

Unless there are extenuating circumstances, this should be an easy fix for any carpenter or deck builder. I'd remove two or three of the deck boards along the house to access

the ledger and see how it's fastened. There should be either lag screws or bolts, which can be removed, allowing the entire assembly to be lifted.

A deck this size usually isn't very heavy and can be raised using pump jacks or, better yet, wall-lifting jacks positioned near the four corners of the deck. You'll have to support the tops of the jack posts with some diagonal bracing down to the ground to ensure stability. Another option—one that may be a bit overkill—would be to rent a couple manual material lifts to raise the deck (see "Air-Sealed and On Piers," *FHB* #285). These are typically rated for higher loads than you have, but the forks and wide bases of these lifts can simplify balancing the load as it's raised and bracing it afterward. There may be some preparatory siding removal and flashing work needed, and that can be done before disengaging the deck.

With the jacks positioned, the ledger fasteners can be removed, as can the fasteners holding the metal post-to-footing connectors at the bottoms of the posts and/or the post-cap connectors from the tops of the posts where they connect to the beam. If there are lateral-load connections between the deck frame and the house framing, those will also need to be disconnected and repositioned after the deck is raised. Once the deck is lifted up to the desired height, the ledger can be fastened back to the house. New deck posts will need to be fit to the raised structure. There shouldn't be many on a small deck, so it shouldn't cost too much to replace them.

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Mechanical advantages

There are about 50,000 lb. of lumber and structural panels in an average house, and standing them in the air requires two fundamental capabilities: reach and lifting power. At 6 ft. 2 in. tall but only 140 lb., I'm well-favored in the former but somewhat challenged by the latter. Whereas my beefier comrades can often prevail with a huff and a grunt, I learned early on to use my best muscles—the ones above my neck—for the big lifts, along with the right equipment.

The most practical lifting device for framing is a set of wall jacks. They're used mostly for walls too heavy to lift by hand, but they can be used for beams as well. There are two types: One uses a metal pole with a side-mounted winch, and the other works with a binding action, walking along a double 2x4 like the pump jacks used for scaffolding. I consider the winch style to be safer because the operator can stand outside the footprint of the load throughout the entire lift. Pump-style jacks require the operator to move forward as the wall rises, placing him in harm's way should something fail.

When using wall jacks, it's important to understand that the wall's center of gravity shifts as it rises, so the bottom of the



HELP FROM ABOVE

Although not inexpensive, having a crane on-site for even a few hours can save an immense amount of effort when it comes to tasks such as lifting and placing trusses.

wall needs to be secured against sliding forward just the same as when raising a wall by hand. This can be done with blocks scabbed to the rim joist or with metal straps fastened to the bottom plate.

Not long after I had forked over a nice chunk of change

for a new pair of 20-ft. Proctor wall jacks, I had an unfortunate incident. I either forgot to secure the bottom of the wall or failed to appreciate the physics involved. We had cranked the wall up about 4 ft. when the whole thing slipped forward off the foundation. Fortunately, it

was close to ground level. No one was hurt, but the wall-jack poles had gained considerable momentum during their unexpected journey, and, coming to a sudden stop, they bent. This was problematic because it compromised the safe lifting capacity of the jacks, shifting



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any future load away from the poles' center. The other bummer was that the poles, which are built as two halves that telescope for transport, were now so bent that the upper tube would no longer slide inside the lower tube.

The story would end sadly had it not been that the client for this job happened to be a Bulgarian-American machinist named Alex. Building Alex's garage had been interesting from the get-go. When I told him I needed to buy anchor bolts for the sills, he rummaged around in his boneyard for some rod stock, bandsawed it into bolts, threaded them on his lathe, and bent them with a torch. They were the prettiest J-bolts I've ever shoved into wet concrete.

The crashing sound of the Great Wall-Jack Catastrophe brought Alex out of his shop to survey the wreckage. He saw me struggling in vain to slide the now banana-shaped wall-jack tubes together and offered to help. We placed one of the tubes under the ram of a hydraulic-press frame and Alex began propping it with V-blocks. When I saw what he was attempting, I was skeptical. There's only about $\frac{1}{16}$ in. of sliding clearance between the 11-ft.-long tubes.

Alex prowled around his patient, eyeballing it from every angle. Behind his darting eyes I imagined little gears analyzing parabolic curvature and the deformation memory of mild steel. Then he started tweaking; a crank here, a reposition, a crank there. In a few hours my wall jacks were once more nesting together happily. Every time I raise the poles on a job I salute my immigrant friend.

My quest for mechanical advantage eventually led me to purchase a telehandler, sometimes referred to as a shooting-boom forklift. It was the bottom of the 2009 recession and heavy equipment was going for fire-sale prices. After the purchase, I assumed that my lifting problems were over, but in practice I discovered that the usefulness of a telehandler is limited by its size and tremendous weight.

must be trained, certified, and re-certified periodically. Regulations aside, it's morally imperative that operators know and obey all the rules, especially when there's a work platform on the end of the boom. I have seen OSHA photos of forklift tip-over accidents, and they are not pretty.

