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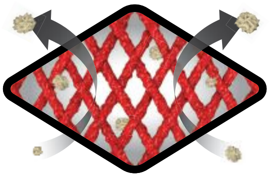

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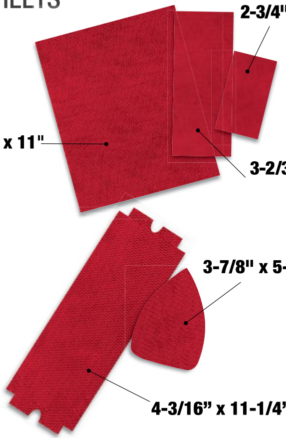

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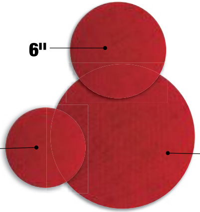

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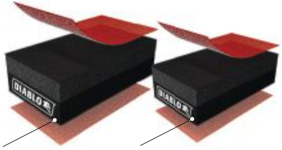

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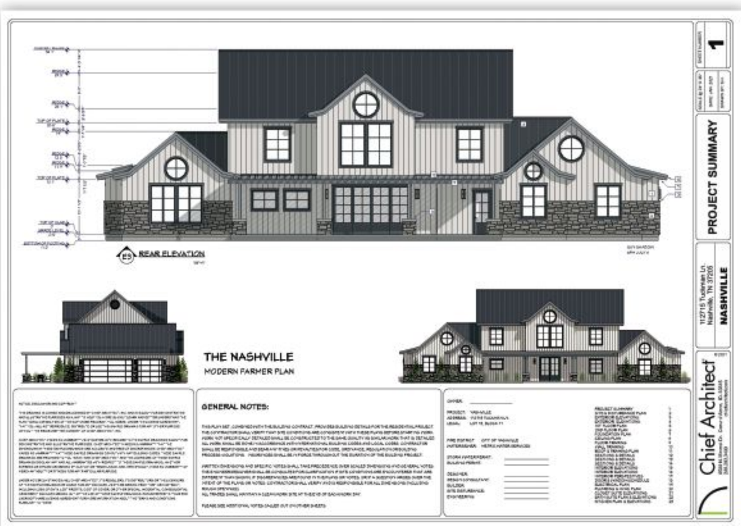

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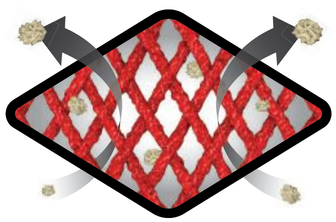

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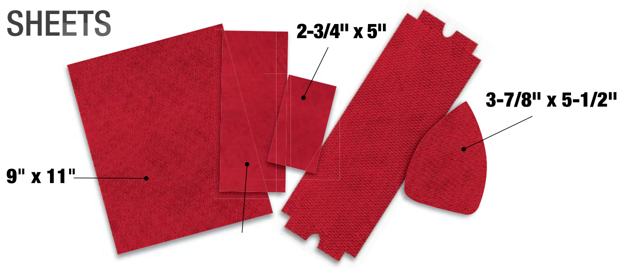

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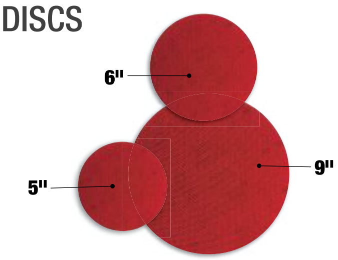

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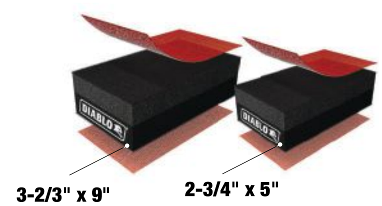

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On the cover: Gary Striegler glues and clamps a poplar face frame to a plywood carcass to make a base cabinet for a new pantry. Photo courtesy Gary Striegler. See the story on page 29.

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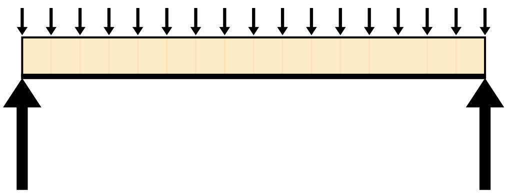
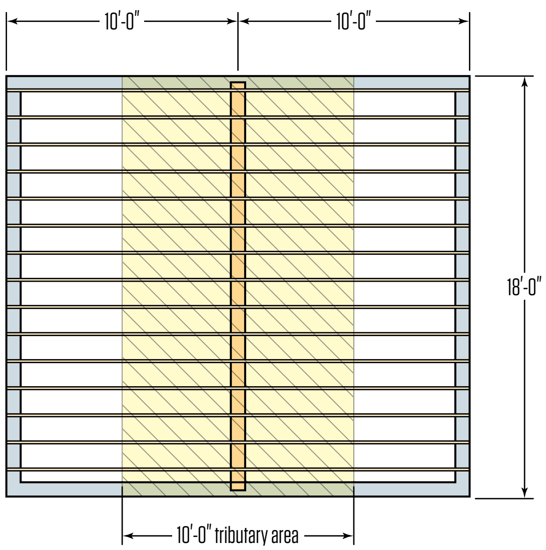
Simple Supported Beam



Tributary Load on a Beam



A simple supported beam (top) is one supported at each end. Half of the uniform load spread across the beam's length equals the "reaction force" at each end. Between the supports, the beam can bend and flex. To begin to measure the load on the beam, we need to look at the "tributary load"—the portion of the loads on other members that feed into the beam. In this case, a floor beam supports half the load on the joists on both sides. The other half of the load on the joists is supported by the foundation walls on each side.

Illustrations by Tim Healey

Structural Design Basics

Structural design is more than picking out the right size for a beam; it is an exercise in understanding a complex of forces resisted by structural assemblies. Each load that imparts a force on a building is supported directly by beams, columns, or walls and is carried down to the ground by a series of other beams, columns, and walls. Carpenters don't have to know the calculations for sizing each component or analyzing the stress values on components and connections, but it's helpful to know how structural systems interact to keep a building upright and also to know how it might fall down. The latter is especially critical when it comes to demolition; you don't want to just start cutting joists or knocking out walls. Instead, you want to be able to "read" a structure to know what is essential to its support, so you can safely remove some parts while temporarily supporting others as you take the building apart. It's also useful to know why you need to follow nailing schedules and why it's important to select the right size lumber and fasteners when assembling structural components. Lumber sizes and the diameter and length of nails and structural screws are not arbitrary choices; they are determined by the structural demands of the building.

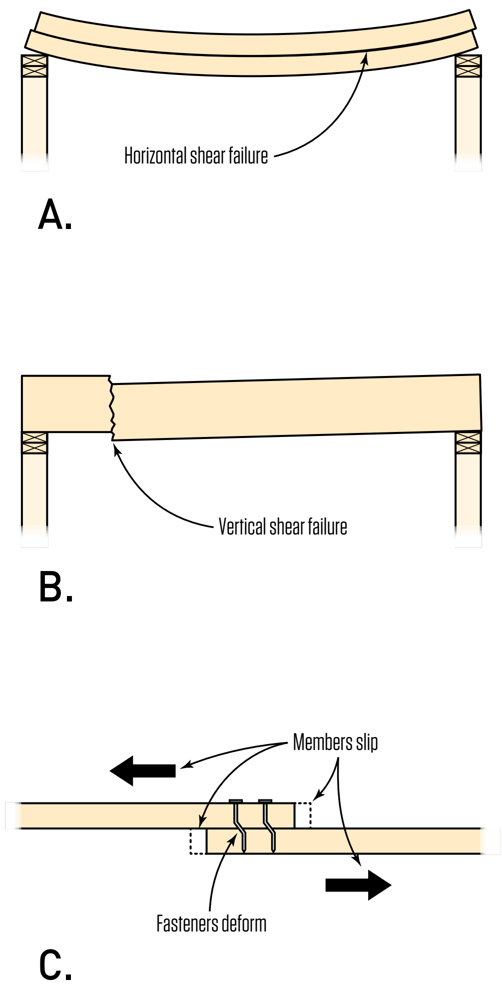
This article is the beginning of a series of articles that will introduce new carpenters to the principles of structural design with an eye toward better understanding how to assemble and dismantle structures. This first article introduces some terms used to describe forces and the general components that are part of the framing to resist those forces. In other articles, we will elaborate on different parts of the frame, as well as tackle principles that relate to a building's other major structural system, the foundation. Be patient as you wade through this material. The forces acting on buildings are a complex of energies acting in different directions at once. To make them rational and measurable, engineers methodically break them down into discrete forces resisted by distinct components and specific properties of materials. Taken by themselves, they will seem abstract, but as you gain an understanding of these terms, you will gradually be able to put them together to analyze how a structure works, and some of the ways it can fail.

LOADS ON BUILDINGS

Let's look first at some of the terms used to describe the loads on a building.

Dead and live loads. As the name implies, dead loads are unmoving, or static, and primarily include only the weight of the materials the building is made from. Live loads are dynamic—they come and go, and when present, may impose greater and lesser force on the

Shear Forces



Shear stresses can cause adjacent materials to want to slide or slip past one another. In a wood member, horizontal shear (A) acts parallel to the wood grain, while vertical shear (B) acts across the grain. Shear is also a big factor in the design of joints and the selection of fasteners and structural hardware (C).

building over time. Live loads include snow loads, which are mostly added weight pushing down from the roof. Live loads also include people, furniture, appliances, equipment, and such—changeable weights and vibrations that come and go and move around. Live loads may also be of variable strength: Wind, which moves at different speeds and imposes both positive and negative pressures that push and pull on a building, is one example. These loads can be extreme (see “Wind-Resilient Buildings,” page 41), as are seismic loads from earthquakes—another example of extreme live loads that vary greatly in magnitude and are a greater risk for buildings in some locations than in others.

Positions of loads. To begin to measure the strength of a material and evaluate its ability to support a given live or dead load, engineers have to distinguish exactly how each load is distributed across the building.

A “uniform load” defines a load evenly spread across a structural member. In reality, loads are never evenly distributed; on a floor, for example, they are concentrated where furnishings and people are, and they can move around. But to size the member, structural designers will assign a uniform load, typically measured in pounds per square foot. This load is based on assumptions to accommodate the shifting nature of real live loads, and a safety factor is typically added to the load.

In contrast to a uniform load, a “point load” is a load concentrated on a small area. An example would be a column supporting one end of a floor beam. In this case, a portion of the load on the beam (the uniform loads on joists that tie into a floor beam on each side) that is supported by the column is concentrated into a small area the size of the end of the column. To size the footing that supports this column and to specify the right concrete for it, we need to know what this point load is.

A “tributary load” describes the portion of a load that is supported by a member, such as a floor beam (see illustration, previous page). The load is defined as an area of the building from which forces flow (think water) to a supporting member.

STRESSES ON BUILDINGS

Loads impart forces on building components, so we need to look next at the terms used to describe different types of forces that a building must resist to stay upright.

Compression pushes building components together. When under a compression force, the molecules in a piece of framing lumber are squeezed together; the force acts to shorten the material. If the compression is too strong for the material to resist, it may be crushed or the member may buckle. Some of the more common compression loads on a building are gravity loads: Heavier materials impose more downward compression force than lighter materials.

Tension is the opposite of compression; tension pulls materials apart, acting to elongate a material. Building materials react in different ways to excess tension: Concrete, which is very strong in compression, but exceedingly weak in tension will crack or crumble under a tension load. Steel, which is strong in tension, will elongate under an extreme tension. Wood’s ability to resist tension is decent if stretched parallel to the grain but much lower if stretched perpendicular to the grain (when it tends to split).

Shear is a stress that wants to make adjacent materials move past each other. The illustration at left shows some of the ways shear acts on building components. When you see the phrase "lateral load," this refers to shear forces acting in a direction parallel with the ground surface.

BEAMS AND COLUMNS

Most framing components in a house are either beams or columns. Most horizontal members are beams and most vertical members are columns.

"Girder" can be a synonym for "beam," in general terms, but in practical terms, girder often refers specifically to a beam that supports multiple joists or rafters. Every joist acting on its own is a small beam, and every rafter a sloped beam. The headers over door or window openings are beams that support the loads coming down the studs or cripples in walls that bear on the header. Sills are beams that are uniformly loaded by the bottom plates of the walls and continuously supported by the foundation. Trusses are complex components that will be examined in detail in a later article, but as a whole, each truss, whether in a floor or a roof system, functions as a beam. Even every wall, taken as a whole, can be looked at as a beam, subject to the same complex of bending forces, which include compression, tension, and shear.

"Post" is a often considered a synonym for "column," but in precise terms, columns are vertical members that support loads from above, in addition to lateral loads. Posts do not support overhead loads. A guardrail post, for example, is an important structural member on a deck that is supporting lateral loads but is not supporting overhead loads. In a wall, every stud, considered on its own, acts like a column, and king and jack studs work together as a column to support each end of a header. The supports at the ends of girders and structural ridge beams are columns.

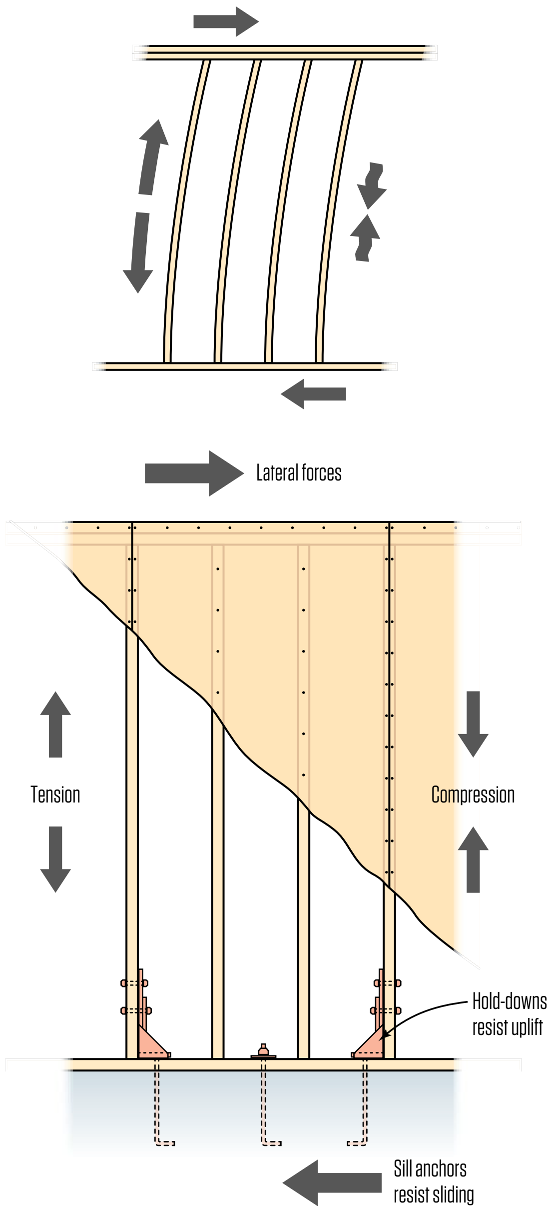
SHEAR WALLS AND DIAPHRAGMS

More-complex assemblies that support buildings are shear walls and diaphragms. All wall sheathing helps to resist shear. When a lateral force is applied to a wall, it's often called a racking force, because it wants to "rack" the wall, tipping the studs out of square. A diagonal brace or piece of OSB nailed to the studs and wall plates is enough to resist the shear imposed by normal wind loads. But for extreme loads, a true shear wall is needed. Shear walls are specific assemblies that include tight nailing on all edges of the plywood (and sometimes blocking, so all edges can be nailed off tightly) and hardware to keep the corners of the shear wall anchored to the foundation to prevent it from tumbling.

Similarly, lateral forces can throw a framed floor system out of square, and floor sheathing ties it together to keep it square. But a true diaphragm is a way to resist extreme lateral forces from windstorms and earthquakes. Diaphragms not only require specifications for the size of the joists and specific nailing patterns for the sheathing (and may include sheathing on the bottom of joists as well), but may also include "force collectors"—added horizontal members in the floor that are heavily sized and anchored with hardware to the walls.

In later articles in this series, we will look closely at all these components, beginning with an examination of the complex of forces that cause beams to bend and columns to buckle, and what goes into sizing these members to limit these distortions.

Forces in Shear Wall



When strong wind or an earthquake exerts a force, the load is delivered to the top of the shear wall, along the plates. As the shear wall resists the load, one edge is put in tension, the other in compression. Anchors at the corners keep the wall from tumbling sideways.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Q We are refinishing a basement in a cold climate. The existing block foundation has no insulation, so we are proposing to build a 2x6 wall and insulate with fiberglass batts. Where should the poly vapor barrier be placed—behind the drywall or against the foundation?

A *Clayton DeKorne, editor of* JLC, *responds:* You shouldn't install any polyethylene at all. Moisture is likely coming from both the exterior and the interior, and it will condense on the poly no matter where it is placed.

I would also avoid using fiberglass insulation in a basement, as it will become a sopping mess if the basement ever floods (either from an exterior source of water, such as heavy rainfall, or an interior source, like a burst pipe or leaking water heater). Instead, consider insulating the inside of the foundation with rigid foam board or closed-cell spray foam and building an uninsulated 2x4 wall. You will likely save a little money using 2x4s and will have an open cavity for any wiring or plumbing that runs in the walls.

The amount of insulation is critical and depends on the climate zone. For climate zones 5 to 8, you need at least R-15, such as 3 inches of extruded polystyrene (XPS) or a little more than 2 inches of closed-cell foam. This R-value is consistent with the 2012 through 2021 versions of the International Residential Code.

Code does allow you to install R-19 cavity insulation in a basement wall without any continuous insulation, but I think it's a mistake to add cavity insulation alone without some condensation control. You need to keep condensation from forming on a cool wall surface by keeping that surface warm (above the dew point temperature), and I know of no other material better suited for this than plastic insulation. Rigid and closed-cell foam are Class 1 vapor retarders and provide insulating value, making them ideal choices at the correct thicknesses. This is one place where the extra cost returns value—by the reducing risk of a mold lawsuit.

I do recognize that foam insulation of any type is more expensive than fiberglass and this creates an incentive to use less foam by filling the cavity wall with batt insulation. You can do this, but you need to be careful to use enough foam. Something like fan-fold foam will not do it. You need enough insulating value to keep the surfaces sufficiently warm to prevent them from becoming condensing surfaces.

The safe answer in climate zone 5 is to use at least R-5 continuous insulation (for example, 1-inch XPS) with a 2x4 wall filled with R-13 batt insulation. In climate zone 6, you should bump up to R-7.5 (for example, 1 1/2 inches of XPS) with R-13 in a 2x4 wall. Table 702.7.1 in Chapter 7 of the IRC provides better guidance on this than the insulation requirements of Chapter 11. Condensation control requires the right proportion of air-permeable cavity insulation to air-impermeable "ci" (continuous insulation), and because basements tend to be moist places, I think the 2021 IRC errs in its basement insulation requirements. That version, for the first time, provides split cavity-insulation and ci values; for all cold climate zones, 5 to 8, it requires 13+5. But in climates zones 6 to 8, 13+5 is risky, especially for the above-grade portions of a basement wall. If you are thinking to go above code on the insulation of a finished basement by installing a 2x6 interior wall with R-19 cavity insulation, follow Chapter 7. Namely, add more air-impermeable continuous insulation—R-7.5 in climate zone 5 or R-11.25 (3 inches of XPS, in practical terms) in climate zone 6. This added R-value for the foam layer is keeping that surface above the dew point so you don't have liquid water forming in the wall.

With any old foundation wall that has not been at least damp-proofed on the outside, it's a good idea to install a waterproof coating, such as Sto Watertight Coat (stocorp.com) or Drylok Masonry Waterproofer (drylok.com) before installing the foam. This provides more robust vapor control. But such a coating, while called "waterproofing," will not be a total solution if the site is not well graded and you have roof runoff draining into the basement or have high water tables—conditions that show visible signs of periodic wetting on the basement walls and slab. If any of these conditions are present, you need to do more than just coat the walls; you should also install an interior drainage system that includes a perforated drain pipe buried in gravel along the basement perimeter. The pipe must drain outside to daylight or to a sump pump. For more on this fix, see "Foolproof Cure for Wet Basements," Dec/05.


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Fitting New Stairs Into a Tight Space

BY ROB CORBO

Clients in Hoboken, N.J., contacted me last year and requested assistance in creating a new floor plan for their home that was more elderly friendly. The home was originally constructed in 1910 as a two-family with each unit comprising two floors: One unit occupied the basement and the first floor, while the second unit occupied the second and third floors. A renovation decades ago connected the first floor to the upper two floors and created a separate basement apartment. Since then, the homeowners had lived on the upper three floors, while they rented out the basement apartment.

The clients wanted to return to the original layout of two residences, each with two floors. To avoid the stair climb to the second and third floors, they would move into the lower residence, and, in time, their daughter and her family would occupy the upper one. To make the lower apartment elderly friendly, they wanted to install a new stairway and elevator from the first floor to the basement as part of the overall renovation.

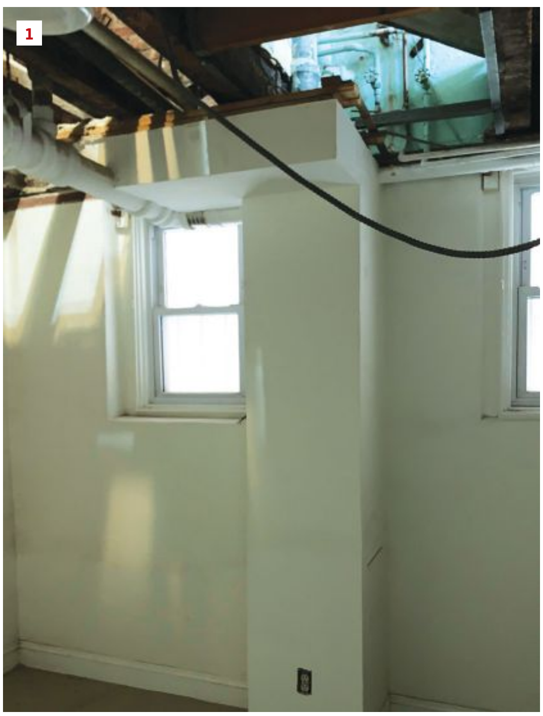
Jerry Schubert, a local architect, was contracted to provide a set of drawings for the renovation. He worked with the client to determine the best location for the stairway and elevator. It was decided that we would frame for the elevator, but the elevator unit would be installed later. Until then, the first-floor portion of the elevator shaft would serve as a closet. Plans were approved by zoning and building, and we pulled permits and got to work.

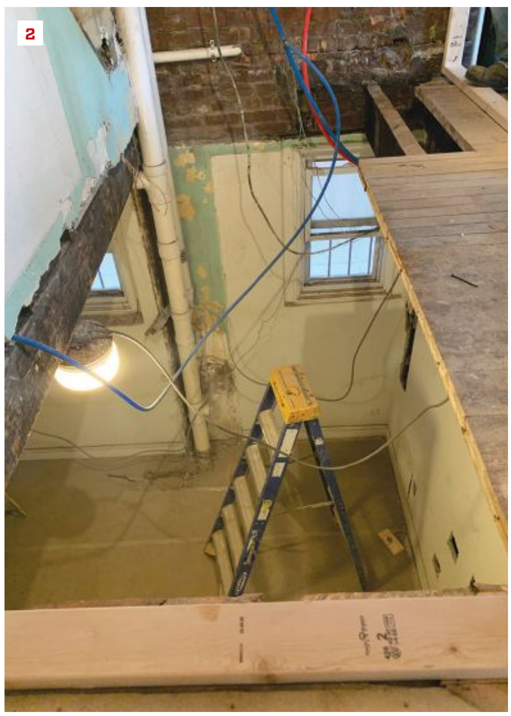
When we lifted the subfloor, we found the original stairway joist framing, or a portion of it, that connected the basement and the first floor. From the opening that we discovered, we could not determine the original design or stair run, at least not one that would meet today's codes. However, we did determine that we would be able to incorporate the original framing into the new winder staircase framing specified in the plans.

The photos and captions that follow explain the steps we went through to fit a safe and legal winder stair into the space.

Rob Corbo is a building contractor based in Elizabeth, N.J., specializing in high-quality gut rehabs and renovations of inner-city residences.

Photos by Rob Corbo





At the outset of the job, the crew began demolition around a plumbing chase, where waste, water, and heat piping would have to be rerouted around the new stair opening **(1)**. As the subfloor was removed, the crew discovered a box-out in the floor from the original straight run of stairs. To make a legal stair, however, they would have to widen and lengthen the floor opening, as well as turn the corner to create an L-shaped opening for a winder **(2)**.


3


4

With the new stair opening defined, the exterior wall was furred out to accommodate the water and heating service lines. This required burying an existing basement window that faced a narrow alley **(3)**. The first step in building the rough carriage was to frame the landing, which would become the first winder **(4)**.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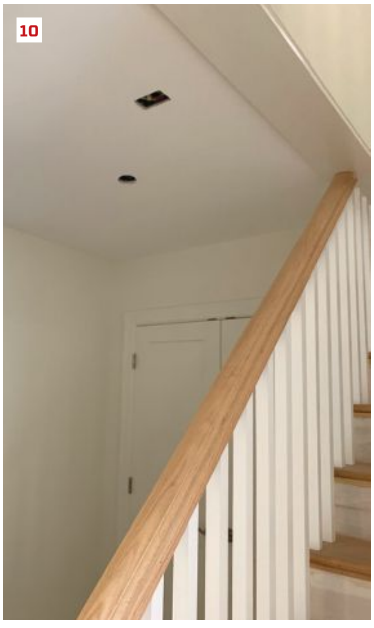
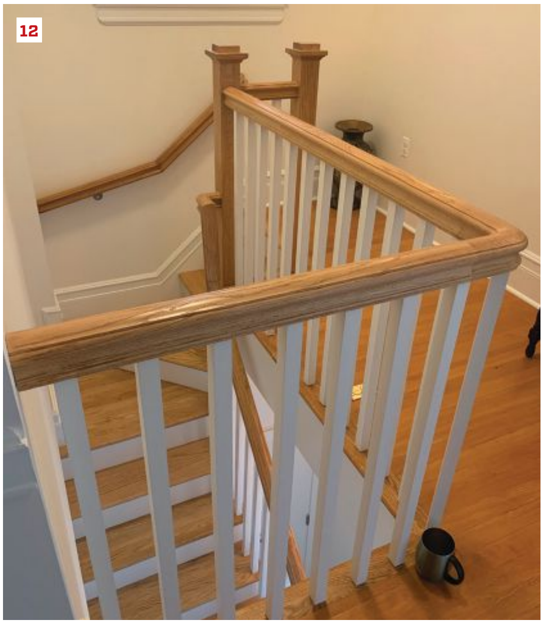
6


7

One of the code challenges with the stair was to create a continuous handrail on the right-hand side of the stairway as you walk up. JP, a carpenter with Passaic Stairs, worked out the distance the lower run of stairs needed to be offset to accommodate the handrail **(5)**, which needed room to gooseneck up to a let-in newel at the stairwell's corner and connect at this newel to the short rail for the top three steps; that rail then tied into the top newel post on the second-floor guard (see photos, facing page). As the lower flight of stairs was installed, the offset was obvious **(6)**. The rail for the left-hand side of the stairs would die into the lower ceiling. To meet headroom requirements, this offset had to be less than 4 3/4 inches (measured from the handrail to the outside corner of the floor opening). To complete the landing, JP notched the first newel **(7)**—a complex notch that picks up the landing on the bottom, as well as the corner of the floor opening at midheight—which rises to the same height as the top newel.

The stair structure ties in with closets at left and right **(8)**—essential to the client's demands. Here, you can see from above the two winder treads **(9)**—the lower one is the landing, with the second winder tread on top of it. By code, the smallest dimension of a winder tread must be 6 inches at the handrail line (with a newel or balusters acting as a guard to keep someone from stepping on a tread area less than this) and 10 inches at the walk line 12 inches away.





The minimum 4 3/4-inch headroom requirement is met where the left handrail intersects the ceiling **(10)**. Headroom between the ceiling at the edge of the floor opening and the stair directly below is also adequate **(11)**; this height must be at least 6 feet 8 inches. The finish stair from the second floor **(12)** shows the continuity of the handrail. Code allows the handrail to be interrupted at a newel for winders, as it is here, where the newel rises to the upper-floor guardrail height.

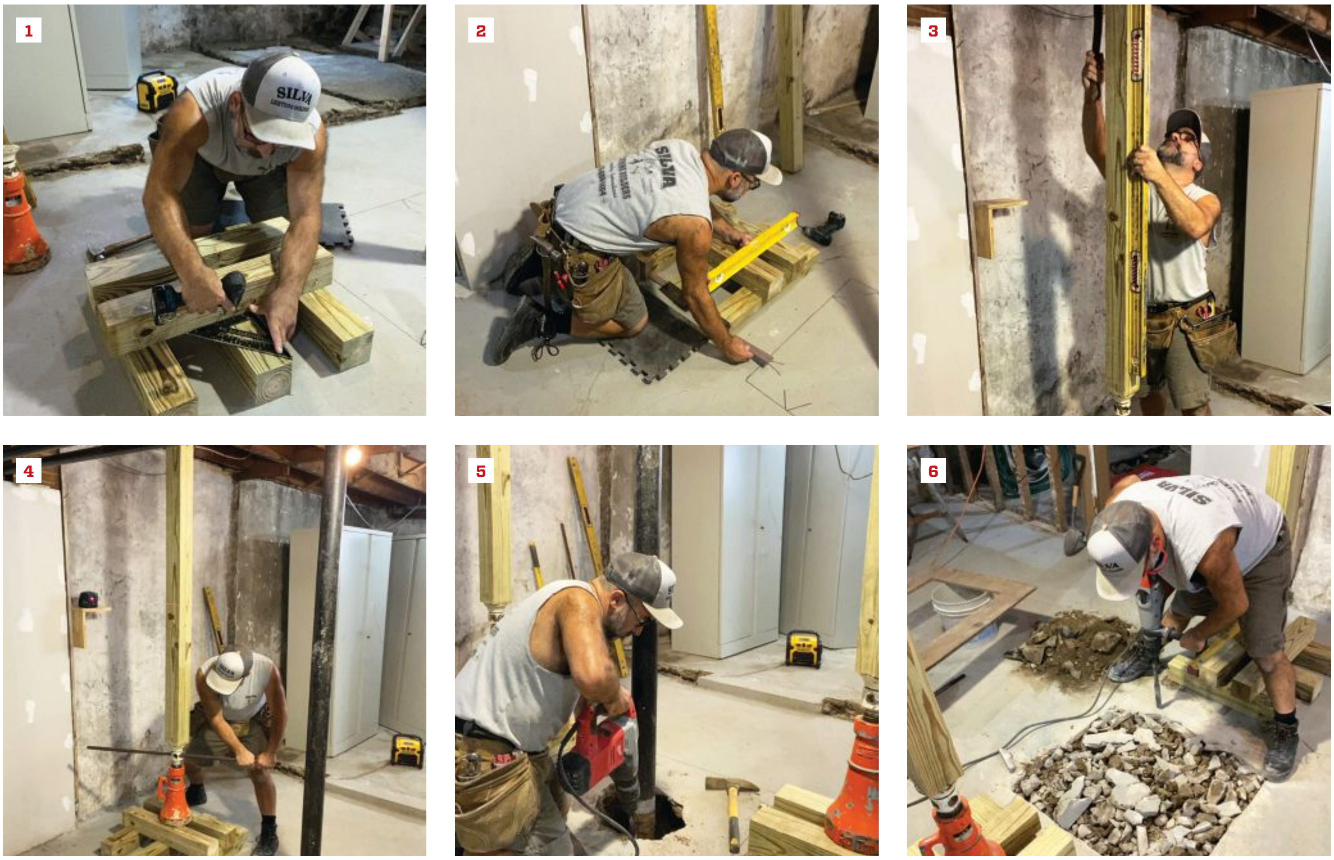
Pinning Column Footings to Broken Ledge

BY EMANUEL SILVA

More than a few of my jobs have been for clients who contacted me after reading one of my *JLC* articles. That was the case for this project, which involved replacing four structural support columns in the basement of a three-story house built in 1895. My client, who had just purchased the house, was concerned about cracks in the basement's concrete slab floor that were radiating out from each column, as well as about some dips in the flooring at the first-floor level and a few binding pocket doors. The scope of work included additional columns as needed to address these issues.

Other contractors had looked at the job but declined to take it on; I'd done similar work before (see "Shoring a Sagging Floor," Mar/12), so I knew what to expect. Still, this was one of my most challenging basement projects, with a concrete floor consisting of two slabs poured at separate times, one on top of the other, over a subbase of broken-up ledge. The bases of the four steel columns were bearing on the stone substrate and buried beneath the two slabs, so the concrete needed to be broken up just to remove the embedded columns.

I started by assembling cribbing from 8-foot-long 4x4 pressure-treated posts cut into 2-foot sections. Solid support is needed for the 20-ton screw jacks that I use to lift floor framing enough to remove a support post **(1)**, and because basement slab floors are rarely level or smooth, I always shim the assembled cribbing carefully **(2)**. Then, while jacking up the temporary 4x4 supports, I check them frequently for plumb in both directions **(3)**. The cribbing at each



Cribbing assembled from 4x4 posts **(1)** and shimmed level either with composite shims (where the gap was less than 1/2 inch) **(2)** or with sawn stock supported the author's 20-ton screw jacks during the project **(3, 4)**. The bases of the existing columns were buried under the basement slab, which had to be chipped away prior to removal of the columns **(5)**. Focusing on one column at a time, the author then used a rotary hammer to enlarge the openings in the slab for new footings **(6)**.

Photos by Emanuel Silva

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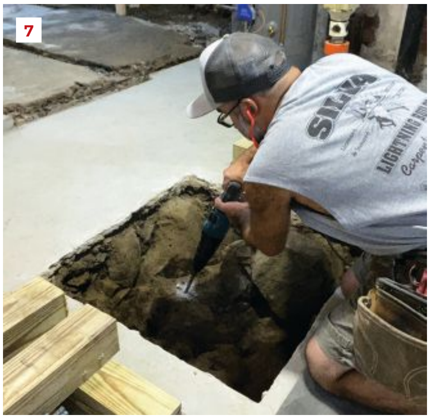

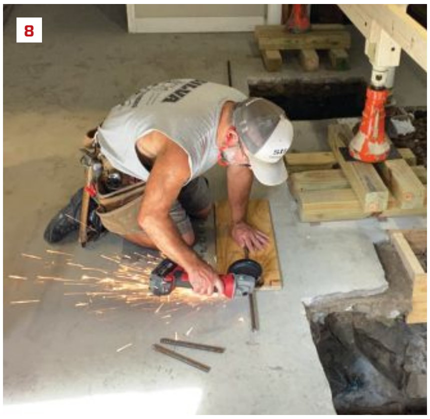

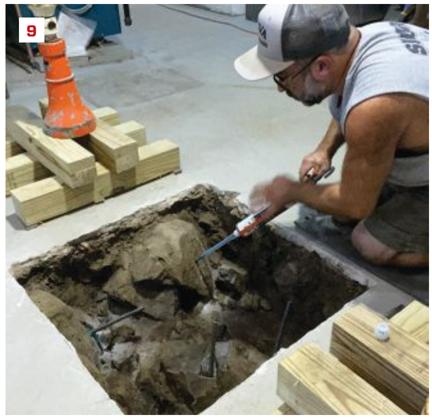

The author drilled holes in the large rocks remaining embedded beneath the slab **(7)** for 1/2-inch rebar dowels **(8)** and epoxy adhesive **(9)** to pin the new footings to the subbase. To form raised piers, he carefully cut 10-inch-diameter tube forms into 6-inch lengths **(10)** prior to mixing up bags of concrete and filling the holes **(11)**. Only one of the footing holes was rock-free; here, the author reinforced the concrete footing with a rebar grid placed about a third of the depth of the hole **(12)**.

location would be in place for about a week, during which time a lot of weight would bear on the assembly. With plumbing, waste lines, and gas supplies at stake, a major shift in the position of the building could be catastrophic, so I worked slowly and carefully to make sure everything was solid, flat, level, and plumb as I proceeded.

I space a pair of temporary supports about 4 feet apart when I'm removing a column and typically jack up existing framing no more than 1/4 inch—just enough to take the weight off the column. To make sure that the temporary supports don't shift positions relative to each other, I set up a laser level in a convenient location, mark a reference elevation on each support post, and check the marks periodically **(4)**.

After breaking away enough of the slab with a rotary hammer to remove the old column **(5)**, I enlarged the opening in the slab to 30 inches square **(6)**. Then the hard part began: removing enough of the underlying soil and broken ledge to provide solid bearing for a new concrete footing. In some cases, the rocks were large enough and extended far enough underneath the slab that attempting to remove them would have caused the edge of the slab to collapse. So, for each of the nine new footings that were needed to replace the four original ones, I had to make a careful judgment about what material could be removed and what could remain.

I loosened rocks and dirt with a small shovel and grub hoe, then switched to a flat bar and my hands to remove as much as I could from each hole. But the key to clearing the holes was a wet/dry vac fitted with a 2-inch-diameter hose, which quickly sucked up loose dirt and small stones as long as the soil wasn't too damp.

Normally, I reinforce footings with a grid of #4 rebar **(12)**, but for eight out of the nine new footings, I instead drilled a series of 5/8-inch-diameter holes at least 4 inches deep into the larger rocks **(7)**. Then I squirted epoxy adhesive into the holes and filled them with 8-inch lengths of rebar **(8, 9)** to tie the new concrete footings to the subbase.

To raise the base of each new column above the level of the existing slab, I used short lengths of 10-inch-diameter tube footing


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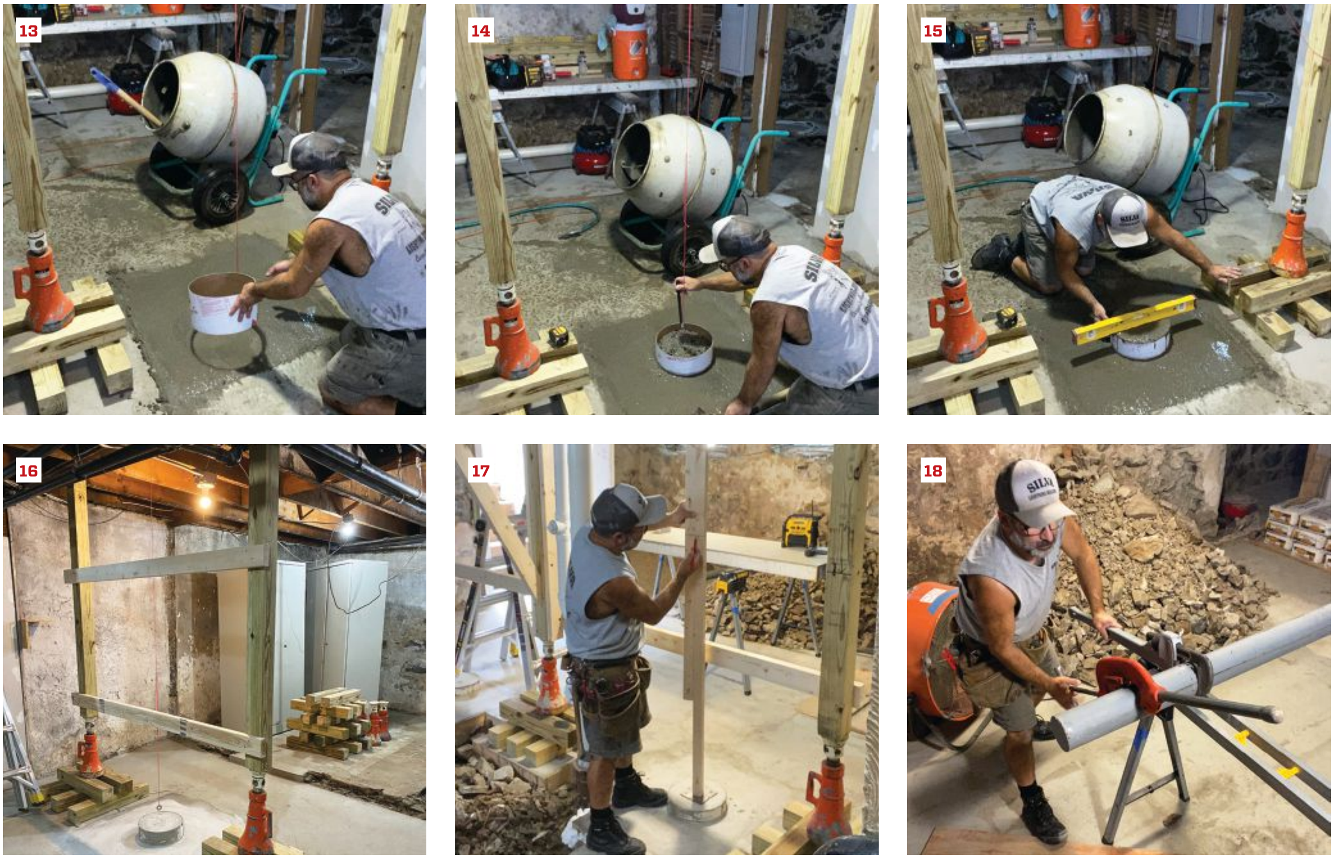

The author inserts a cardboard tube footing form into the wet concrete **(13)**, centering it with a weighted string fastened to the beam above **(14)**. After filling the form with concrete, inserting rebar, and leveling the form **(15)**, he screeded and troweled the top of the pier smooth **(16)**. A pair of overlapping 2x4s **(17)** were used to get an accurate length for cutting the new column to fit **(18)**.

forms to create monolithic footings and piers. I used a length of aluminum flashing to mark the cut line for each 6-inch-long section, then slowly scored my mark with a sharp utility knife so that the tops of the cardboard forms would have a clean edge, making it easier to screed the tops of the piers smooth **(10)**.

For each 30-inch-square-by-12-inch-deep footing, I had estimated about 15 80-pound bags of concrete (though I used less because of the irregular stone remaining in most of the holes), which I mixed up one bag at a time **(11)**. After filling a hole, tamping it with a shovel to remove air bubbles, and screeding the new concrete flush with the old slab, I embedded a 6-inch-long footing form about 3 inches into the wet concrete to create a raised pier **(13)**. To make sure the piers were centered underneath the column locations, I hung a washer tied to a string from a screw driven into the framing. I filled the form with concrete, then inserted additional short lengths of rebar into the pier **(14)** before leveling it and screeding the top smooth **(15)**.

I typically wait about a week for new concrete to cure before placing any weight on it. In the meantime, I screwed a couple of braces to the temporary support posts and moved on to the next column location on this project **(16)**.

To find a precise measurement for the length of the new columns, I used a couple of shorter lengths of 2x4 to make an adjustable story pole **(17)**, positioned the column base on the footing, and screwed the Springfield plate column cap to the beam. By resting the bottom of one 2x4 on the dimpled plate column base, pushing the other 2x4 up tight against the column cap, and marking a reference line across both 2x4s, I could then transfer the exact length to the column.

On this project, I installed 4-inch-diameter Lally columns (which are considerably stronger than typical 3 1/2-inch-diameter columns), using a large aluminum pipe wrench to hold them in place while I cut them to length **(18)**. I ended up installing nine new columns: four to replace the original ones and the rest to provide additional support for the floor framing.

Emanuel Silva, a frequent contributor to JLC*, owns Silva Lightning Builders in North Andover, Mass.*

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BY JAKE BRUTON

Choosing a Client

It took years of being in business for me to realize I didn't need to win every project that came through the door. It took a couple more years to realize I didn't *want* every project that came through the door. And not to push it too far, but it took even longer to realize that I had the power to choose. When your business is new or the market is slow, choosing your clients may not be an option. However, if you can build your business to the point that you can say no (and I don't mean bid yourself out of a job to avoid conflict, but to really say no), then you will position yourself for even greater success.

CLIENT CRITERIA

Let's start by thinking about past projects for a minute. Have you done any projects on which you lost money? I have—more than I would like to admit—and I wish I had said no when those projects came through the door. I once heard someone say, "I wish I had given those people $500 to go away the first time we talked. I would have lost less money." When I think about the jobs on which I lost money, that certainly rings true. So how do we make that choice? What are the criteria by which I decide to turn potential clients into clients or turn them away?

How to determine those criteria was not the exercise I thought it would be. I first thought, well, can I make money on this? Do the clients seem nice? If so, then we would pursue. While those criteria are still roughly true, they were too general for any real process of elimination, and it took some time to develop a workable list. Then we put our process in writing so all decision makers are on the same page when deciding what job is right for our firm and what job is not.