The ultimate lifting device is a crane. With a big enough machine, you can hang a gable

and my grand plan had come to a screeching halt. The crane rental plus the extra labor meant that the meter was running north of \$300 an hour, and I was a growing warm under the collar. The operator tried lifting the machine by pushing down with his side stabilizers; imagine King Kong climbing out of a bathtub. It was a good strategy, but the stabilizers just plunged into the muck with

The operator tried lifting the machine by pushing down with his side stabilizers; imagine King Kong climbing out of a bathtub. It was a good strategy, but the stabilizers just plunged into the muck with no effect.

Although they're terrific for building a new structure on a flat, unfinished site, the fear of rutting a lawn or cracking a driveway makes them impractical for remodeling. It's also difficult maneuvering on tight lots or steep ground.

Telehandlers face another limitation: When exterior walls go up, their reach is greatly impeded. To extend over the wall you must back up the machine or steepen the boom angle. This can make placement of interior beams and trusses impossible. If I did more framing work, I would invest in a truss jib, which is an attachment that extends the boom for placing relatively light loads at a greater distance.

These heavy machines come with heavy responsibilities. Legally speaking, operators

wall or a structural ridge wherever you want it. The problem can be getting the sucker on site. I once ordered a crane for raising a large stick-and-timber-frame addition. At \$800 a day, the rental was nothing to sneeze at. I also had to supplement my crew on lifting day with additional carpenters to take full advantage of the crane.

In preparation, every component was numbered; every move choreographed in advance. We stood around nervously until the diesel-guzzling behemoth arrived. I directed the operator to set up on a rise behind the addition. The bank leading up to the rise was still soft from the previous night's rain, and as the crane started climbing the bank, the tires began to spin. Soon the beast was mired in wet Virginia clay

no effect. A voice in my head hollered, "Think, damn you, *think!*" Gazing into the distance to compose my thoughts, my eyes fell upon a nearby culvert bridge, its sides faced with dry-laid fieldstone. Light bulb!

There was no time to get the owner's permission, so I just gave the order: Everybody haul rocks! We had no tractor and no wheelbarrows, just a half-dozen pumped-up carpenters waddling back and forth from the bridge to the crane like penguins carrying 40-lb. eggs. There was a lot of praying and cursing. Successive batches of stones were rammed into the mud until finally the crane began to rise. A cheer went up. By this time, the road's surface had started to dry, and we sprinkled it with sawdust. I exhaled, and soon we were flying exterior walls into place.



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Scott McBride is a builder and writer in Virginia.

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For nearly 140 years, the North Bennet Street School in Boston's North End has been training men and women seeking gainful employment and excellence in craft. The school's teaching philosophy is built upon the Sloyd system, a Swedish method of education that focuses on character development, intellectual capacity, hand skills, and a comprehensive understanding of process and materials. Michael Burrey, who teaches preservation carpentry, is helping to carry on this legacy.

Burrey, the son of an architect, found his passion for building at age 13 in the pages of a book. "My mother took me to a gallery in Washington, D.C., where I pulled Eric Sloan's *American Barns and Covered Bridges* off the shelf. That book spoke to me. It got into my soul." With support from his parents, who took him to antiques shops to purchase old and traditional tools, Burrey began felling trees and hewing them out with broadaxes to build timber-frame structures. After being educated in early colonial American life, archeology, and landscape management, Burrey found himself in an 11-year position as the resident timber-framer and interpretive artisan at Plimouth Plantation, building reproductions of 17th-century homes in a period-appropriate manner. In 2015, he took his skills and building wisdom to the storied halls of North Bennet Street School.

The preservation-carpentry program that he helps run under department head Steven O'Shaughnessy is an intensive two-year course that attracts a dynamic range of students. Their average age is 33. "They come here with a varied background. Most have been out in the world, gone to college, and ended up in an office. They get frustrated with their position. They want to use their hands and see the results of their efforts." Students are given a foundation in pre-20th-century New England home construction, including stabilizing endangered buildings and recreating historical details. Once they graduate, their work is in high demand. And by pouring themselves into buildings that last hundreds of years, they honor the craftsmen that came before them. —Rob Yagid, executive director, Keep Craft Alive

"That's the essence of preservation carpentry—to let the building dictate, as much as possible, the work to be done."

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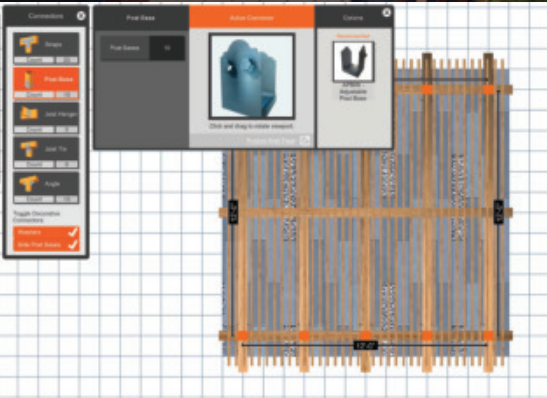


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