FIRST RULE: DON'T MAKE ENEMIES

While the goal is to qualify or disqualify clients based on a set of criteria, it is important to avoid making enemies during the process. Figuring out that a client isn't a good fit may be easier than letting them know that. So, the selection process must be approached with a delicate touch. I try to be straightforward while being extremely polite. When I decide a potential client isn't a good fit, I thank them for their time before explaining that my firm will need to pass on their project. Each client is different and the more times you say no, the easier it will be to feel a client out and express your regret in a way that doesn't prompt them to post a bad review somewhere.

When a potential client calls or emails, the first step is to have a phone call to discuss the project prior to investing time in traveling to the jobsite or potential client meetings. Our goal is to not waste anyone's time, ours or the client's. So, we have a simple phone conversation that eliminates three-quarters of all inquiries from our system. When we started doing this, it seemed cold and we were worried it would offend people, but the opposite was true. Potential clients are happy to discuss their project on the phone for 10 minutes and are almost never offended when they are informed that they simply are not a good fit for our firm.

OUR CRITERIA

Here's the list of criteria we now use when deciding whether to take a job, ranked in order of importance for our company.

1. Project cost. We set a threshold value on the cost of the job. For our company, that's around $20,000; we cannot mobilize for smaller projects and provide a value to the clients while remaining profitable. Sometimes there are projects under that price point on which we could be profitable. However, the margins are smaller, so we would be taking a risk. It's better to avoid those jobs to ensure we can make money.

2. Location. We generally do not even consider projects more than 25 minutes from our office. In our case, that 25-minute mark is the time at which we have agreed to start paying our employees for drive time. Accepting a job 30 minutes from the office means that we will automatically raise the budget of the project and reduce our productivity because we are paying crew members for nonproductive windshield time. This makes the job less likely to succeed.

The other reason for the 25-minute rule is that we start to lose subcontractor and supplier options at that mileage. We don't want to build a new team for each project. The last 12 years have been spent on building relationships with subs on which we know we can rely to help us succeed, and those are the people we want to work with.

3. Budget. It might seem like a bad idea to pester a client in the first call about their budget, but it isn't. Phrasing is everything. Before asking about the budget, though, ask about the scope of work (SOW). A client could say they have $40,000 for a bathroom remodel, and you might think that sounds reasonable compared with recent projects. However, if you first asked about SOW and the client replied that they have a 2,000-square-foot bathroom in a 20,000-square-foot house and they want to spend only $40,000 to completely renovate and relocate items inside the bathroom, then you would know that $40,000 was not realistic. Don't dive too deep in the SOW conversation; listen for keywords. For instance, if clients say "tile shower" instead of "shower," they probably mean something closer to a $5,000 tile enclosure than a $400 acrylic unit.

We have generated a set of questions to ask for each type of project. On a new home, the first question is, "Do you own the property yet?" If the client has not chosen a property, then we cannot qualify it will be in our service area and cannot make any assumptions about site fees. Land in the city limits has access to city utilities that are going to be substantially less expensive than the options outside of an organized municipality. These are key ingredients to an "off the cuff" budget assessment that lead to further conversation or an immediate no.

> If you can build your business to the point that you can say no (and I don't mean bid yourself out of a job to avoid conflict, but to really say no), then you will position yourself for even greater success.

No single item will decide whether the budget and SOW are acceptable. However, some large items can be telling. For example, our market runs between $230 to $350 per square foot for most custom homes for the build and utilities, not including land. I ask prospects about their square-footage requirements with a few follow-up questions about finishes and energy goals to decide if they have a budget worth our time. If a client says, "I want 6,000 square feet and marble floors and I have $400,000," I know to pass on the project. When the numbers are close to something we can achieve, I can say, "This seems like it would be a very tight budget, but if you are willing to be flexible about size and finishes, I can potentially be a good fit for you," and follow with an appointment.

4. Client values. This item is one of my favorites. On the list of questions I ask in the exploratory phone call is "How will you judge the success of the project?" The answers I've received are amazing. Some of the better answers are "We are looking to build a comfortable home" or "We want something to pass along to our children." Sometimes the response includes specific building standards by name, like Passive House. These are responses that suggest a client we can work with. What I don't want to hear is "This has been happening for a couple of years and it is time for us to do something about it"; or "If we can start in the next two weeks, you are our builder"; or my personal favorite, "I need this as cheap as possible. I could do it myself, but I don't have the time." All these answers are different and most have a meaningful subtext. If a client's values don't align with ours, then we most likely can't have a successful project with them. We are not in the business of tackling projects on which we are destined to fail. We want clients who value what we do.

5. Personality. Some builders may put personality higher on their list, but I don't have to be best friends with my clients; we simply have to get along. There have been very few clients in my career with whom I didn't get along. Very few. I am not offended by anything a client says or does, and I don't get frustrated easily. When someone has a complaint, I start by assuming it is legitimate and I am going to need to resolve something. That may turn out not to be the case, but if you start in a humble place, it is difficult to be angry when the complaint does turn out to be nothing.

6. Timeline. As with personality, this consideration may seem like it should be higher on the list. I would argue that if your sales process positions you as the best professional for a project, then timeline will become much less of a concern. I have had clients say, "We need this done by fall," but once we have met and they understand what we bring to the table, their request often—though admittedly, not always—changes to "When can you get us on the schedule?" Selling your expertise and product in an honest way educates your potential clients about the benefit of working with you. This creates flexibility in the timeline as well as other areas of their project because you are building trust. You will wait for a table at your favorite restaurant because you know the experience will be satisfactory. Convince your potential clients the experience will be worth the wait.

BE READY TO BREAK THE RULES

Be willing to break your own rules if it is the right thing for your business. This sounds contradictory, but we might work with a client whose project is 35 minutes from the office if they are a good fit for our firm in every other way, breaking at least one rule. Having guidelines in the first place is the important part. If you have a list that helps you understand what the "right" job is, then positioning yourself for success comes from applying that list. In the end, that is what we are working for—success.

Jake Bruton is the owner of Aarow Building in Columbia, Mo. Follow him at @jake.bruton on Instagram.

BY PETE FOWLER CONSTRUCTION

Building Investigation Basics

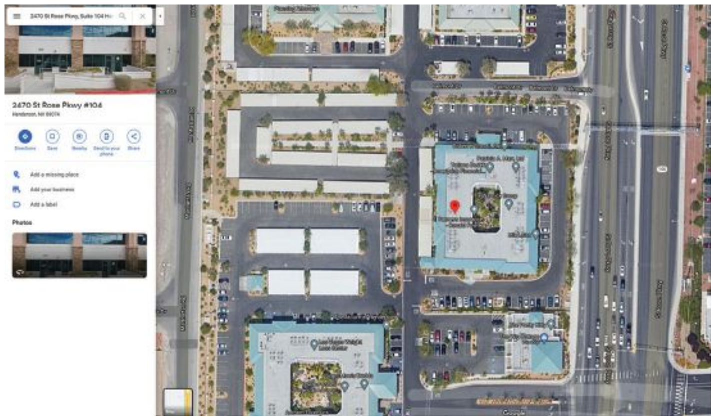
At Pete Fowler Construction, we work on hundreds of projects every year, and most of them have expensive problems. Our work includes single-family homes, skyscrapers, hospitals, factories, highways, and everything in between. In addition to being hired for our traditional services, which include inspection and testing as well as quality and construction management, we are hired to help clients understand the technical issues and costs of insurance claims and litigated matters related to buildings. We regularly testify as expert witnesses, so our work is scrutinized by lawyers who have an interest in making us look bad. What some people call an "inspection," we call an "investigation." Inspection is too passive for what we do; we proactively seek understanding and document this work in a forensic and professional way so it can be presented in a court of law.

THE OBJECTIVE

The following Investigation Checklist is designed to translate what we have learned from 25 years of experience helping building professionals (including architects, engineers, contractors, and property managers) as well as non-technical people (such as owners and tenants) conduct an effective investigation and document the observations in a systematic, usable way. If you are composing an RFP for maintenance or repairs, or you have an insurance claim, a catastrophic event (leak, storm damage, and such), a construction dispute, a landlord-tenant dispute, or any other need to document a building, this process can be used as your general investigation procedure.

The investigation documentation, which will include photos, notes, and diagrams, and maybe even material samples, should give an overall feel for the situation. Ideally, the documentation will tell a complete story that is easily understood by all, and upon which opinions can be based.

Naturally, no one article can address every situation that could be encountered. So, as in so many situations related to building problems, you'll have to stop, think, and apply judgment.



For each investigation, the author documents the project location using satellite and street views on Google Maps. These images can be useful communicating the issues and location for other parties involved in the project.

www.petefowler.com [redacted] [redacted]

Document Timeline

No.	Date	Event/Document	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Content
1	[redacted]	House built									House built.
2	[redacted]	[redacted] purchase home			X						[redacted] purchase home.
3	[redacted]	New roof installed			X						New roof installed.
4	[redacted]	Date of Loss		X						X	Date of Loss.
5	[redacted]	Water Intrusion			X						From [redacted] Deposition page 120. First noticed water in office, Master Bedroom, [redacted]'s Room adjacent to Master. No water seen in bath or hallway where floors are tile and wood.
6	[redacted]	Emergency Response			X						[redacted] invoice in the amount $[redacted] 7 days of drying in an unspecified area(s) although it appears for drying surfaces in the detached office.
7	[redacted]	Inspection/Estimate		X							Estimate total $[redacted] Work in "Bedroom" (reference from estimate) only. Clean carpet only. Estimate by [redacted]
8	[redacted]	Inspection/Estimate		X							Estimate total $[redacted]. Work in "Bedroom, Back Bedroom, Child's Room and Other structure" (reference from estimate) only. Estimate by [redacted].
9	[redacted]	Water Intrusion			X						From [redacted] Deposition page 19. First noticed water intrusion.
10	[redacted]	Drainage repairs			X						Waterproofing foundation and drainage installed. ([redacted] depo) .
11	[redacted]	Mold sampling							X		Mold sampling conducted.
12	[redacted]	Mold report							X		Mold report and test results.
13	[redacted]	Date of Loss			X						Date of Loss.
14	[redacted]	Estimate		X							[redacted] estimate in the sum of $[redacted]
15	[redacted]	Estimate		X							[redacted] estimate in the sum of $[redacted]
16	[redacted]	Estimate		X							[redacted] estimate in the sum of $[redacted]
17	[redacted]	Estimate for mold remediation						X			Estimate for mold remediation $[redacted] (guest room (office), guest bath, garage, [redacted] bedroom, MB, hall bath, [redacted] bedroom and hall).
18	[redacted]	Post Mold Remediation Sampling							X		Post Mold Remediation Sampling.
19	[redacted]	Post Mold Remediation report							X		Post Mold Remediation Confirmation Sampling by [redacted]
20	[redacted]	Inspection		X	X		X			X	Attended by [redacted]
21	[redacted]	Estimate						X			Service master estimate for [redacted]
22	[redacted]	Investigation Report					X				Roof inspection. Incomplete [redacted]
23	[redacted]	Initial meeting			X						[redacted] initial meeting with [redacted]
24	[redacted]	Estimate		X							Estimate total $[redacted] Work in "Bedroom, Master Bedroom, [redacted] Room, Other Structure, Living Room and Bathroom" (reference from estimate). Expanded scope with revisions listed below original scope in estimate. [redacted]
25	[redacted]	[redacted] first visit				X					[redacted] first visit and took photographs. [redacted]

[redacted] SE Timeline [redacted]

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Page 1 of 2

This "timeline" from the author's investigation of repairs on a single-family home with water intrusion damage identifies the people involved (not visible, because the column heads have been redacted) at each of the projects.

THE INVESTIGATION CHECKLIST

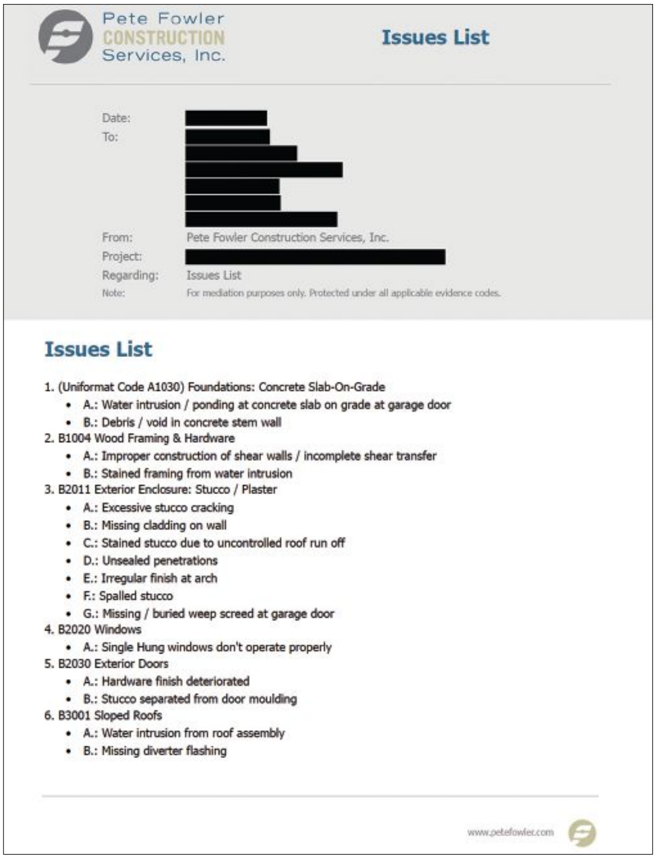
This checklist is divided into three parts—before the project begins, during the project, and after the project has been completed.

BEFORE

- ☐ Choose a device to take good quality photos; usually a smartphone, but a digital or even film camera will work just as well.
- ☐ Find a way to store and send the photos that memorializes the investigation and preserves the quality of the photos; that is, don't email them in a small file size. Consider Dropbox, Google Drive, or a similar service.
- ☐ Gather paper, a pen, and colored pens or markers.
- ☐ Have a tape measure and a small measuring device, like a pointer or gauge.
- ☐ Collect construction drawings, if available, to mark up during inspection to show where an issue is located.
- ☐ Assemble other graphic aids like site plans, floor plans, building elevations, or documents like brochures from the time of sale, an appraisal report, etc. to mark up during the investigation.
- ☐ Collect and use images from tools like Google Maps and Google Earth. If possible, print these and mark locations on them. For example: If the problem is with the roof, driveway, or something in the backyard, an aerial image from Google or Bing with an indication of where the investigation is taking place can be an amazing aid in helping others understand the situation (see examples, previous page).
- ☐ Collect the information necessary to make a list of people involved along with a timeline or a list describing the service history (see example at left). Or collect the information so someone else can create these lists.
- ☐ Prepare an "issues list" (this includes problems, complaints, damages, etc.) and print for use during your investigation to guide your photographs and documentation. Be sure to organize this information in a sensible manner for later review (see example, facing page).
- ☐ Establish a pattern for how the building will be inspected. When photos and notes are taken, they should follow a logical pattern that someone other than the inspector can understand. For example: front yard and elevation, the right side of the house, back of the house, the left side of the house, etc. and then move to the interior. Begin with the foyer and move in a counterclockwise direction throughout the house.
- ☐ Consider creating a list of rooms. List the rooms in the order you will be investigating them.

DURING

- ☐ Begin your investigation notes by writing your name, the date, street address, city, state, and any other basic information on paper and take a photo of this piece of paper. Make this the first photo of your investigation. If multiple units are being inspected, make sheets for each unit and take a photo of each sheet at the beginning of each unit's investigation.
- ☐ At the beginning, perform an initial walk-through of the property without taking any photos.
- ☐ Update your "issues list" with any additional problems you notice.
- ☐ Interview anyone who knows about the situation being documented and take detailed notes including their name, contact information, and a chronological list of important information discussed during the interview. Don't rely on your memory. Write everything down.
- ☐ After your walk-through, take photos of the building's exterior and surrounding area. Within the first few photos, it should be perfectly clear whether it is out in the country, in the city, or somewhere in between.
- ☐ Take an overall photo, a semi-detailed photo, and a detailed photo of each issue (in general, at least three photos per issue). If some areas don't have issues, take one or two general


Pete Fowler CONSTRUCTION Services, Inc.

Issues List

Date: [redacted]
To: [redacted]
From: Pete Fowler Construction Services, Inc.
Project: [redacted]
Regarding: Issues List
Note: For mediation purposes only. Protected under all applicable evidence codes.

Issues List

1. (Uniformat Code A1030) Foundations: Concrete Slab-On-Grade
   - A.: Water intrusion / ponding at concrete slab on grade at garage door
   - B.: Debris / void in concrete stem wall
2. B1004 Wood Framing & Hardware
   - A.: Improper construction of shear walls / incomplete shear transfer
   - B.: Stained framing from water intrusion
3. B2011 Exterior Enclosure: Stucco / Plaster
   - A.: Excessive stucco cracking
   - B.: Missing cladding on wall
   - C.: Stained stucco due to uncontrolled roof run off
   - D.: Unsealed penetrations
   - E.: Irregular finish at arch
   - F.: Spalled stucco
   - G.: Missing / buried weep screed at garage door
4. B2020 Windows
   - A.: Single Hung windows don't operate properly
5. B2030 Exterior Doors
   - A.: Hardware finish deteriorated
   - B.: Stucco separated from door moulding
6. B3001 Sloped Roofs
   - A.: Water intrusion from roof assembly
   - B.: Missing diverter flashing

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An "issues list," such as this example used on the repair of a condominium with roofing, stucco, and concrete problems, serves as a guide for the investigation team to gather photos and documents on each item.

orientation photos of those as well.

- ☐ Include a measuring tape or gauge in photos to give an idea of the size of the issues being documented.
- ☐ Take as many photos as necessary to clearly document the building and issues.
- ☐ Photos should follow a sequence:
  - ☐ Site address and general area.
  - ☐ Issue-specific photos (overall, semi-detailed, detailed).
  - ☐ Photos of notes, sketches, or marked-up drawings.
- ☐ Take notes for every area being investigated. Sometimes the issue is better explained by the notes than the picture. Note dimensions and measurements when necessary or helpful.
- ☐ Draw sketches and diagrams even if you're bad at it. A picture is worth 1,000 words, and a diagram or sketch can be worth 1,000 pictures. Include dimensions of what's being diagrammed.
- ☐ Make marks on any visual aids that were collected before the inspection (like Google Maps images) to identify where issues are occurring. Use colored pens or markers to make notes and markups easy to see.
- ☐ Put a page number, date, and the inspector's name on every page, sketch, and diagram.
- ☐ Inspect like you're the only investigator who will ever have access to the property. If you don't document an issue, it will be hard to prove to someone who wasn't there. Photos may not explain the whole issue, so write notes that will explain the photos.
- ☐ At the end, update your "issues list" again to make sure it includes 100% of the problems.
- ☐ Go through the "issues list" and use it as a checklist to make 100% sure you didn't miss anything that needs documenting.

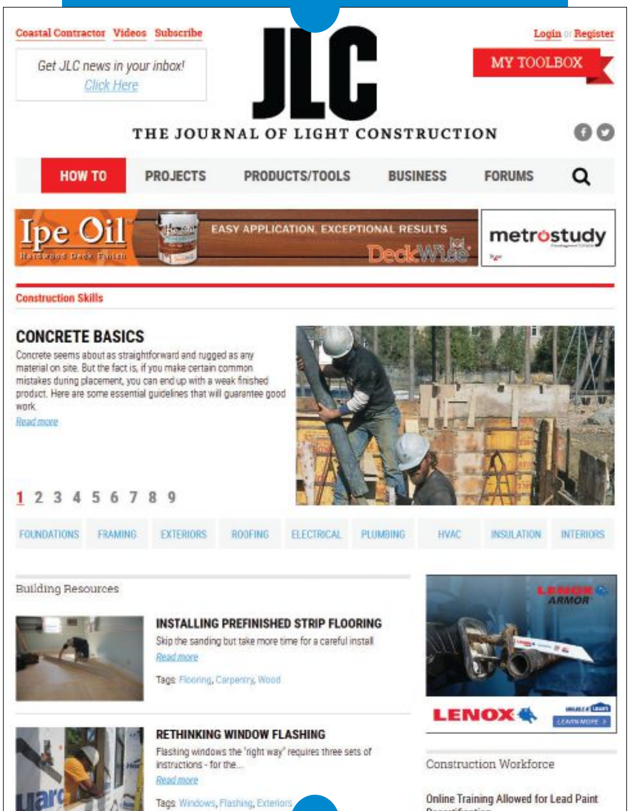
AFTER

- ☐ Take a photo of each page of inspection notes, sketches, diagrams, and marked-up visual aids.
- ☐ Once the inspection is complete, organize and number the photos, notes, sketches, and diagrams in a sensible manner. Make sure photos are oriented properly.
- ☐ Suggested organizational scheme:
  - ☐ Photo of paper with your name, date, street address, city, state, and any other basic information.
  - ☐ General area photos (neighborhood, site, yard, outside of building).
  - ☐ Photos of issues (from general to detailed for each respective issue).
  - ☐ Photos of notes, diagrams, and sketches.
- ☐ Download the photographs from the camera or smart device into a program like Dropbox or Google Drive and number them in the order that they were taken.
- ☐ Write a brief summary of what is happening with the building. Keep this as fact oriented as possible. It could be as simple as a bullet list of what was observed during the inspection.
- ☐ Update the original "issues list" to make sure it includes everything you discovered during the inspection.

If you follow these steps, you will greatly increase your chances of doing a great building investigation. Some of the graphic examples included with this article are from a project that went to trial—and we won! When collecting your examples, keep in mind that other people should be able to understand what is going on from the photos, notes, and diagrams without having to physically visit the property. Too few photos won't tell the whole story; too many photos will make it hard to identify what the real issues are. Preparation and organization are critical. The better you understand what is going on and the more prepared you are to communicate the issues, the easier it will be for others to understand your investigation data.

Pete Fowler is president of Pete Fowler Construction Services, which provides building inspection and testing, estimating, quality assurance, and construction management, as well as claims and litigation support, for construction professionals throughout the U.S.

JLC



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Zonda Media

Photos by Gary Striegler

Rethinking the Pantry

Practical upgrades include customized shelving and cabinets, work surfaces, and matching finishes

BY GARY STRIEGLER

These days, most of the kitchens that we build feature an open floor plan, with few, if any, walls separating the kitchen from the home's living space. Clients say that everyone ends up in the kitchen anyway, so why not make it a part of the living area? There's logic to this argument, but on the other hand, the absence of walls means that the kitchen will have fewer upper cabinets for storage, and any clutter in the kitchen that can't be hidden behind a door will always be in plain view.

The practical solution for most of my clients is an upgraded pantry. Traditionally, pantries have been small back rooms with utilitarian shelves for bulk storage of food and maybe a place to store a mop and a broom. But now, I like to think of the pantry as an extension of the kitchen, with work surfaces and better storage options, along with cabinetry and finishes to match. It's an easy upgrade to sell, even for homes without an open floor plan; 85% of home buyers consider a kitchen pantry "essential" or "desirable," the National Association of Home Builders reports.

When a client wants pantry cabinetry with doors and drawers, the author assembles poplar face frames with pocket screws **(1)**. Utilitarian drawer boxes are built with plywood and glued and nailed together **(2)**. Shelving and shelf supports are typically cut from MDF; to make the shelving adjustable, the author uses a Kreg shelf pin jig to drill holes in the supports for removable pins **(3)**. After the pantry shelves have been installed, the painting crew sprays them with primer and a finish coat **(4)**.

SHELVING AND CABINETS

Every pantry I build has at least one section of 24-inch-deep shelves that are 36 inches tall with a fixed countertop. I tell clients that this countertop is a great place to sit bags of groceries while stocking the shelves or to gather together the ingredients for a recipe or a meal. A popular upgrade is to add a stone top to match the countertops in the kitchen.

Food and supply storage is still the primary function of a pantry, with versatile storage a must. We build in adjustable full-height shelving in depths ranging from as narrow as 4 inches for single cans to 16 inches deep for bulky items like laundry detergent. We try to optimize the shelving layout to eliminate blind corners (where access to shelves on one wall is blocked by shelving on an adjacent wall) and maximize floor space.

Our pantry shelves and cabinets are always painted, so we typically build the shelving using MDF. Since we use MDF extensively for interior trim elsewhere in the house, we are able to use up offcuts and rippings to make shelving and supports and reduce waste. Where there isn't already a factory bullnose profile on our 3/4-inch-thick shelving stock, we apply it ourselves with a couple of passes of




Shallow shelves provide good visibility for cans and bottles **(5)**, while dishes, cookware, and other bulk items require deeper shelves **(6)**. To prevent sagging, limit shelf width to less than 30 inches **(7)**. A work surface is a key feature in a pantry **(8)**.




Convenience hardware can be fitted to pantry cabinetry to minimize clutter; examples include this mixer lift **(9)** and pull-out baskets **(10)**. Be sure that the pantry is fitted with plenty of counter-height receptacles for small appliances such as toaster ovens and microwaves **(11)**. Serious chefs will appreciate having a second oven—and storage for frequently used baking supplies—close at hand **(12)**.

a router fitted with a $3/8$-inch quarter-round bearing bit.

Once shelving gets to be longer than 30 inches, we either face the shelves with poplar nosings glued and pinned to the shelving or attach a cleat under the back edge of the shelf. Either method works to help prevent sagging, but cleats take less labor.

Oftentimes, clients want us to trim the shelf supports with face frames—which we also build out of poplar—to match the look of their kitchen cabinetry. For some clients, the pantry shelving is elevated to cabinetry with doors, drawers, and pull-out shelves, especially for base units. When we make these upgrades, though, we generally use more-utilitarian construction details than for our regular kitchen cabinetry. For example, most of our kitchens have undermount soft-close hardware and dovetail drawers; in a pantry, we nail the drawers together like plywood boxes and install them

13


14


15


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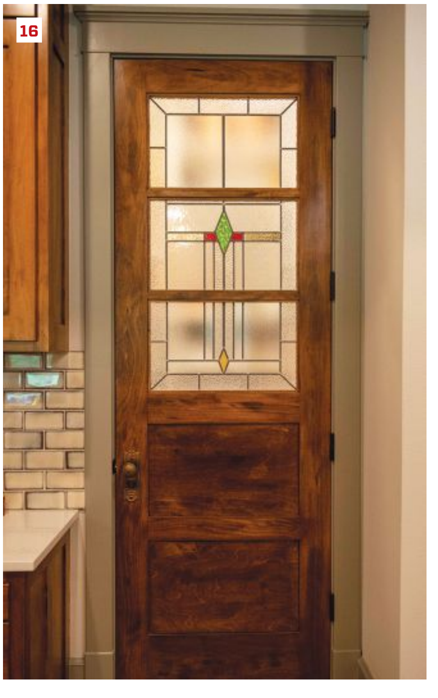


Shallow shelving for canned goods won't interfere with an in-swinging entry door into the pantry **(13)**. When space is tight, consider a pocket door **(14)** or a sliding door fitted with barn-door-style hardware **(15)**. A door fitted with decorative glass offers a stylish touch and a degree of illumination, while blocking views of pantry clutter when the door is closed **(16)**.

using side-mount full-extension slides.

We don't recommend doors on pantry cabinetry unless they are within the line of sight of the entry door into the pantry; otherwise, they get in the way. If we do install cabinet doors, we match those that we build for the kitchen but fit them with standard rather than more-expensive soft-close hinges.

APPLIANCES, ACCESSORIES, AND ACCESS

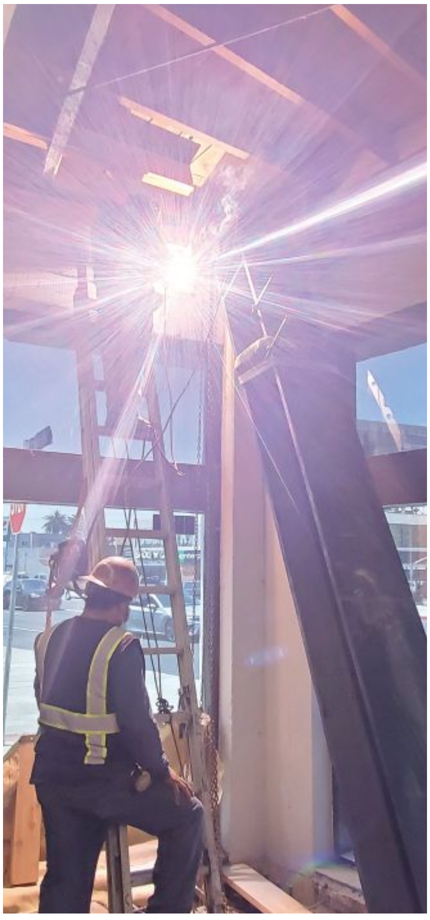
Many of our clients move small appliances like coffee makers or wine coolers into the pantry to get them out of sight. One client added a sink, simply to be able to fill their coffee pot and rinse it out afterward. With limited upper cabinet space in the main kitchen, sometimes clients decide to move their microwave into the pantry too. Another option is to simply add a second microwave in the pantry; once we even added a second oven there.

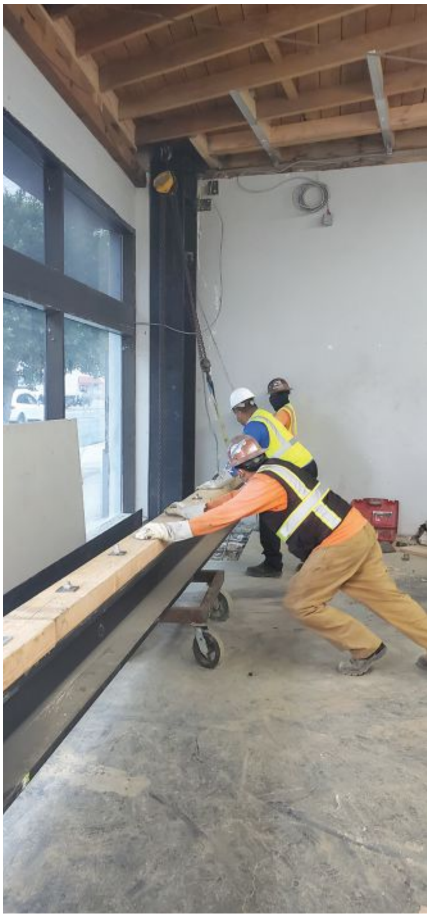
Convenience hardware such as pull-out trash bin slides and appliance lifts are popular base-cabinet upgrades for our clients. We typically use Rev-a-Shelf hardware (rev-a-shelf.com), because the quality is good and it's easy to point clients to the company's website for design ideas.

We also pay extra attention to the entry door into the pantry. Some clients opt for a pocket door so that no part of the pantry is blocked by an inswing door. Transoms (when there are tall ceilings) and custom glass in doors are also popular; we've custom-built several pantry doors fitted with decorative glass.

Lighting. In our jurisdiction, pantries are considered closet space and fall under those code requirements for receptacles, light fixtures, and heating and cooling. Still, we make it a point to provide illumination (most pantries don't have windows) and electrical outlets at countertop level. It's also a good idea to make sure there is adequate heating, cooling, and ventilation by adding a supply duct (a return typically isn't needed).

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





A Two-Phase Seismic Retrofit

Prepping a 1930s-era building for the next 'big one'

BY GERRET WIKOFF

Ah, Los Angeles: home of the Dodgers, the Lakers, and Hollywood. The City of Dreams has not only produced some amazing disaster movies over the years but has experienced numerous disasters off the screen as well. The city and surrounding counties have endured winter storms washing away beachfront houses and wildfires burning homes to cinders, along with mudslides, floods, and earthquakes, with the prospect of next "big one" looming in the back of many an Angeleno's mind.

The LA basin has witnessed many major temblors: the Long Beach quake (1933), the Sylmar quake (1971), and the Whitter (1987) and Northridge (1994) quakes, to name a few. According to the California Earthquake Authority (CEA), the last "big one," the Northridge earthquake and its spawn of aftershocks, caused an estimated $20 billion in damage—nearly $35 billion in today's dollars—to thousands of residential structures alone. I've been a licensed building and remodeling contractor in LA since 1980 and have lived through the Sylmar, Whitter, and Northridge quakes. I spent the better part of a year repairing earthquake-damaged homes, their knocked-down chimneys facing due south as a result of Northridge's violent northward thrust.

Recently, I was contacted by owners of a commercial building seeking to make their investment property as earthquake resilient as possible. They were worried the building might not survive the next big quake because of its proximity to a major fault line, the Inglewood Fault (also called the Wilmington Blind-Thrust fault).

Photos by Gerret Wikoff

A plucky structure. The dust from the 1933 Long Beach quake had barely settled when construction began in 1934 on what would be a new Packard car dealership. It was built with 12-inch-thick concrete walls and covered with a conventional wood-framed roof supported by bowstring trusses constructed on-site. In the intervening years, this 2,500-square-foot piece of history has served as a Saab dealership, an independent Porsche repair shop, a wheel and tire business, and most recently, a shop selling vans modified with ramps for people with disabilities. The 87-year-old structure has managed to survive every quake since its inception—no small feat considering the devastation the city has suffered over the years.

While inspecting the structure three years ago, I noticed the 12-inch-thick poured concrete walls were in good shape for a building of its age, but the connections tying the roof to the walls were woefully inadequate. Where the 2x8 rafters ran perpendicular to the walls, the rafter ends were connected to the wall by steel rods embedded in the concrete. The ends of the rods, bent 90 degrees to form short, 2-inch-long legs, were inserted into holes drilled in the ends of the individual rafters and held in place with some bent-over nails. Also, the ends of the bowstring trusses were held in place by steel brackets buried in the concrete walls, and if a quake strong enough to pull them free occurred, there would be nothing left to support them. We'd therefore have to provide posts at all the truss locations.

I recommended a respected structural engineering firm, which the owners approved. The firm then ordered "as-built" drawings showing the dimensions of the building.

A big opening. The L-shaped, single-story building was divided into three parts: an open garage, a sales office, and a showroom. The showroom (and part of the sales office) occupied the short leg of the L-shaped building. A notable characteristic of the showroom wing was its nearly 45-foot-long open storefront entry and window wall, which ran at an angle conforming to the city street grid layout beyond (see "Partial Roof Framing Plan," page 36).

In the 1970s, the building was remodeled and two central concrete posts along the angled wall were removed to create a wider glazed storefront. The previous builders had constructed a heavily reinforced Z-shaped lintel to span the nearly 50-foot width of the showroom's end wall, bearing it on two 18-inch-thick concrete columns at each end. The engineer's assessment noted that a moment frame would be needed at this angled, fully glazed end wall to resist potentially strong lateral forces brought on by a major temblor.

We planned to complete the seismic retrofit in two phases: First, we would work around the building's tenants, installing required roof-to-wall and truss-to-post connections, and then, during the tenant's slow sales season, we'd begin the more invasive work installing the steel moment frame.

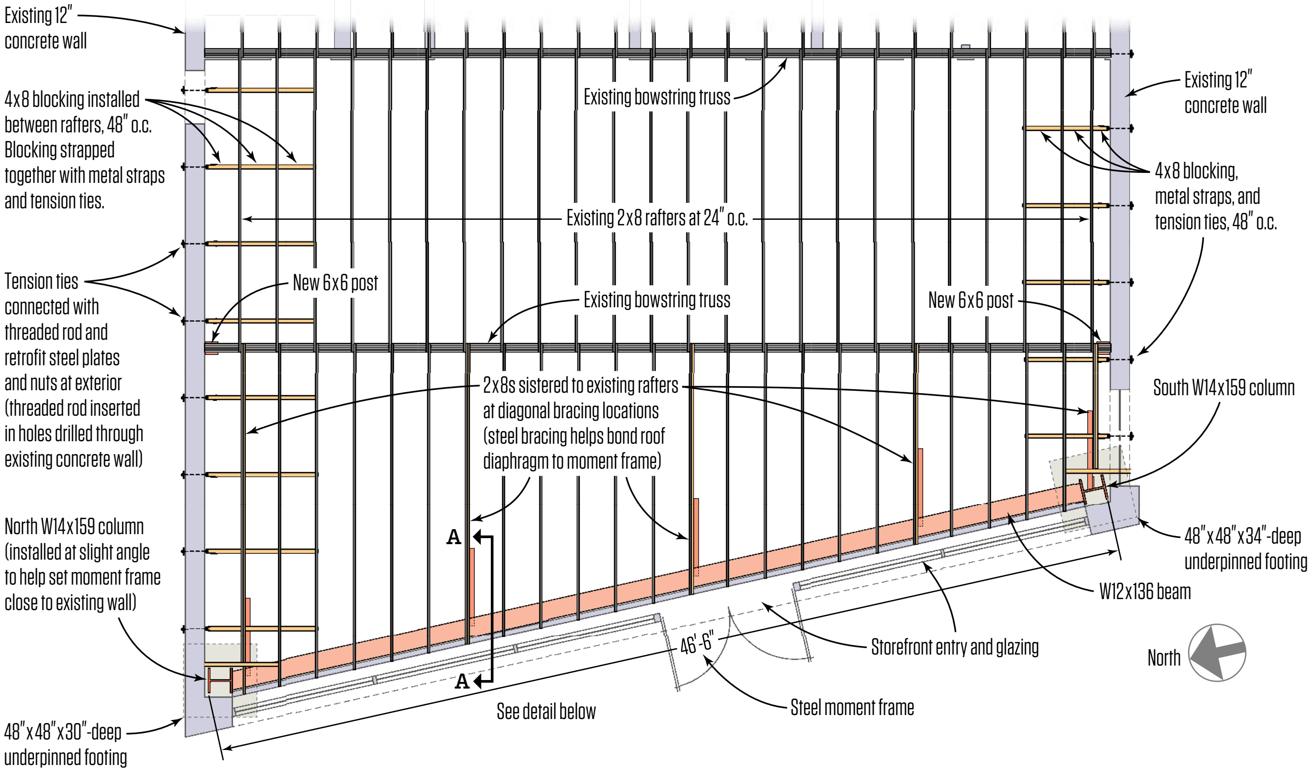
PHASE 1: TYING THE ROOF TO THE WALLS

The structural design relied on the roof diaphragm to hold the building together in a seismic or wind event. This meant beefing up several roof-to-wall connections around the perimeter of

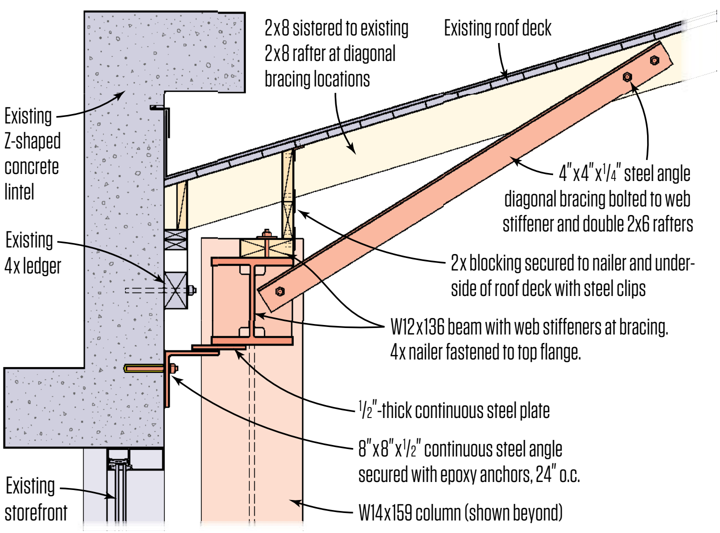
The 2-by rafters transition from a bowstring truss to a ledger above a wall-to-wall storefront entry **(1)**.

Moment frame. One of the two concrete pillars supporting a Z-shaped lintel **(2)**. Column layout for the new moment frame, south corner **(3)**. A crew member begins work accessing the existing north footing **(4)**. "Sacrificial" bottle jacks are used to support the existing footing during footing underpinning **(5)**.

Two-Phase Seismic Retrofit — Partial Roof Framing Plan



Section A-A



A new 46-foot-6-inch-long moment frame was needed at the angled wall-to-wall storefront opening (plan, top). Rafter ends would be connected to the moment frame via 2-by blocking and metal clips (detail, above).

the building. Where the rafters ran parallel to the wall, we installed 4x8 blocks at 4 feet on-center between the existing 2x8 rafters in the first three bays from the wall. We then strapped the blocking together with Simpson Strong-Tie ST6236 straps and nailed Simpson HTT5 tension ties to the blocking abutting the wall. After drilling a hole through the 12-inch-thick concrete wall, we connected the tension ties with 3/4-inch galvanized threaded rod and octagonal Simpson RP6 retrofit steel plates secured with nuts on the face of the exterior wall. We nailed Simpson A35 framing clips to the rafters and screwed them to the 1-by roof deck boards (in lieu of removing the roof materials and providing boundary nailing and re-roofing).

Where the rafters ran perpendicular to the walls, we attached HTT5 tension ties to the ends of the rafters, 48 inches on-center.

In the garage area, we sistered new 2x8 rafters to every third existing one and connected HTT5 ties similarly (through-bolted with retrofit steel plates and nuts on the exterior).

In the showroom wing, the rafter ends were connected to the moment frame via 2-by blocking and steel connectors, bonding the roof diaphragm to the moment frame. See the section detail, at left.

Illustrations by Tim Healey

Supplemental posts. In addition to beefing up the connections, we also had to add support, so we installed new 6x6 Doug-fir wood posts in most locations under the ends of the existing bowstring trusses. We secured the post bottoms with Simpson AB post-base connectors set into the thickened edge of the existing concrete slab with epoxy anchors, and at the top, we married the posts to the bowstring trusses with custom-welded saddles. I opted for steel columns at the garage door locations, having seen my share of wood posts damaged by workers backing into them on jobsites.

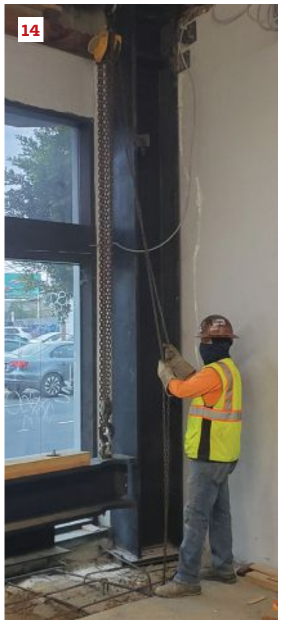
PHASE 2: THE MOMENT FRAME

We completed the bulk of the roof-to-wall seismic retrofit work, then the project hit a nearly two-year intermission. The tenants didn't want to close the showroom. "Wait until September when our sales taper off," they said. Well, September came and went as did many more months until the pandemic shut the world down. More waiting. Then the tenants finally moved out and we invaded the empty showroom to complete work on the steel moment frame. Our steel costs more than doubled (from approximately $30,000 to more than $60,000) over that time.

The engineer's design called for a massive moment frame with a 45-foot-long W12x136 steel beam weighing approximately 6,100 pounds and two 13-and-half-foot-long W14x159 columns weighing roughly 2,145 pounds each. When deciding during preconstruction planning how to install these heavy steel members, our first idea was to cut a hole in the roof and crane them in place, but the Z-shaped concrete lintel blocked access from above (also, cutting a hole in a perfectly good roof wasn't an idea I relished). Using a forklift

Roof connections. Crew members sister new 2x8s onto existing rafters at steel angle diagonal brace locations above the storefront entry **(6)**. Between rafters parallel to the wall, 4-by blocking was added and secured with metal strapping and tension ties **(7)**.

Moment frame. A 1/8-inch-thick steel template **(10)** made to correspond to the steel bottom plate **(8)** is used to lay out the drilled anchor bolt locations **(9)**. The template holds the all-thread bolts in alignment **(10)** during the concrete pour **(11)**.



Moment frame. The W14x159 column at the south end is hoisted into place **(12)**. A 4-by nailer is bolted to the top flange of the W12x136 beam; the nailer is needed to bond the roof diaphragm to the moment frame **(13)**. With the W14x159 column at the north end installed, the W12x136 beam begins its ascent **(14)**.

Moment frame. The W12x136 beam is hoisted into place with chain hoists hung from steel brackets **(15)**. Temporary shoring columns are continuously tightened as the beam is raised into place **(16)**. With the beam set and welded, the 4-by nailer bolted to the beam is ready for 2-by blocking and metal clips **(17)**.

was not an option, as its mast would hit the ceiling lifting the beam upward. Consulting with the ironworkers, or steel fabricators as they're referred to in California, we decided to lift the beam and columns in place old-school style with chain hoists.

Underpinning the existing footings. Starting out, we needed to increase the size and bearing capacity of the footings under the two concrete pillars supporting the existing lintel in the corners of the showroom's end wall. We dug under the existing footings to create 4-foot-square by 24-inch-deep footings centered on the new W14x159 columns. The existing south footing was 18 inches deep, while the existing north footing was 14 inches deep. We needed to provide a minimum 16-inch-high work area under the existing footings, which resulted in roughly 34- and 30-inch-deep footings for the south and north locations, respectively. Using hammer drills and chipping guns, we first dug access pits alongside the footings so we could lay on our sides or crouch to dig out the clay soil from under the footings.

Before excavating horizontally under the footings, we needed to keep them from collapsing in the hole we were digging. The engineer recommended using sacrificial bottle jacks (a technique that was validated by a house mover I discussed the project with). Based on the load and the bearing values of the soil, the engineer's detail called for six 12-ton jacks under each pad. To compensate for uneven soil, we dug out some soil, made a 4-inch-deep form, placed rebar in it, used rapid-set high-strength concrete, and troweled it smooth. We then set the jack on that. To compensate for the uneven bottom of the existing footing, we made a self-hardening modeling-clay dam around the perimeter of a 12x12 steel plate and poured a small pond of rapid-set high-strength grout in the center. Next, we placed the plate on the jack and jacked it up. Once the grout hardened, we jacked it tight. Then we were back to lying on our sides and digging (with horizontal digging, gravity doesn't help push the hammer drill into the soil, so we got our exercise).

With excavation complete on both footings, we drilled six holes through the existing pads at each column for the footing-to-column connection. In the holes, we inserted 3/4-inch-diameter F1554 GR36 threaded rod, long enough to be embedded in the new concrete below the existing footing. Working from inside the access pits, we installed double-nutted square bearing plates on the threaded rod to resist pull-out forces. Then, #6 rebar was fished between the bottle jacks and threaded anchor bolts and set on stand-offs to make a grid.

After the engineer and building inspector blessed our work, we turned to filling the access pits with plastic sand bags filled with the excavated clay soil and embarked on pumping in the first of two concrete pours.

Erecting the steel. The steel fabricators showed up with their crane and the W12x136 steel beam and W14x159 columns. They craned the steel onto heavy-duty dollies and muscled the I-beams into the showroom through a nearby side door (there's nothing quite like seeing a 6,000-pound-plus steel beam swinging over parked cars to get the blood flowing).

To make room for the steel brackets that the chain hoists hung from, we had to cut out some of the blocking we had installed earlier. The chain hoist gears whirred as the steel columns were dragged slowly up into place and lowered onto the all-thread bolts. The fabricators then plumbed the W14x159s with lasers.

While the fabricators were in the midst of installing the columns, our crew bolted a 4-by nailer to the top flange of the W12x136 beam. We later connected the rafter ends to the 4-by nailer with 2-by blocking and Simpson LTP4 clips and Simpson A35 framing clips that were nailed to the rafters and screwed to the roof decking.

Raising the beam, the fabricators worked one chain hoist at a time, switching from end to end as the beam inched skyward until it was high enough for us to weld the steel beam to the columns. Temporary shoring columns were continuously tightened, to act as a fail-safe measure, as the beam was raised into place.

Full-penetration welding (as specified by the engineer's plans) to marry the beam to the columns ensued under the deputy welding inspector's watchful eyes. Rapid-set grout was packed under the 3/4-inch steel bottom plates at both columns and the moment frame was essentially completed.

Steel lintel. With the inspection completed, an 8x8x1/2-inch steel angle was welded to the moment frame by the fabricators and later fastened to the existing Z-shaped concrete lintel. The point of this exercise was to bond the concrete lintel to the moment frame to resist sideways motion commonly found in earthquakes, and prevent its collapse. Previously, I had the lintel radared and the buried rebar located and marked so when we drilled out and installed the new anchors (5/8-inch-diameter GR36 threaded rod at 24 inches on-center set in epoxy), we wouldn't hit buried rebar and potentially weaken the lintel.

Finishing up. Now it was time for the second concrete pour, which buried the column base plates. The finisher troweled the pour smooth. It's an impressive thing of beauty, this moment frame consisting of three massive sticks of steel, yet it tucks into the showroom unobtrusively.

Gerret Wikoff is a builder-remodeler based in Los Angeles.

18

19

Roof connections. Completed structural work at the angled, wall-to-wall storefront opening includes the steel angle lintel, steel angle diagonal bracing, 2-by blocking, and metal connectors **(18, 19)**.

20

Moment frame. A second concrete pour buries the column base plates and is troweled smooth **(20)**.


Insurance Institute for Business and Home Safety

Wind-Resilient Buildings
A guide to building against hurricane winds and tornadoes

BY JLC STAFF

As storms, hurricanes and tornadoes are different beasts, but they share enough similarities that the construction methods to make homes more resilient to destruction from both types of storms are similar. Both hurricanes and tornadoes are "cyclonic" storms with very strong winds swirling in a spiral around a center. The horizontal "tangential" winds at the outside of the storm are moving at higher speeds, predominately upward, while the winds closer to the center push predominately downward. Homes near the track of a cyclonic storm see strong winds from all directions. If the eye passes over a home, it will be subjected to winds approximately half the time from one direction and half the time from the opposite direction. At any given time, the windward face of a structure will experience positive pressures while the leeward face will experience negative pressures. The negative pressures are about 20% higher, owing to the aerodynamics of wind rising over and moving around the building.

Hurricanes tend to be more destructive because of their sheer size, which ranges from about 60 miles in diameter up to 1,000 miles. They generate all their force over the ocean, but that force can carry them inland for 100 to 200 miles, and they can persist for several days. Tornadoes are relatively small—on average mowing a path of destruction 300 to 500 yards wide—and relatively short-lived, sometimes lasting only a few minutes. On average, tornadoes move a distance of about 26 miles, usually at speeds from 30 mph to 60 mph, though the largest travel up to 50 miles at speeds up to 300 mph.

In this illustrated resource, we focus on framing methods to

Recommended Tornado-Resistant Wood Framing

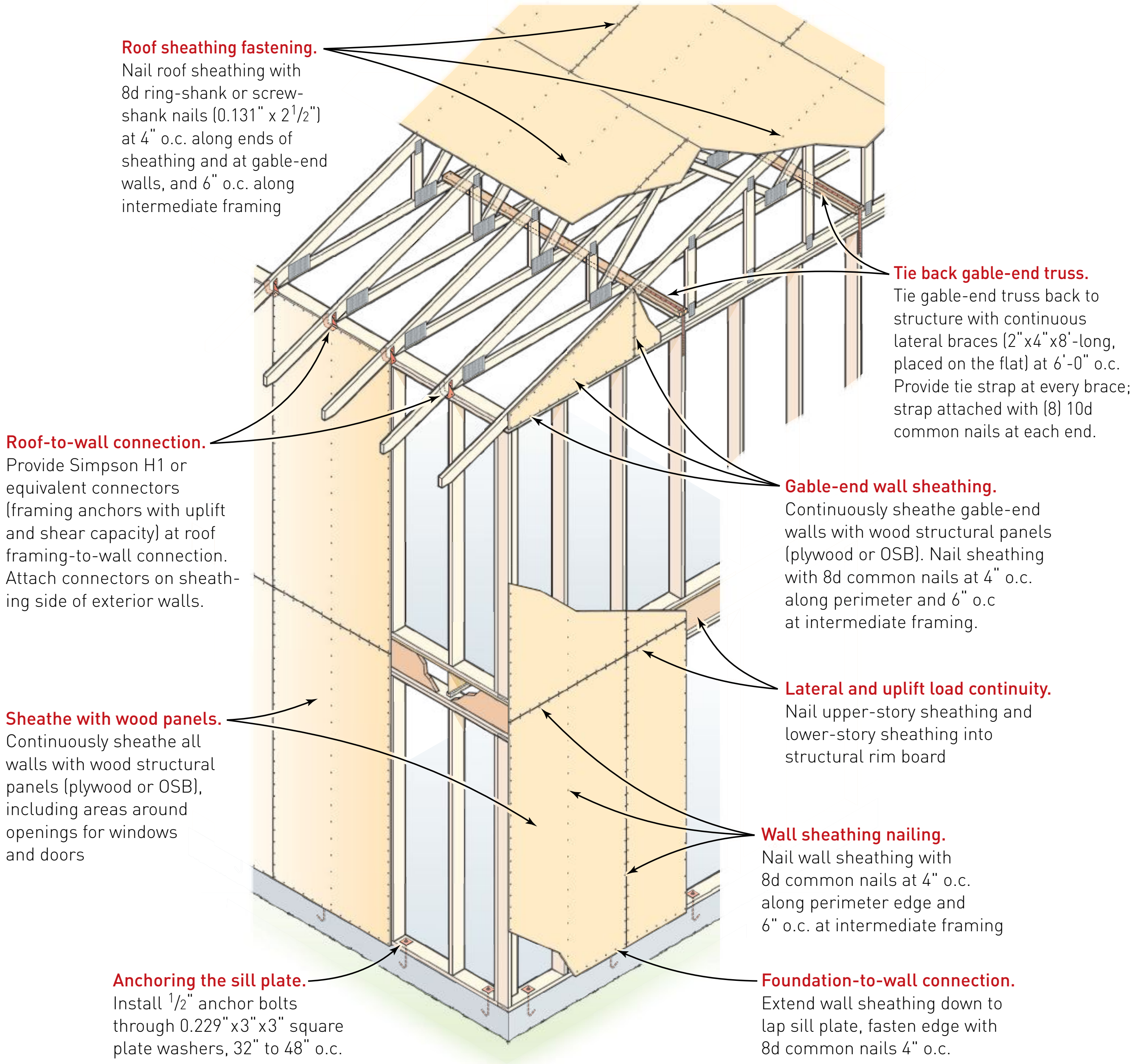
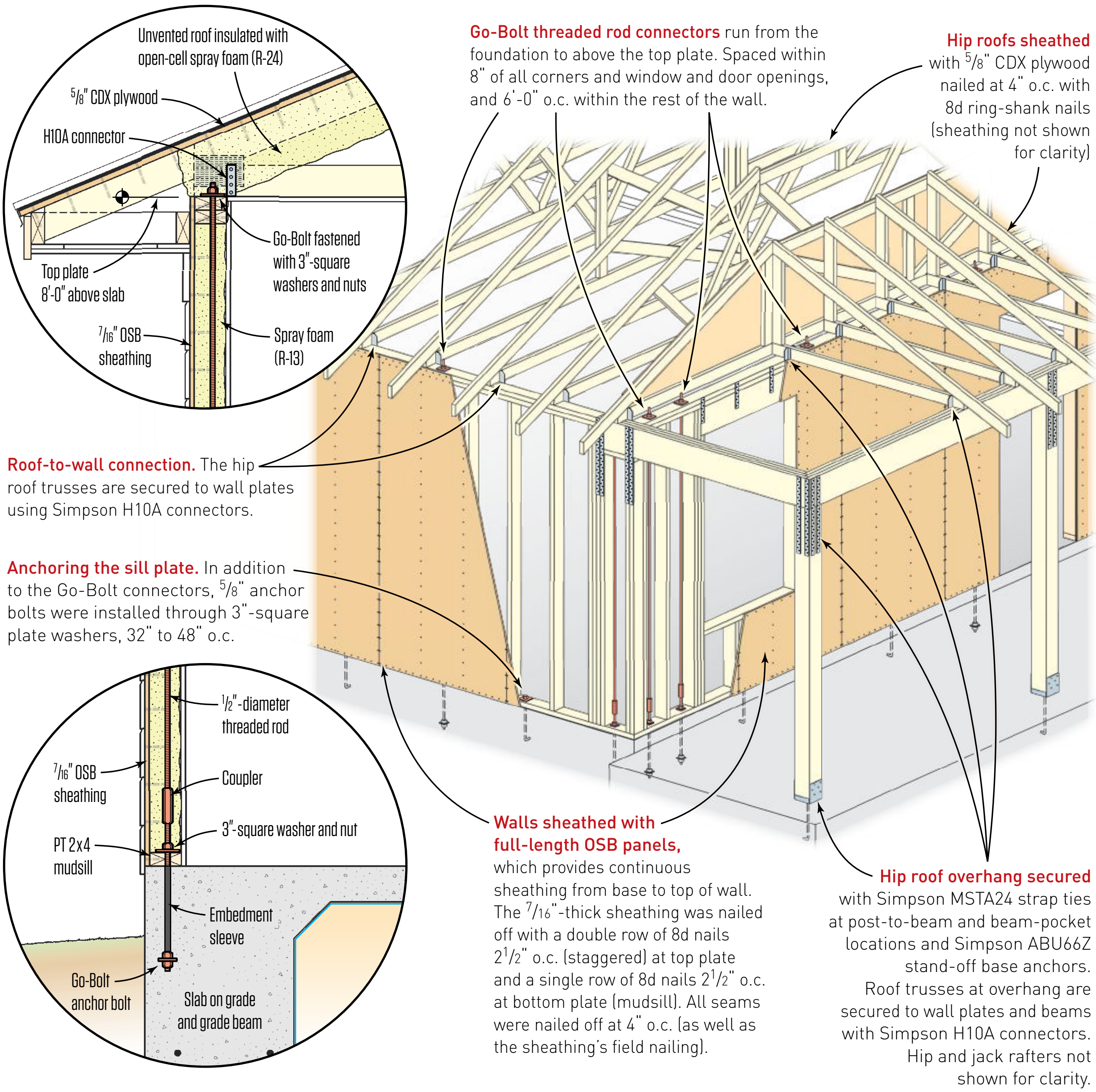


Illustration adapted by JLC from APA "Building for High Wind Resistance in Light-Frame Wood Construction Manual" (M310, 2015).

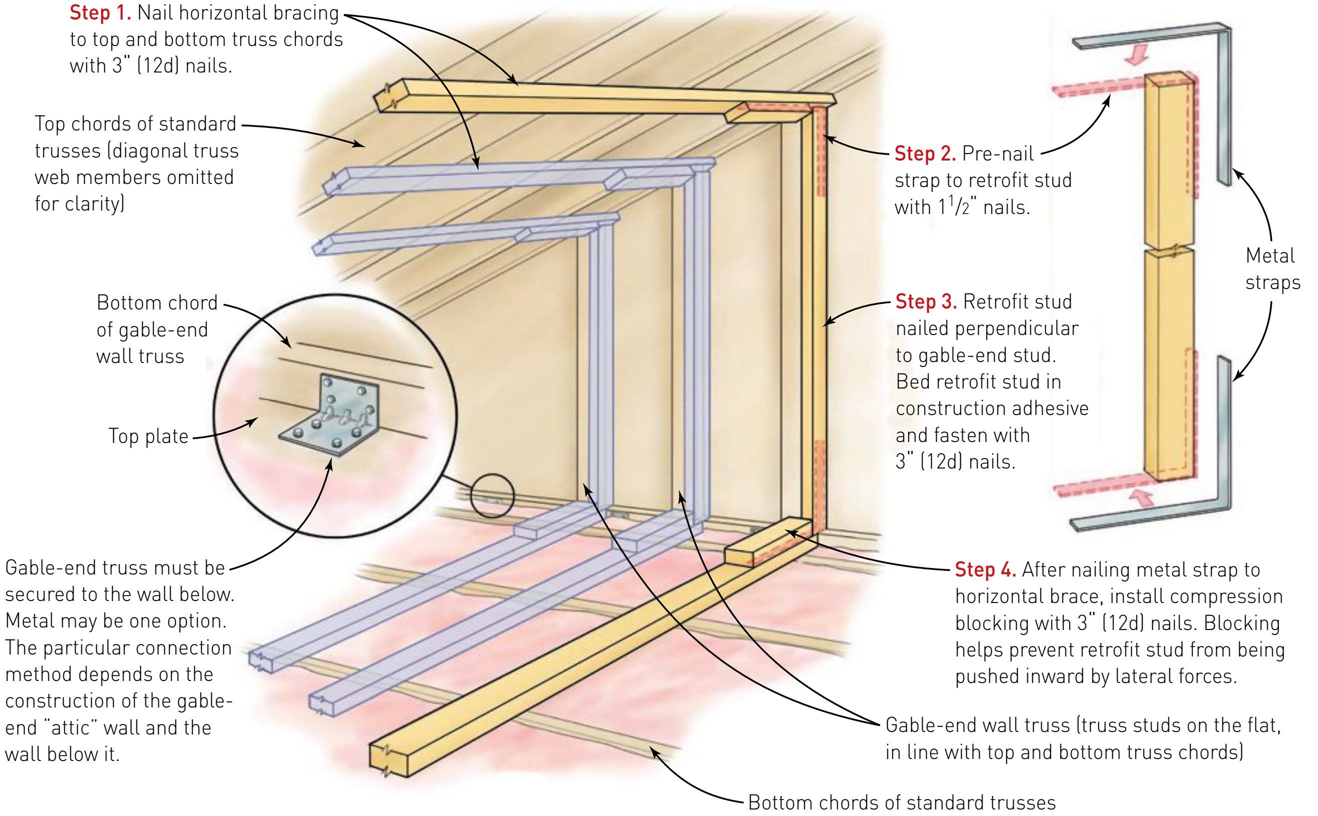
New-construction framing. The framing recommendations shown here reflect hundreds of inspections of tornado-damaged homes by APA engineers. The engineers concluded that many homes in regions at risk of tornadoes could be saved at a reasonable cost if built with these upgrades to framing component and assembly connections.

Recommended Hurricane-Resistant Wood Framing



New-construction framing. The details shown here summarize load-path upgrades modeled on the recommendations of the Fortified Home program developed by the Institute for Business and Home Safety (IBHS). These were employed by builder Eric Anderson in Florida for Habitat for Humanity's Habitat Strong program, demonstrating cost-effective solutions for homes at risk of hurricanes with winds speeds of 130 to 156 mph (Category 4).

Strengthening and Bracing a Gable-End Truss



Retrofit framing. To strengthen the gable ends of existing homes in hurricane zones, each stud of a gable-end truss gets this basic retrofit assembly: Horizontal braces (each about 6 feet long) are first attached to the top and bottom chords of the roof, and then a retrofit stud is installed perpendicular to the gable-end truss. The L-straps must be preinstalled at the end of each retrofit stud before the stud is secured to the horizontal braces.

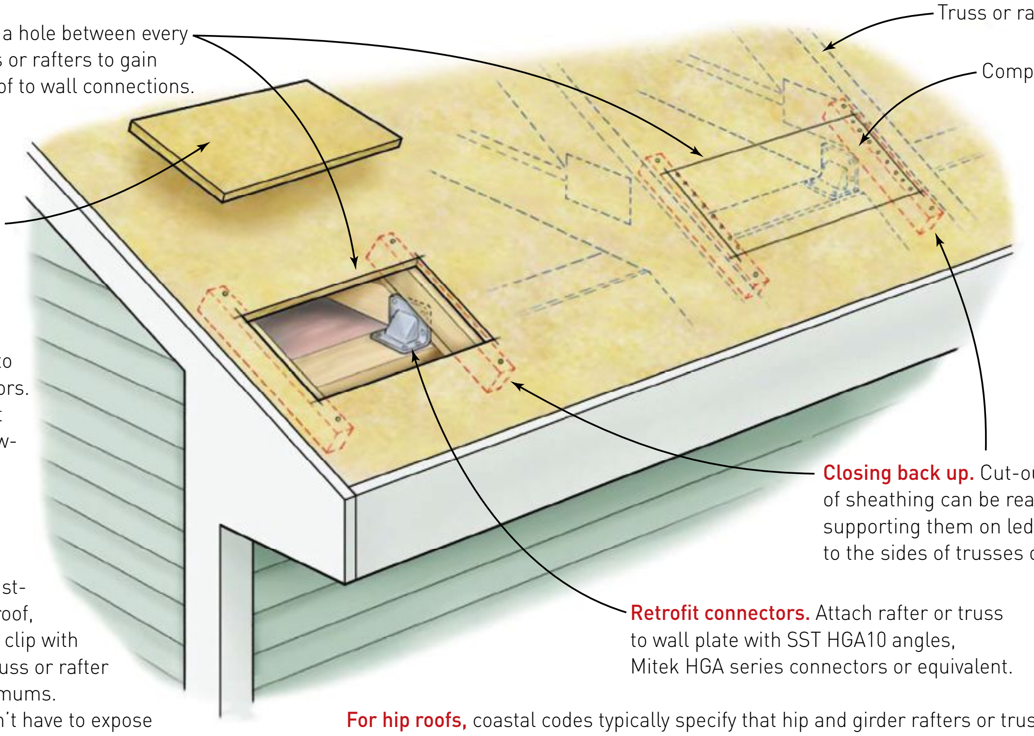
resist wind forces. But both hurricanes and tornadoes are also water events. Along with delivering destructive winds, hurricanes can cause floods from both sustained rainfall and storm surge—the wall of ocean water pushed up by descending winds at the center of the storm. Tornadoes are usually accompanied by heavy thunderstorms, which can cause water damage too. To address these risks, we will cover water-resilient buildings in a later issue.

OVERCOMING UPLIFT

The key to hurricane and tornado resilience is found in strengthening the load path. Most builders understand that buildings need a continuous load path to support down-bearing gravity forces. To support the roof, the beams and rafters must be supported on columns and load-bearing walls, which in turn must be supported by a solid foundation. The forces here are largely compressive, pushing the parts of the house into each other, so every framing member must be supported by another, and each must be sufficiently large enough to bear the downward force, which is ultimately borne by the earth itself. In addition, this downward force threatens to shear off the fasteners—many driven horizontally—that are holding the frame together. Too few or too small, and the fasteners fail. Shear forces also affect beams that are supported at the ends on columns or on joists that rest on sills: The downward force threatens to shear the wood fibers where they hang out over empty space beyond their end supports.

In a high-wind event, intense uplift pressures are the loads pulling the parts of the house in the other direction—up. To resist these forces, we need to focus on the same load path as for gravity loads, but we need to make sure that tension forces don't pull the connections apart and that extreme shear forces don't sever the horizontal connections as the framing is wrenched upward. Steel hardware as well as shear walls and plywood gussets with tight nailing patterns are the prime defenders along the load path to keep the building from flying apart in high winds.

Strengthening Roof-to-Wall Connections



Retrofit framing. To minimize demolition of the roof edge, rectangular holes are cut into every other rafter or truss bay, and gusset angles are installed on each side of the hole. The cut-out can be saved and used to patch in the opening by securing it to scabs nailed to the side of the trusses.

WEIGHING RISKS

If you put enough steel, which is very strong in tension, into a wood frame, you can resist even very high uplift pressures. But at what cost in material and labor? The recommendations put forward by organizations like the APA – The Engineered Wood Association (APA), American Wood Council (AWS), and the Insurance Institute for Business and Home Safety (IBHS) tend to look at this question through a risk lens, which weighs the likelihood that a house in a given location will experience a high wind event. It wouldn't make sense for every house to be built to hurricane or tornado standards, or even for homes in tornado country to be built to the same standards as those subject to hurricanes, which are larger storms affecting more homes for longer periods.

The illustrations on pages 42 and 43 show two approaches to upgrading the load path. Both will work in hurricane and tornado zones, but the one on page 42 is less expensive to build and probably better suited to homes in tornado country, where the chances of a home being hit by a tornado are lower than the chances of a home in a coastal zone being hit by a hurricane.

The approach on page 43 uses more steel hardware, which is more expensive but requires much less nailing and is easier to inspect.

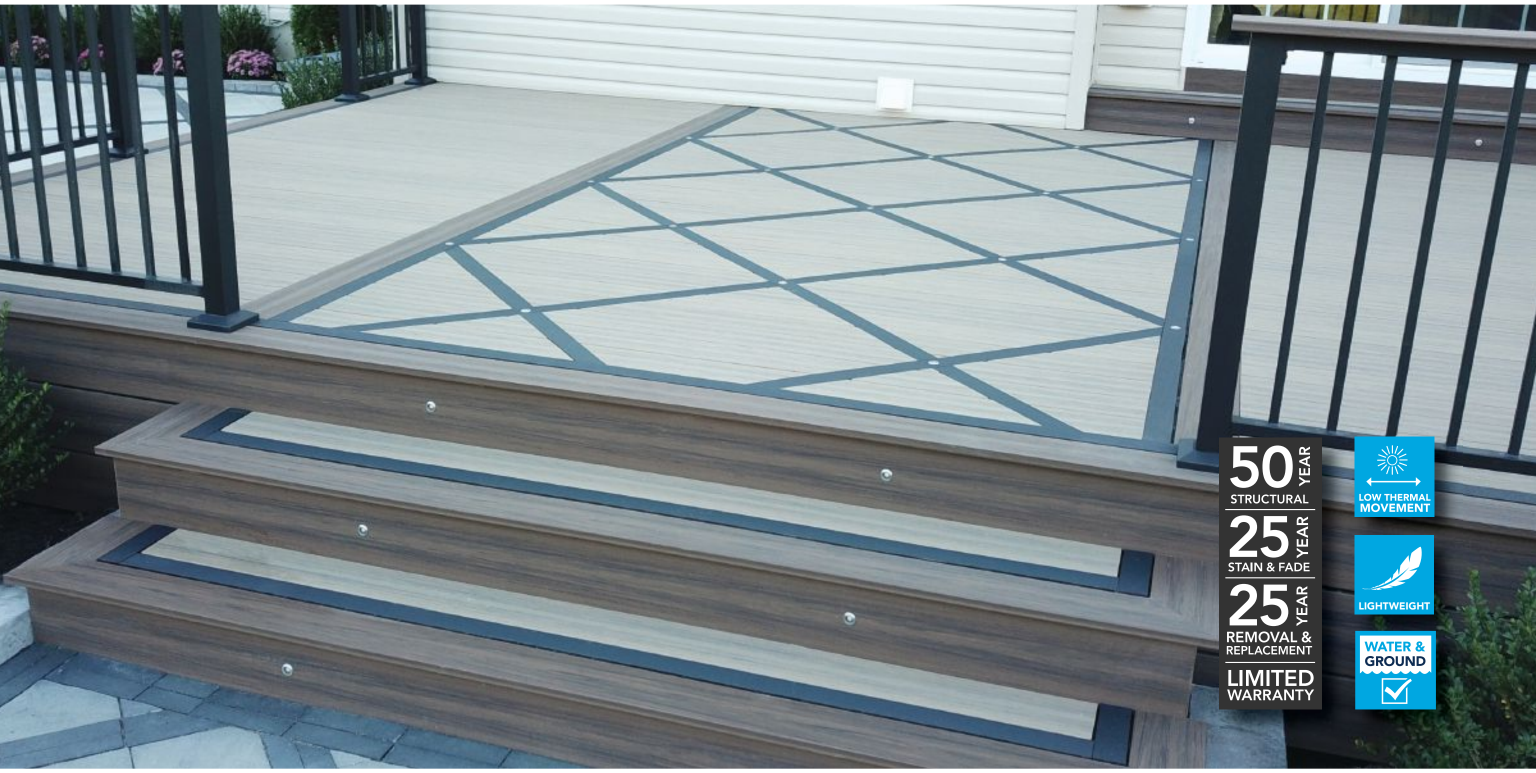
RETROFIT OPTIONS

When it comes to retrofitting existing homes, access to all the load-path connections is more of a challenge. The focus here is narrower, targeting the highest frequency failures in roof connections. Rafters and trusses that are typically fastened in place with a few 10d or 16d toenails are easily torn apart in a high wind. Also, gable-end trusses that are toenailed into the top plates often blow out when the attic gets pressurized by high winds, leading to catastrophic failure. The framing retrofits shown here offer effective ways to strengthen these critical structural connections.

professional
deck builder
October 2021

NEW DIMENSION CONSTRUCTION

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Guards, Handrails, and the 2021 IRC

by Glenn Mathewson

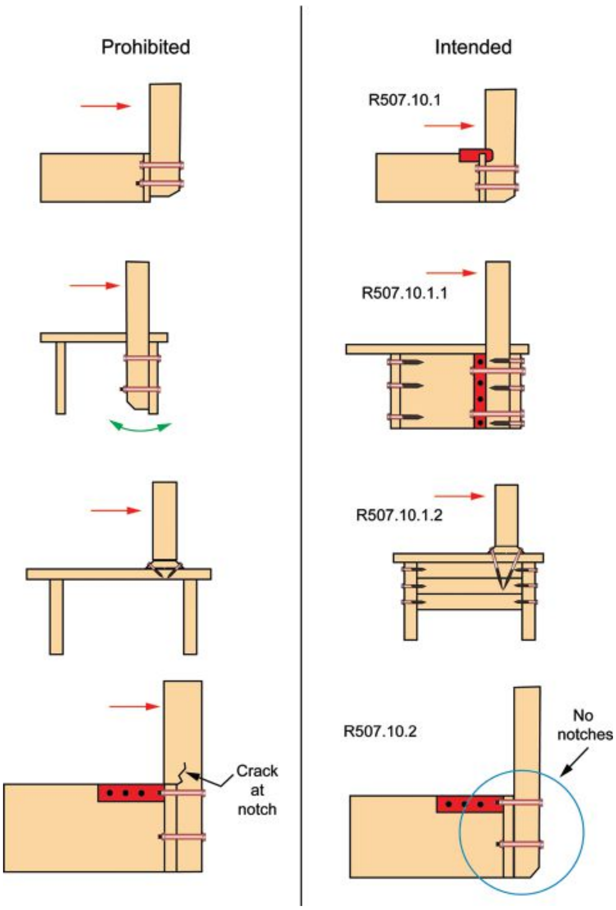
Guardrails, rails, guards, handrails ... these terms are often used interchangeably. In the International Residential Code, however, they are distinctly different features with distinctly different functions. A guard, for example, is designed to help prevent someone from accidentally falling off an elevated walking surface, while a handrail is provided for someone using a stairway or ramp to purposefully grasp for assistance and stability. In the code, a rail is referred to as a "handrail," while a guardrail is called a "guard" (see "Guardrails vs. Handrails," at jlconline.com).

While the architectural requirements for guards, such as minimum height and maximum opening size, are well understood and easy to satisfy in design and construction, validating a guard's structural capacity has only recently been formally discussed. For both interior stairs and deck stairs, inspectors typically have only one way to verify and approve the strength of a guard after completion: with a push and a pull. But research by Frank Woeste, Joseph Loferski, and others in the early 2000s brought attention to substandard deck guards and the insufficiency of typical notched guard-post attachments (see "Strong Rail-Post Connections for Wooden Decks," *JLC*, Feb/05). In response to their findings, the market focused more attention on the guard-post attachment, with deck guides and manufacturers recommending hold-down-type anchors to tie the post into the structure rather than to just the outer joist or beam.

Opinions vary on whether a prescriptive method of guard construction should be included in the IRC. The consumer market enjoys the variety of deck-guard designs that can be created, and some builders fear that if an approved structural design for guards came to be codified, it would become the single mandated design. On the other hand, the lack of any guidance in the code has led to dangerous ideas of how guards can be built. Understanding the need and realizing the stalemate, all stakeholders made compromises during the latest code modification cycle, and the 2021 IRC now offers some guidance on deck-guard construction.

Design loads. A critical first step in providing structural provisions in the code for guards was to address the design loads that must be resisted. Starting with the first version of the IRC, in 2000, guard and handrail design loads have been identical: 200 lb. in any direction at any point along the top. However, as the market began to discuss guard-post connections capable of resisting a 500-lb. design load (200 lb. x 2.5 safety factor), questions arose regarding the direction this test load must be applied. By the IRC requirement in Table R301.5, a guard must resist 200 lb. "in all directions"—which would include inward. Of course, a guard isn't there to protect an inward fall, and it doesn't require anything be attached to it for someone to grab, like a handrail. Consequently, the

Guard Post Connections



On the left are examples of incomplete guard load paths, while the examples on the right illustrate how blocking, structural screws, and metal hardware can be used to correct those defects by tying framing members connected to the post back into adjacent joists.

ILLUSTRATION COURTESY INTERNATIONAL CODE COUNCIL, WASHINGTON, D.C.

The goal of the new guard-post provisions in the 2021 IRC is to avoid relying on fasteners loaded in end-grain withdrawal as part of the critical guard-post load path. Here, where blocking for the bolted guard-post connection is fastened to the joists, the end-grain connection should be reinforced with additional nails, structural screws, hardware, or some combination of all three.

PHOTO: GLENN MATHEWSON

2021 IRC makes a distinction between guards and handrails in their minimum design loading. Now, a guard must resist the 200-lb. concentrated load only in the outward and downward direction, with the recognition that a guard capable of resisting such loads in those directions would be sufficiently stable if it were pulled inward.

The most notable and obvious guard provisions in the 2021 IRC are in the new section R507.10, Exterior guards, which contains four subsections covering support, posts, plastic composites, and other guards. R507.10.3 simply points back to R507.2.2, where the general requirements for testing and installation of composites are detailed. R507.10.4, Other guards, is specifically meant as a reminder that all types of guards and guard materials are permitted, provided they are installed per the manufacturer's instructions and in accordance with engineering principles. It is still the authority of the building official to request validation of either of these.

No notched posts. R507.10.2 is one compromise in the code that will make a big difference in reducing the number of dangerously built guards, but without dictating a specific design. Here, 4x4 guard posts are prohibited from being notched at the connection point when the posts support loads at the top. Though this is a common construction method in many parts of the country, time and research has proven that in most applications, a notched post cannot support the minimum design loads. It's important to note that this prohibition was specifically written to address only the connection location. A turned 4x4 or one notched within its length is not universally prohibited.

Continuous load path. The most significant new provisions are in Section R507.10.1, Support of guards. A clear expectation is made in this section that "guard loads shall be transferred to the deck framing with a continuous load path to the deck joists." This requirement is general enough to allow for a variety of connection methods, yet descriptive enough to address the most problematic issue in guard construction: a connection only to the outer member of a deck frame. Two more subsections further address posts connected to the side of a deck frame and those connected to the top. When connected to the side, the post can be on the interior or exterior of the frame, but it must be connected to the adjacent joists in a manner that prohibits rotation of the joist or beam it is directly attached to. This can be achieved with a variety of metal hardware or by using blocking and standard fasteners. The IRC doesn't require a specific load to be resisted at this connection, as determining such a load would depend on many variables in the overall guard design that are not easily verified with engineering or product testing. When blocking and fasteners are used, the new provisions do make it clear that fasteners in end grain cannot be relied on for withdrawal resistance.

For connections to the top of the frame, the expectations are similar. Posts can be connected over the top of the decking, but the connection cannot be to the decking alone. Instead, it must be made to the frame or to blocking in accordance with the manufacturer's instructions. This connection method is intended only for designs using a manufactured and tested product for which there are installation instructions and that has been evaluated for load resistance.

For many deck builders, the new 2021 IRC deck guard post provisions won't be surprising, but for others, they should offer guidance for building stronger guards. For inspectors working daily with DIY homeowners and novice deck builders, these new codes provide something to lean on (other than the guards themselves) when evaluating guards or asking for remediation of questionable guards. While guards will still have to be validated with the same push/pull they have always been tested by, the visual observation of guard-post connections are now another means of evaluation. And remember, the "pull" part of testing guards may be easier and safer to do, but the "push" is what the code is interested in. ❖

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

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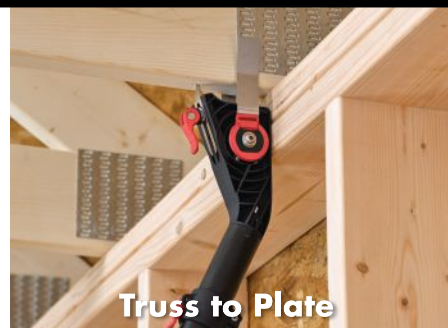

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Chief Architect X13 for Deck Builders

by Matthew Breyer

Our residential remodeling company primarily designs and builds custom backyard environments consisting of decks, patios, pergolas, and enclosures. Over the course of a year, about 75% of our work fits that description, with most projects involving more than one component, such as a deck with a roof over part of it and a patio below. We have four designers on staff; among us, we use a variety of computer-aided design tools, augmented with old-fashioned pen and paper, first during the “concept capture” with prospective clients and then again while working through the plans, orders, and permitting stage prior to construction.

For example, in the past, we used VizTerra from Structure Studio for much of our design work, largely because of its unmatched rendering capability. However, this software is too intensive and detail orientated for the many simpler, straightforward decks we build. Now we occasionally use an older version of Visionscape but have largely transitioned to Realtime Landscaping Pro from Idea Spectrum for the bulk of our design work (see Clemens Jellema’s review of Realtime Landscaping Architect, on page 9).

For structural drawings, we generally turn to Chief Architect, so we were eager to try out the latest version, Chief Architect X13, and compare it with our current programs and practices. While it promises a number of new features, what caught our eye was the company’s claim that it had dramatically improved the software’s 3D rendering.

Power User

Our production manager, Ryan LeBon, has grown up using Chief Architect and is familiar with all the menus, boxes, tools, and catalogs. Typically, he creates basement 3D renderings and technical structural drawings for decks, roofs, and remodeling projects and works with Chief Architect X12 in these capacities on a weekly basis. He runs a Windows Surface Pro 7 with an Intel i5 processor, 8 gigabytes of RAM, and the built-in graphics card.

Ryan enjoys the software’s ability to create a simplified building diagram quickly, while he has the option to dive into a robust library of videos and training if needed and infinitely refine the details. As he notes, this is a company that supports its products and their users. I asked him to look at the X13 version and identify any new features that might stand out for our uses.

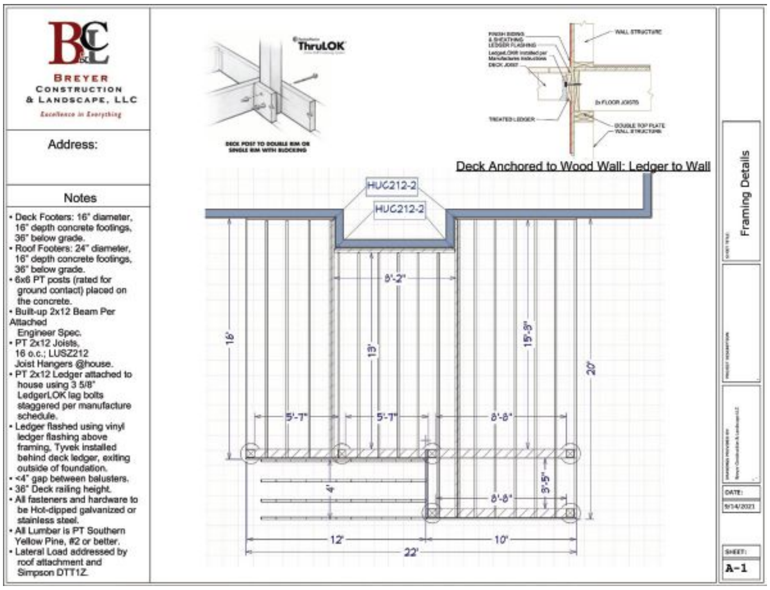
He found that the smaller menu/interface refinements were a nice improvement and was also excited that the all-new graphics engine allowed his Surface Pro to again create 3D renderings—the X12 version had stopped working several months before on his machine. It moved a little slowly in the renderings, but he thought that may have been because of his limited RAM. Ryan’s impression was that the software is an excellent fit for us, but, because most of his work uses just the 2D and structural-drawing functions, the upgrade wasn’t mandatory for our company. Still, it would be a welcome improvement if we decided to pull the trigger.

Renderings

Zach Daller, our design consultant, designs both basements and backyards, typically working with Realtime Landscaping Architect loaded on a Dell Precision with an Intel i7 processor, 16 GB of RAM, and an NVIDIA GeForce GTX

SCREEN CAPTURE COURTESY CHIEF ARCHITECT

New features in Chief Architect X13 include a dynamic task-linked help menu that can be toggled on and off, thumbnail previews for saved elevations and schedules, 3D shape editing, and a text library that allows general descriptions to be used in future projects. Attributes from one wall can now be applied to other walls as well.



Like previous versions, Chief Architect X13 is well-suited for creating construction drawings with framing and connection details. Shown above is the structural design for one of the author's projects that is currently in build.

While Chief Architect X13 boasts a new "engine" that speeds up 3D renderings, the author found that the learning curve is steeper than with simpler CAD programs for decks. Shown here is his initial attempt at a deck design after taking a brief X13 tutorial.

1060 graphics card. Zach focuses on client-facing interactions, so I asked him to see how quickly he could get around in this program intuitively, and in what scenarios it might be possible to rely more heavily on the rendering capabilities of the software.

Zach is often sitting in front of a client, working to turn their vision into a rendering that can be handed off to Ryan for technical drawings once the project is confirmed. With a client looking over his shoulder, speed and agility, as well as an attractive 3D rendering, are critical for him.

He commented that the program was less intuitive compared with a simpler design program solely focused on outdoor living spaces, but that the additional tools and sections would be invaluable to a design-build firm working on a whole house or on a more intensive remodeling project with multiple layers and connections to account for. He said that with a bit more time on the mouse, his speed and results with the program would certainly have improved.

Mock-ups

I do most of my design work on an Origin PC with an i7 processor, 32 GB RAM, and an NVIDIA GeForce GTX 1070 graphics card, typically using an old version of Visionscape or Structure Studios. I usually work either with repeat clients or on unusual projects, and often use design software to mock up concepts that the software was not intended for. I decided to try mocking up a quick concept—without a lot of preparation and training—using Chief Architect X13.

To better appreciate the basics of what the software can do and to learn a little bit about what has been improved upon, I started by watching the introduction video for a prior version (X12), and then the video for this new release. Then, as is my habit, I simply jumped in and attempted to design a rather basic deck, with a set of steps, railings, and a glass wall or rail along the front section. I've included a screenshot of my attempts so you can have a laugh at my expense (see image, left). It took me perhaps 30 minutes of working with the program, trying to figure out the tools and menus, to get to this point ... which is about 10 times longer than it would have taken me to deliver a completed 3D design for a deck this size in Visionscape. That may be an unfair comparison, but my point is that this is not a fast, "jump right in" program; it's a "spend weeks learning this before ever using it for client work" kind of program.

If I were planning on using this software full-time, I'd invest in watching the training on setting elevations, making sure stairways properly connect, and applying finishes to walls and deck floors before ever creating designs for clients.

SCREEN CAPTURES BY MATTHEW BREYER

Chief Architect X13 has a ton of tools and power, but it is a bulky program, and it forces you to design in a 2D environment before rendering in 3D—whereas my background is mostly in designing in a dynamic 3D environment before generating static 2D drawings as needed.

Conclusions

Our shared consensus is that this software is unmatched in the industry for power, detail, and capabilities—but that it requires purchase of the "complete package." You can't simply purchase the "exterior tools" that would most benefit a deck building business. For a residential or commercial remodeling firm that builds more involved projects than a typical deck builder does, or for a ground-up custom home builder, this is probably the best design option on the market for delivering accurate plans, take-offs, and renderings. For deck builders and those with an eye toward expanding into additional areas of service, it's also worth considering—especially for the detailed and accurate construction drawing capabilities.

Available now for both Mac and Windows, Chief Architect Premier (for full residential design) sells for about $3,000 and the Interiors version (for kitchen and bath designers) sells for $2,200. Both products can be rented monthly for $200 (chiefarchitect.com).

Matthew Breyer is president of Breyer Construction and Landscape, in Reading, Pa., and current president of NADRA (the North American Deck and Railing Association). He's a former chairman of NADRA's Education & Codes Committee and a regular PDB *contributor.*

Realtime Landscaping Architect

by Clemens Jellema

These days, most of my clients expect computer-generated drawings—including 3D renderings—to help them to visualize their project. As a professional deck builder, I need tools that help me to quickly and easily create these presentations. The ability to generate images that "tell a story" and create a concept within a reasonable time frame adds value to the services I offer to my clients, and that's just as true now as it was in 2010, when three colleagues and I teamed up to test several different CAD programs that could serve the specific needs of deck builders (see "Deck Design Software," *PDB*, November 2010). What we found then is also still true—most CAD programs are either too simple or too complicated.

The exception then, and now, was a program targeted for landscape designers called Realtime Landscaping Architect (ideaspectrum.com). More than a decade later, I'm still using RTL to create all my renderings for outdoor projects like porches, gazebos, pavilions, pergolas, and more. There are other options, but I haven't yet had a design challenge this software couldn't handle, no matter how complicated.

SCREEN CAPTURE: CLEMENS JELLEMA

Figure 1. Plan view mode in Realtime Landscaping Architect (indicated in the bottom left corner of the screen) includes all the information shown in the screen shot above, such as the menu bar, object category tabs, and object creation tools. On the left side of the screen are icons for editing tools, view tools, and grid/snap on and off. On the right-hand side of the screen, all the information about a highlighted object is shown. This information will not show up in the 3D renderings in either Perspective or Walkthrough views.

Don't let the name of the software fool you. Sure, it's loaded with an extensive library of landscaping features, such as climate zone–specific plantings and trees, and water features, such as ponds, pools, and hot tubs, and the library of deck options is limited compared with what more deck-specific software offers. But it's also capable of producing amazingly lifelike 3D renderings of decks, houses, patios, gardens, and other outdoor living features to create a realistic view of your design. In addition, you can do the following:

- Illuminate the design with post lights, stair lights, and many other features

Figure 2. Renderings of a project in 3D can be made in either Perspective view (A) or in Walkthrough view (B), where shadows and other realistic environmental details are added to the rendering. In either mode, realistic renderings can be made from different angles, allowing clients to compare actual photos of their existing home (C) with multiple design possibilities and finish options, as illustrated by rendering B, above.

- Produce foundation plans and construction drawings, including elevations
- Create roof plans for gazebos, porches, and pavilions
- Import CAD models
- Import plot plans and add your structure in scale for permitting
- Create videos, adding 3D text and dimensions

Three Versions

Realtime Landscaping comes in Plus ($100) and Pro ($150) versions but best for deck builders is the Architect version ($400), which gives you the ability to create landscape plans and CAD drawings with the powerful Plan Detail tool. More of a drafting tool than a 3D rendering tool, this feature allows me to create almost anything as a 2D design, including construction plans, elevation views, roof plans, cross sections, HOA forms for my clients, and draft plot plans—pretty much anything I would need for a permit application.

Then, when I've completed my design in Plan view, I have several options. If I want to send my client a Top view plan showing square footage, field measurements, material info, and other details, I can capture what is displayed on the screen by clicking on the "Export Viewport to File" option in the File menu. Here, the quality of the image can be adjusted by choosing a higher or lower resolution (**Figure 1**).

Designs can be created in either Plan view or Perspective view, and you can easily toggle between the two modes—by selecting the desired tab at the bottom left of the screen—to add details and see how they affect the overall look of the design.

Renderings in 3D can be created in either Perspective view or Walkthrough view. In Perspective view (as in Plan view), an image can be captured by going to the File menu and clicking on "Export Viewport to File" (**Figure 2**).

In Walkthrough view, the environment can be activated by choosing the time of day and adding a skyline and other features. In this dynamic view, you will see trees and shrubs blowing in the wind, light fixtures that are turned on or off, and even a flickering fire pit. ❖

Clemens Jellema owns Fine Decks, in Calvert County, Md.

PHOTO AND SCREEN CAPTURES: CLEMENS JELLEMA

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PHOTOS BY EDMUND BOURKE

Retrofitting a Rooftop Deck to a Stucco Home

Removing an attic gave this California home more outdoor living space and better ocean views

by Edmund Bourke

Located midway between Los Angeles and San Diego, Dana Point is a midsized coastal community with million-dollar views of the Pacific Ocean and real estate prices to match. So our client's decision to remove a perfectly good clay-tile roof over an unused attic space on her home and replace it with a 450-square-foot rooftop deck to gain more outdoor living space and a better vantage point for viewing ocean sunsets made perfect sense.

Her 2,200-square-foot home is located on a small, pie-shaped lot in a gated community with strict wind, seismic, fire, and drainage requirements. To meet those requirements, our work was done according to plans that were designed and engineered by Leo Burke Engineering of Dana Point. In addition to building the new deck, we replaced a pair of small windows with bi-folding patio doors, which allowed access to the deck from the two second-floor bedrooms, and installed a new outdoor gas fireplace. Also, to provide access to the deck from the existing patio and pool area, we built a seismically reinforced set of stairs. On the interior, the engineers specced a retrofitted shear wall tied to a new grade beam to seismically reinforce the home.

Demo

The roof that was slated for demolition enclosed attic rather than living space, but there were still plenty of existing electrical and gas lines and AC ductwork running through the space that had to be rerouted. After carefully removing the clay tiles to save them for later repairs to the remaining roof, but before dismantling the sheathing and existing truss roof system, we installed temporary walls in the first-floor master bedroom and family room to support the drywall ceilings from below. Combined with weather protection from above, the walls would allow the homeowner and her constant

Figure 1. With most of the truss roof dismantled except for the gable end, the Pacific Ocean begins to come into view (A). Workers dismantled the roof trusses from the top down, removing the bottom chords last in order to leave the ceiling drywall intact (B). Before hanging new $9\frac{1}{4}$-inch PSL ceiling joists, workers ripped V-shaped tapers along their top edge so that the flat-framed deck would slope toward drains installed in the center of the deck rather than toward the outside edge. While waiting for the waterproof deck membrane to be installed, workers tented the area with tarps to protect the living space below (C).

companions—a pair of large Labrador retrievers—to remain in the house during construction (**Figure 1**).

We left the bottom chords intact as we started disassembling the roof trusses, leaving the drywall ceiling fastened to the chords and the back of the drywall exposed. Then, as we removed what was left of the trusses, we were careful to minimize damage to the drywall. Though we had to pull the fasteners out through the back of the drywall, the process left the paper face fairly intact, which made patching the ceiling later on easier.

Then we stripped away the stucco finish from the wall to expose the framing so that we could fasten a $9\frac{1}{4}$-inch PSL ledger to the house with structural screws. We also installed a PSL rim joist on top of the existing wall plate, then hung $9\frac{1}{4}$-inch PSL ceiling joists from the ledger and rim joist 16 inches on-center, fastening the joists to the ledger with joist hangers.

This rooftop deck was designed to drain to the center rather than along the outside edge. So before hanging the joists, we ripped V-shaped tapers along their top edges from both ends toward the middle so that the roof sheathing would slope away both from the house and from the edge of the deck toward the center. With a slope of $\frac{1}{4}$ inch per foot, these tapers still left plenty of material—about 7 inches—in the middle of the joists to support roof loads on the 14-foot-wide deck.

After the joists were in place, we reconnected the HVAC ducts to supply the existing registers and rerouted the electrical and gas lines as needed so that everything was buried within the ceiling framing. We also installed three pairs of 3-inch-diameter schedule 40 drainpipe that would connect roof drains in the center of the deck to a 6-inch seamless aluminum gutter mounted on the fascia, allowing water to drain off the deck and down to the home's existing drainage system. After insulating the joist bays with fiberglass batts, we glued and nailed $\frac{3}{4}$-inch sheathing to the joists.

Waterproof Roof Deck

Originally, the designer had determined that three 3-inch-diameter drains—one in the center and one at each end—would provide the necessary capacity to handle water flowing off the deck. We decided to play it safe and doubled up the drainage capacity by installing two drain lines instead of just one at each location, in case of a heavy rain event or a drain blockage from debris. The drains exit through the rim joist and empty into a gutter.

We installed the six flanged drain

Figure 2. The roof deck was finished with a three-coat stucco finish over diamond lath stapled to the sheathing, followed by a Silcor liquid-applied waterproofing membrane system (A). Water drains through three pairs of roof drains oriented along the centerline of the deck (B). Once the new deck was watertight, workers reframed the wall to install two new bi-fold doors to match the doors on the first floor (C).

bodies when we installed the sheathing, and subcontracted the roof deck waterproofing to another company. Those workers taped the joints in the sheathing, applied a primer/sealer, and flashed around the perimeter of the deck. Next, they stapled diamond lath to the sheathing and applied a three-coat stucco finish (**Figure 2**).

To waterproof the deck, the crew rolled on Silcor 575 liquid-applied polyurethane waterproofing membrane (th.gcpat.com) over the stucco finish. Then they applied a rolled-on coat of Silcor Top Coat 80 finish, followed by a sprayed-on texture coat. Later, the deck surface was spray-painted to match the finishes on the rest of the house.

Exterior Details

With the roof deck installed and the living space below fully protected from weather, our next task was to strip back the remaining stucco on the gable end wall and prep the framing for the new bi-fold patio doors to replace the small windows in each upstairs bedroom. In addition to framing the new rough openings for the doors, we installed T-straps and other metal hardware to reinforce the wall. At the same time, we stripped the stucco from the lower level so we could access the wall framing to let in diagonal bracing, part of the package of seismic retrofits included in the project.

To make room for a new direct-vent gas fireplace for the rooftop deck, we reconfigured an existing chimney chase, which contained the vent for a gas fireplace in the living room. Instead of being oriented vertically, the new chase is framed as a low wall, providing the deck with a little bit of visual separation from the neighbors.

The new LaCantina bi-fold doors (lacantinadoors.com) were specced to match the home's existing doors on the ground floor and were installed by the window and door supplier. After the doors were fitted and flashed, our crew returned to insulate the wall cavities, staple up a double layer of building paper integrated with the door flashings and other wall flashings, install the metal lath, and apply a traditional three-coat stucco finish to the walls and chimney chase.

The original plans called for a spiral staircase for access from the ground level to the upper deck, but the city building department asked for a more robust, seismically reinforced design. Our solution was to install a grade beam at the lower landing as well as a pier foundation for the upper landing, frame the landing like a moment frame, and connect the lower and upper landings with stringers cut from four 4x14 treated Douglas fir beams. After we installed plywood treads and risers, the stairs received the same stucco and Silcor finish as the roof deck, creating a dry space for storage underneath (**Figure 3**).

Figure 3. To seismically reinforce the stairs, workers connected a grade beam at the lower landing to the moment-framed upper landing with stringers cut from 4x14 treated Douglas fir beams (A). The chimney was reconfigured to make room for a new direct-vent gas fireplace for the rooftop deck and reframed as a low privacy wall (B).

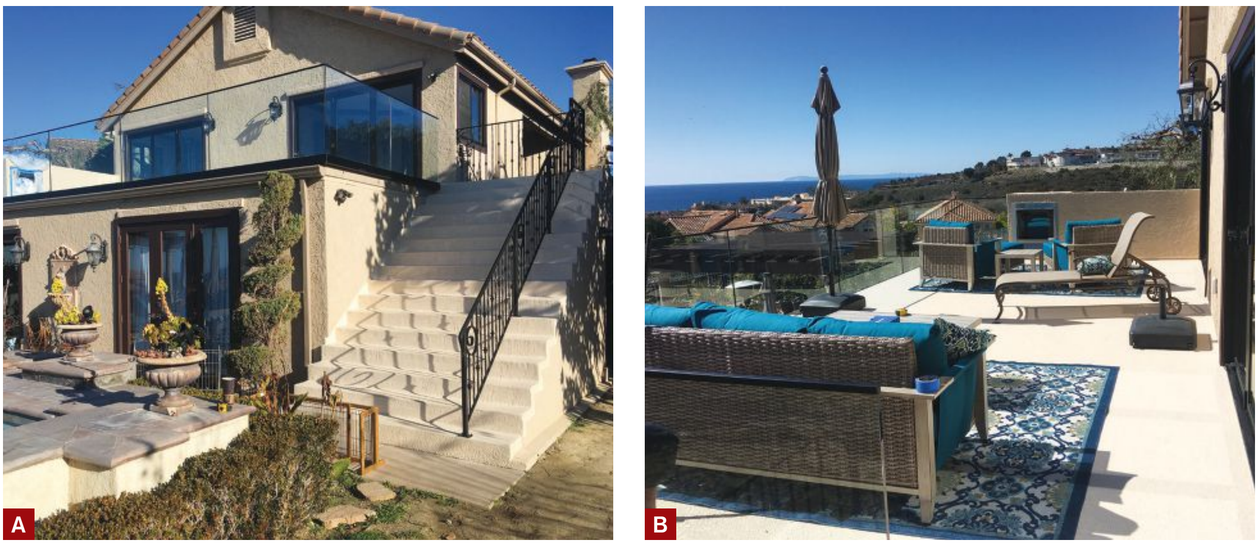

Figure 4. The stairs received the same stucco and Silcor finish as the roof deck, followed by a fire-retardant paint, creating a dry, nonflammable space for storage underneath (A). The stairs were fitted with a wrought iron railing, while the deck's custom-fabricated glass-panel guard system preserves the views of the Pacific Ocean (B).

Finishing Touches

Because the home is located in an area that the city of Dana Point has designated a Very High Fire Hazard Severity Zone (VHFHSZ), certain construction elements applied to the project. While a retrofitted sprinkler system wasn't required, the deck surface had to qualify as an ignition-resistant or noncombustible material per SFM Standard 12-7A-4 and 12-7A-5 in the California Building Code. We supplemented the three-coat stucco walking surface and new stucco wall surfaces with a fire-retardant paint (**Figure 4**).

To avoid obscuring the ocean views in any way, we installed a custom-fabricated glass-panel guardrail system, which is supported by fascia-mounted brackets. On the stairs, we installed a custom-fabricated wrought iron railing to match the home's existing gates and fences. Lastly, we installed the new direct-vent fireplace. ❖

Edmund Bourke has owned Bourke Construction in Orange County, Calif., since 1996.


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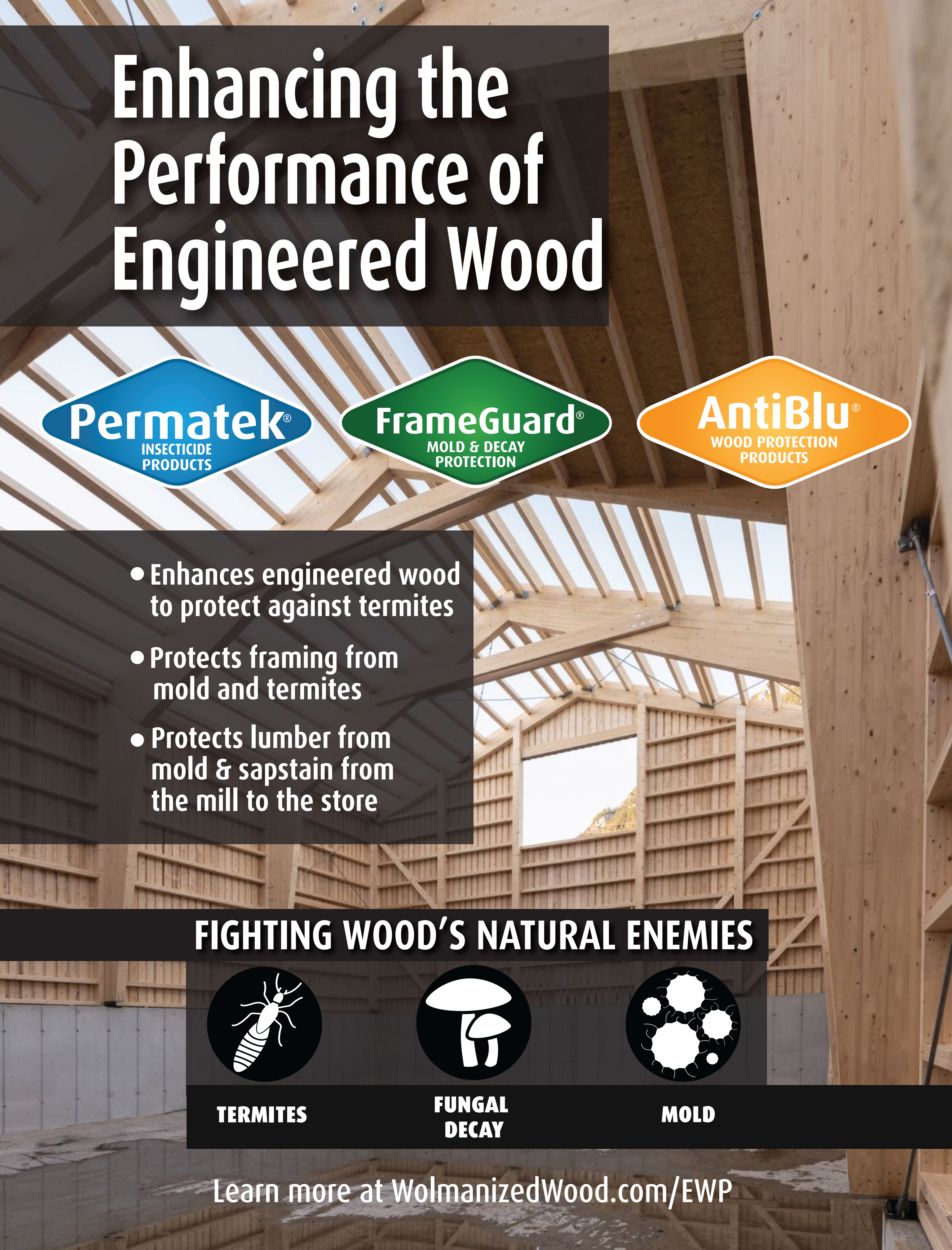
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PHOTOS BY NEW DIMENSION CONSTRUCTION

Durable Wood Fencing

A pinned post connection makes for a longer-lasting wood fence

by Ryan Labrenz

Finishing up a recent remodeling project, my company, New Dimension Construction, was tasked with installing custom-built cedar fencing around the home's newly installed in-ground pool and garden area. The homeowners preferred to use wood instead of more durable materials for aesthetic reasons and chose a fence design made from western red cedar and heavy-gauge galvanized wire mesh.

Our chief concern with using wood for the fencing was its lifespan; namely, we didn't want to embed the posts in concrete and have them prematurely fail within 10 years and thus waste a large amount of expensive cedar. Also, the site had slow-draining clay soils, which had the potential to rot embedded posts at an even faster rate. To increase the longevity of the fencing, we decided to pin the cedar posts to concrete pier footings with lengths of 2-inch galvanized water pipe.

Durable posts. The fence design called for 40 4x4 cedar posts for the pool enclosure, and 15 4x4s and 16 6x6s for the garden area. To accomplish our pinned post detail, we needed to bore large holes into the end grain of each cedar post—something easier said than done.

To hold the 4x4 posts while we bored the holes, we built a big three-sided jig out of scrap 2-by stock, which we used as a giant drill press. We first screwed two 2x4s on end to a 2x10 to act as guide rails. Then we cut a pair of $3\frac{1}{2}$-inch-square 2-by blocks with holes drilled in the center large enough for a 24-inch-long drill bit extension to run through. We

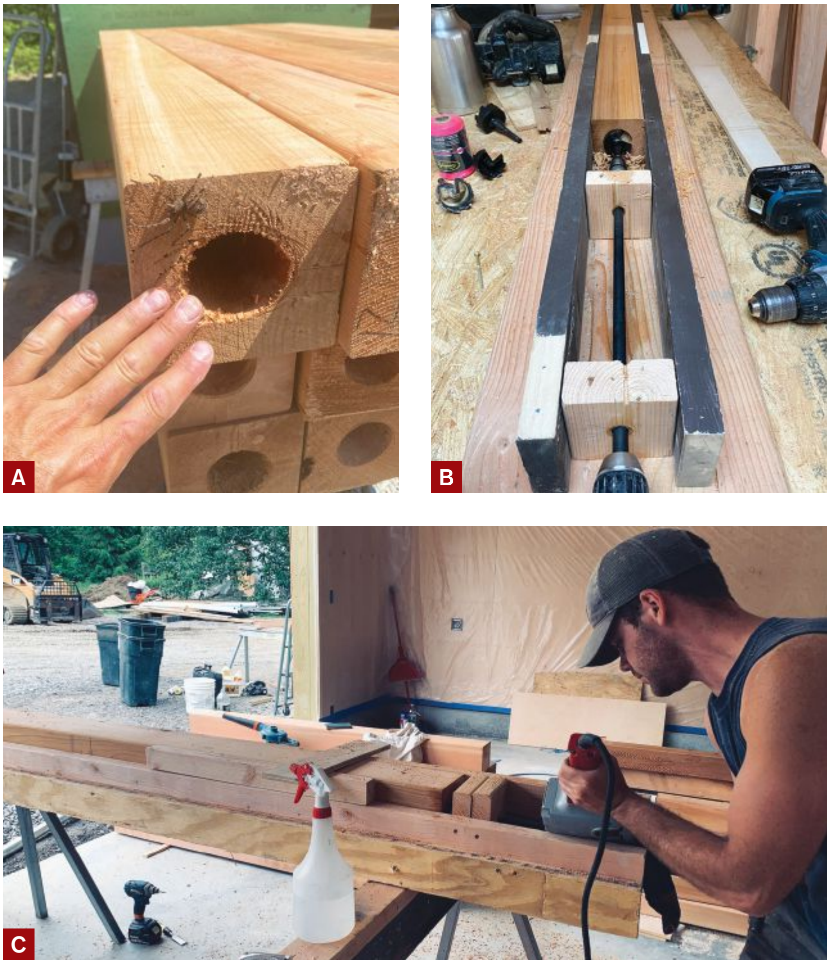


Figure 1. Large holes were bored through the end grain of the posts for piping that would pin them to concrete footings (A). A three-sided jig with a 2-by set block and a sliding 2-by block acted like a giant drill press (B, C).

Figure 2. Before sliding the 2-inch hot-dipped galvanized piping into the cedar posts, workers brushed Gorilla glue onto the pipe ends (A). With the post assemblies standing up against a wall, gravity did the work of settling the wood onto the steel (B).

screwed one of the blocks about 2 feet up from the end of the rails to act as a fixed point, while the other block served as a sliding guide for the drill as we plunged into the end grain of a post. We placed a post between the 2-by rails, set it against a stop at the opposite end of the jig, and started augering (**Figure 1**).

To bore out the holes, we used a 2 1⁄4-inch-diameter Forstner bit (which was slightly larger than the pipe's 2 1⁄8-inch diameter) attached to the extension rod and a corded drill. We had to apply a fair amount of pressure to bore out the holes and took our time plunging into the posts.

We made a similar, larger jig with 5 1⁄2-inch-square 2-by blocks to bore out the 6x6 posts for the garden.

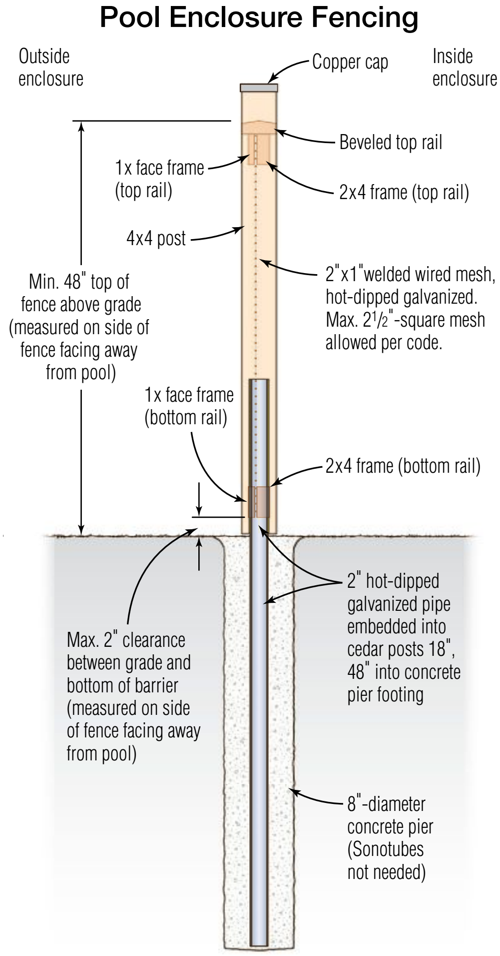
Bonding wood to steel. The 2-inch hot-dipped galvanized water pipe came in 21-foot lengths, which we cut up into 66-inch lengths for our pins; we planned to embed the galvanized piping 48 inches into concrete pier footings and 18 inches into the western red cedar.

To assemble the posts, we first applied Gorilla glue with a paintbrush roughly 18 inches up one end of the pipe. To activate the adhesion of the glue, we sprayed some water into the bored-out hole. The Gorilla glue acted as a lubricant, so we were able to slide the piping into the cedar relatively easily (**Figure 2**).

We stood each post assembly vertically against a wall to let gravity do the work of settling the wood onto the steel and moved onto the next post. After curing, the resulting bond was rock-solid and through-bolts were not needed to make the connection stronger.

Fence installation. Prior to marrying the steel pipe and wood together, we cut the 4x4 and 6x6 cedar post stock long so we'd be able to trim the post heights level to one another after installation. Although the pool and garden areas were fairly level, we wanted to account for any slight variations in the terrain and drilled-out pier footing depths.

Pool Enclosure Fencing



At pool enclosures, fencing needs to be a minimum of 48 inches tall with no more than a 2-inch gap at the bottom of the fence as measured from outside the fence, according to New York state code (illustration, above).

Figure 3. A Toro Dingo with an auger powerhead (A, at left) bored 8-inch holes for the post footings. After installation, the posts were trimmed level with a portable 6-inch battery-powered band saw (B).

Figure 4. Alternating 6x6 and 4x4 cedar posts were installed in the garden area; here, they have been aligned, plumbed, and braced, and are ready for concrete (A). In this area, the fence design required taller, 6x6 cedar posts with three stainless steel cables run between them at the top to prevent deer from bounding into the garden (B).

ILLUSTRATION BY TIM HEALEY

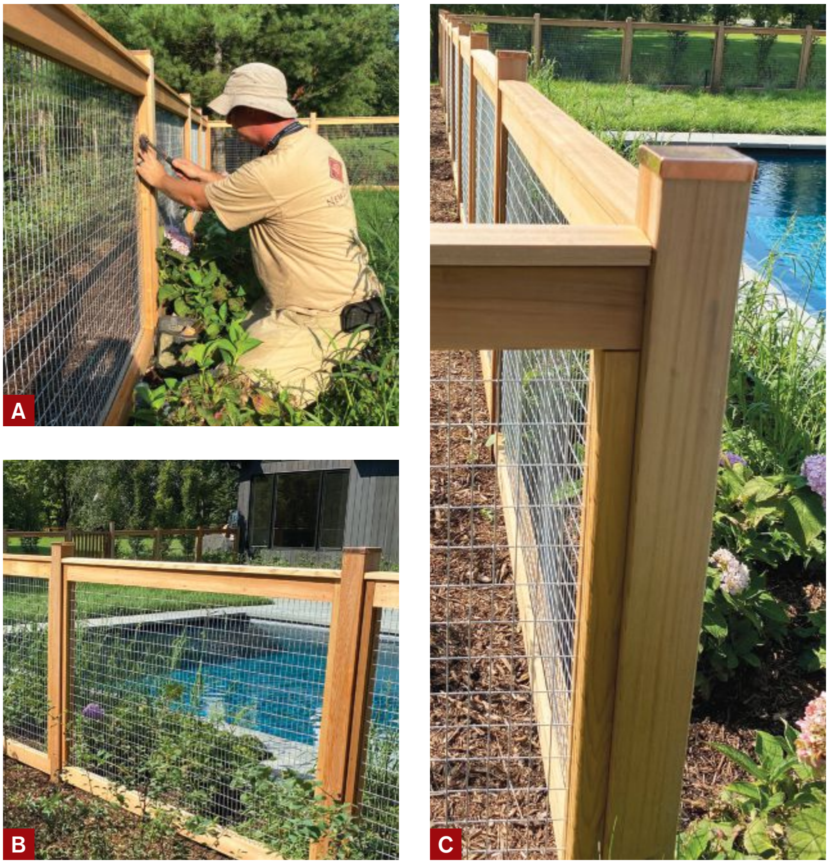


Figure 5. Workers prefabricated cedar fencing panels, sandwiching galvanized welded wired mesh between a 2x4 frame and a 1-by face frame, and then fastened them to the posts with stainless steel screws (A, B). The posts were topped with site-fabricated copper caps (C).

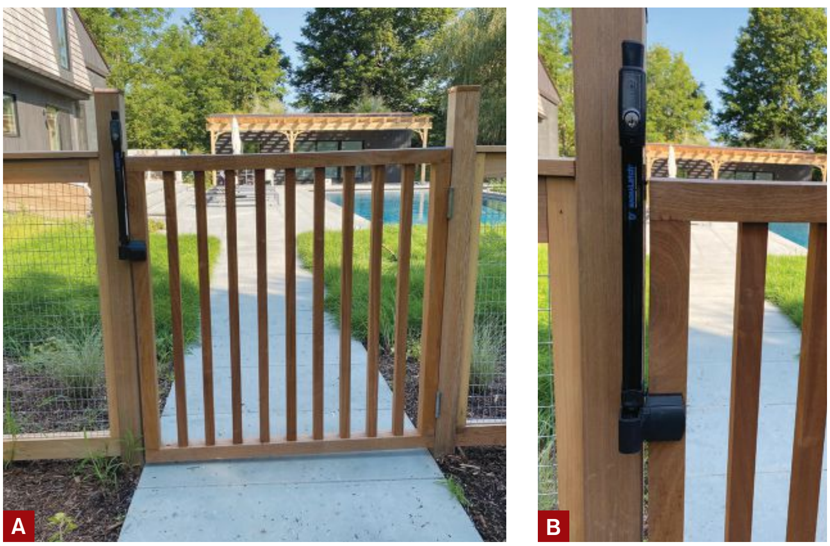


Figure 6. To meet code, the pool's access gate is equipped with self-closing hinges that swing away from the pool (A) and a locking Magna-Latch (us.ddtech.com) mounted 54 inches above ground level (B).

We hired a local fencing company to help us install the fence posts. The company has a Toro Dingo (toro.com) with a high-torque auger powerhead, which made quick work of boring 8-inch-diameter holes in the clay soils for pier footings. We worked hand and hand with the fencing workers to make sure the posts were perfectly aligned and plumb, and we helped mix and pour the concrete for the pier footings (two 80-pound bags of Pro-Grade Sakrete per hole) (**Figures 3, 4**).

Pool enclosure fencing. For the pool fencing, we made panels by sandwiching welded wired mesh (mcnichols.com) between a 2x4 frame and a 1-by face frame (the 2x4 frame would face the pool area). We fastened the hot-dipped galvanized 2-inch-by-1-inch welded wired mesh to the cedar 2x4 frame with 1-inch-long by 1/4-inch stainless steel crown staples and screwed the cedar 1-by face frame over the edges of the mesh to hide the staples (**Figure 5**).

For the top rail, we beveled 2x4 western red cedar stock using a molder in our shop, then secured the beveled rail with construction adhesive and three stainless steel trim-head screws screwed from above. We used stainless steel screws throughout to construct the panels and then attach the panels to the posts.

Pool fencing and code. When designing and building the pool enclosure, we had to adhere to a number of code regulations mandated by the state of New York—see "Pool Enclosure Fencing" on page 20 for critical dimensions. In addition, gate latches needed to be mounted a minimum of 54 inches from the ground, and gates with self-closing hinges needed to swing away from the pool (**Figure 6**). An alarm was also required at the kitchen slider access door to the pool area (an audible voice alarm is activated when the slider door is opened). ❖

Ryan Labrenz is a lead carpenter for New Dimension Construction, in Millbrook, N.Y.

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PHOTOS BY MATT HISSONG

The Eighth of an Acre Deck

by Andrew Wormer

Matt Hissong worked as a lumber salesman from 2006 to 2020, but he's always been a builder at heart. So when pandemic-related changes in the industry led him to reconsider his life's path, he was ready to leap into his next career. And that's exactly when he says a once-in-a-lifetime building project landed in his lap. Shown here is a 5,290-square-foot ipe deck that he recently built, but it's only the tip of the iceberg.

While a structural engineer sized the piers, steel beams, and framing for the deck, the owner gave Hissong free reign to design the overall project, which includes a pool, a timber-framed pool house, a domed vault over a grotto, and other water features seen more often in a theme park than in a residential project; we'll feature it in a future *PDB* article.

With Hissong's extensive experience in the industry, he was comfortable specing Pacific Woodtech's new pressure-treated LVLs (pacificwoodtech.com) to frame the deck **(A)**. Workers prefabricated 83 ¼-inch-square ipe decking panels in Hissong's shop, fastening the ipe to pressure treated 2x4 frames with ¼-in. x 2-in. U2 construction screws (U2fasteners.com) driven through the frame into the back of the decking **(B)**. To avoid exposed fasteners, Camo Edge deck screws (camofasteners.com) were used where decking was installed in the field.

To preserve the trees on the site, the deck includes generous tree wells **(C)**. After the deck panels were installed, workers trimmed the wells with ipe, then dropped in custom-fabricated stainless steel grates supported by cleats **(D)**.

Workers prefinished the decking when fabricating the panels, but the finish didn't adhere well to the ipe. So after installation, the crew stripped the old finish and applied Penofin penetrating oil finish for hardwoods (penofin.com) **(E)**. ❖

Andrew Wormer is JLC*'s executive editor.*


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BY VINCENT SALANDRO

1. Easy-Install Outdoor Kitchens
Manufactured using glass-fiber-reinforced concrete for durability, Signature Kitchens and Outdoor Cabinets from Kindred Outdoors and Surrounds can be installed on any solid flooring surface without footings or rebar in a single day. Signature Kitchens are a collection of pre-designed, customizable, lightweight building blocks, cabinets, bolts, and end caps. Outdoor Cabinets can be purchased individually for custom configuration. Pricing varies. mykindredliving.com

1

2. Powder-Coated Aluminum Decking
Nexan LockDry decking's powder-coated aluminum construction prevents rotting, cracking, and warping and requires no painting, staining, or waterproofing after installation. According to Nexan, LockDry stays cooler than most composite decking products in extreme sun exposure and supports up to 240 pounds per square foot of live load for heavy snowfall. Fireproof and noncombustible, the decking does not emit any toxic fumes. Contact Nexan for pricing. nexaninc.com

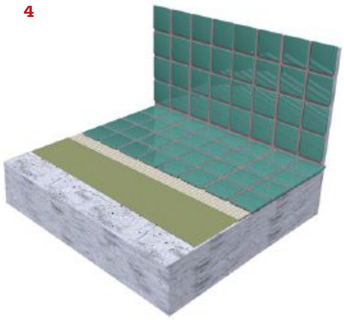
2

3. HFC-Free Sealant
Froth-Pak Spray Foam Sealant from DuPont is a two-component, quick-cure polyurethane foam that fills penetrations and cracks in rim joists, at roof-wall junctions, and around pipes and ducts. The HFC-free foam seals out moisture, dust, allergens, and pests while its application nozzle reduces overspray. DuPont says the spray foam delivers a global warming potential reduction of more than 99% compared with current formulations. Pricing varies by size. dupont.com

3

4. Tile Waterproofing Solutions
Laticrete has expanded its waterproofing and crack-isolation portfolio with two products, Hydro Ban XP and Hydro Barrier Plus. Hydro Ban XP is designed for use in all waterproofing applications and cures at 35°F or above. The product's lighter color helps with visibility for inspection in dimly lit areas and offers contrast for chalk and laser level lines. Hydro Barrier Plus is a load-bearing, self-curing, liquid rubber polymer that forms a seamless waterproofing, anti-fracture membrane without the need for fabric reinforcement. Sold in gallon pails, Hydro Barrier Plus and Hydro Ban XP cost $80 and $100, respectively. laticrete.com

4



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5. Standing-Seam Metal Cladding

AEP Span's Select Seam Shingle Cladding is a traditional 22-gauge-metal standing-seam profile. The cladding, available in 12- and 16-inch-wide panels in lengths starting at 8 feet, can be installed vertically on solid substrates; staggering the lengths provides a shingle look. According to AEP, the cladding is code-compliant for wind uplift, air infiltration, and water infiltration. Contact an AEP representative for pricing. aepspan.com

6. Thin-Profile Cable Fencing

DSI aluminum cable fencing combines aluminum posts and rails with thin vertical stainless steel cables and aluminum pickets, allowing for minimally obstructed views of the surroundings. The fencing comes in preassembled and tensioned sections to ease installation. According to the manufacturer, its 10-step powder-coating system is PCI 4000 certified and provides a lasting color finish that can resist fading. The fencing is available in two-rail or three-rail designs in twelve standard colors in addition to textured or satin finishes. Contact a local distributor for pricing. diggerspecialties.com

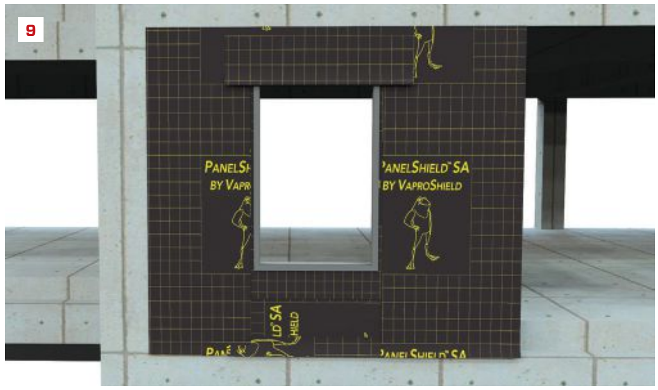
7. Nailable Composite Stone Veneer

Lightweight and easy to install, Evolve Stone Mortarless Series Stone Veneer can be used for both interior and exterior applications. Formulated from the company's stone and glass-fiber composite, the veneer can be face nailed with stainless-steel finish nails using a standard finish nailer. According to the manufacturer, the veneer holds its color throughout, can be cut to fit on-site, is moisture impermeable and UV resistant, is not impacted when exposed to salt spray or freeze/thaw cycles, and performs well under wind loading. It's available in five designs and four colors. Pricing varies by region. evolvestone.com

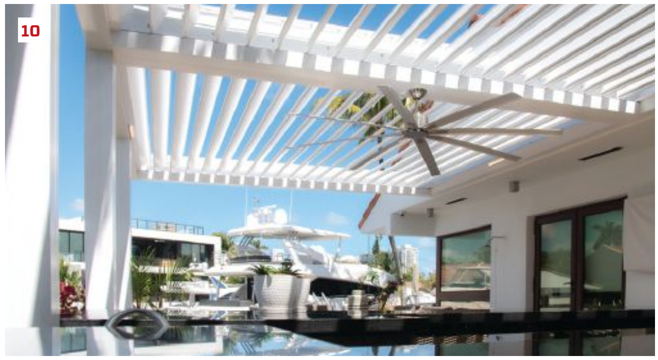
8. Decorative Post-Base Wrap

Simpson Strong-Tie's new decorative four-piece post-base wrap fits around most nominal 4x4 and 6x6 post bases; it also can be wrapped around posts without bases. Fabricated in black composite, the APBDW Outdoor Accents wrap features the arched profile of Simpson Strong-Tie's Outdoor Accents Mission Collection style. We found one for a 6x6 post for $62 online. strongtie.com

9. Polyester WRB Membrane
PanelShield SA from VaproShield is designed for use behind closed-joint screen cladding assemblies. The product is composed of a proprietary polyacrylic coating on spun-bond fabric with a specially formulated adhesive that ensures membrane adhesion on multiple substrate types, including plywood, OSB, gypsum sheathing, concrete, and steel. PanelShield SA does not require a primer. It can be installed in any weather conditions, including in temperatures below freezing, and can be exposed for up to 12 months before being covered by cladding. Contact a distributor for pricing. vaproshield.com


9

10. Automated, Adjustable Pergola
Azenco's R-Blade adjustable roof pergola can be equipped with an automated louvered roof system that uses sensors to determine when to open or close: a wind sensor for strong winds, a rain sensor, and a temperature sensor in case of snow or frost conditions. The roof is made with twin-wall aluminum louvers to achieve strong sealing and resistance, and the posts feature an invisible gutter system to keep the area under the roof dry. Contact a distributor for pricing. azenco-outdoor.com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11. Energy Star Dehumidifier
The Aprilaire Ventilating Dehumidifier combines an energy-efficient dehumidifier (model EE100V) with a damper plenum (8190FF). Aprilaire says the system can minimize virus survival rates, prevent mold and mildew growth, minimize air-conditioning calls, and help protect wood furnishings and floors, while exceeding code requirements for fresh air to reduce moisture issues. Recognized by Energy Star for efficiency, the ventilating dehumidifier costs approximately $1,800. aprilairepartners.com

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12. Panelized Stone Cladding
Qora Cut LedgeStone TightStack exterior cladding is composed of a foam core, a fiberglass-reinforced compound, and stone materials. Available in 48-inch-by-18-inch and 48-inch-by-36-inch panels, the lightweight system can be installed using general carpentry tools. Three color patterns are available to complement vinyl, wood, or fiber-cement siding exteriors. The cladding does not burn and will not rot, buckle, or delaminate over time, according to Qora. Contact a distributor for pricing. qoracladding.com


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Paslode XP Cordless Framing Nailer

BY TIM UHLER

Paslode used to make the only hoseless framing gun available, but over the last decade, quite a few more guns have come onto the market. To compete, Paslode has once again updated its gas-powered nailer (introduced as the XP in 2015), and I've been using the newest version for a few months.

When I reviewed the XP nailer for *Tools of the Trade* in 2015 (see "Field Tested: Paslode's Cordless XP Framing Nailer," jlconline.com), I gave it excellent marks because of how well it performed. In our testing then, we shot through three boxes of nails and two gas canisters without a single jam or misfire and had no trouble shooting into LVLs. For blocking and pickup work, the gun was plenty fast, and the aggressive nosepiece made it easy to toenail accurately. The latest version of the XP shares all of these characteristics.

So what's new? Before sitting down to write this review, I compared the 2015 model with the 2021 model, and the only significant difference in operation I found is that I can load the magazine before pulling back the slide. But I'm not irritated at all to be reviewing a gun that is nearly identical to the gun I reviewed six years ago. That just means Paslode got it right then and has now made a great gun a little better.

Since this gun is gas powered, it requires fuel and a spark, but the tiny, 7-volt lithium-ion battery is very light, as are the gas canisters, which are widely available. Paslode claims that a canister of gas will shoot up to 1,200 nails, and that a battery will last 9,000 nails. What I found is that I never ran out of fuel before I used up the nails in a box and canister combo.

Performance. It is true some battery-powered nailers are very fast. Paslode claims this gun (sequential trigger only) shoots three nails per second. I don't care what the actual number is; it shoots as fast as I nail, which is good enough for me.

Photos: Tim Uhler

Paslode's cordless CFN325XP framing nailer is light at 7.2 pounds and compact enough to easily fit inside framing bays, making it ideal for installing blocking and other pickup work (left). It has an aggressive nosepiece that prevents the nailer from slipping when toenailing, and tool-free depth-of-drive adjustment (right).

What I have always loved about Paslode is the quality of its fasteners. These are the only gun nails that don't bend when I shoot them into an LSL (don't get me started on how much I loathe LSLs). Even when I've reviewed battery-powered nailers from other manufacturers, I've bought Paslode nails. One caveat: Check to make sure that the offset full-head nails will meet your local codes.

Weight. Even when loaded with a strip of nails, the gun weighs in at right around the 7-pound-6-ounce mark—about 4 pounds less than comparable battery-powered nailers on the market. That matters because when I hang the gun from my bags, I'm not lopsided. It means when I frame overhead, I cause less wear and tear on my shoulders, and the list goes on. And the recoil is light, so there's little shock to my wrist when I use it.

This is important to me; I'm nearly 44 years old and have always worked in the trades, specifically framing, foundations, and siding. Choosing tools with a view to staying healthy cannot be oversold. I love this gun and recommend it.

I've used this gun in its different iterations for the last 20 years as a pickup framing gun, and it just keeps getting better. Consumables aren't cheap, but then again, nothing is anymore. Online, the gun retails for $390. paslode.com

Tim Uhler is a lead carpenter for Pioneer Builders in Port Orchard, Wash. He is a contributing editor to JLC. *Follow him on Instagram at @awesome framers, subscribe to his YouTube channel, or visit his website at awesomeframers.com.*

The Paslode XP nailer has a big rafter hook that rotates so that the nailer can also be hung from a tool belt.

Multipurpose Prescription Safety Glasses

BY TOM O'BRIEN

I'm a working carpenter and a serious bicyclist who's nearsighted as well as astigmatic, so I've come to depend on an assortment of prescription eyewear to correct my vision and protect my eyes: safety glasses for the job, wraparounds for the bike, sunglasses and "attractive" frames for leisure wear. Recently, when my optometrist changed my prescription, I set out in search of a frame that was capable of multitasking. My quest was rewarded when I discovered Wiley X (wileyx.com). This company was founded in 1987 to manufacture eye protection for military personnel, but it later branched out to serve blue-collar workers and outdoor sporting enthusiasts.

What sets Wiley X apart from competitors is that every product it makes meets the ANSI Z87.1 safety standards and is classified as personal protective equipment (PPE). As a bonus, even its wraparound frames can accommodate a strong prescription like mine.

I chose the company's P-17 model outfitted with transition lenses so I could dispense with sunglasses. After using them for six months on the jobsite, I can say without hesitation that these are the best prescription safety glasses I have ever worn. The wraparound lenses afford a super-wide field of view and seem to deflect airborne debris as well as or better than side shields—with none of the dork factor.

On the jobsite, my only complaint is the time it takes for the transition lenses to lighten when I go inside after being out in the sun. If someone were going to wear these glasses only on the job, I would recommend clear lenses. But for my multitasking needs, I can live with this minor annoyance.

Wiley X P-17 prescription safety glasses (top left) feature an impact-resistant wraparound frame that does not require side shields. Choosing transition lenses (which darken in sunlight) enabled the author to retire the assortment of frames and lenses (bottom left) he used to rely on for work and sports.

Wiley X sells directly to consumers and through dealers. I bought my glasses from SportRx (sportrx.com), whose excellent customer service people steered me toward the model I purchased. The frames are available in different colors, and the cost for a prescription pair starts at $155 on Wiley X's prescription website, wileyxrx.com.

Tom O'Brien is a freelance writer and a restoration carpenter in New Milford, Conn., and a frequent contributor to JLC.

Photos: nailer, Tim Uhler; glasses, Tom O'Brien

Metabo HPT VB3616DA Cordless Rebar Cutter/Bender

BY JOHN CARROLL

The Metabo HPT VB3616DA Cordless Rebar Cutter/Bender is a battery-powered version of the manufacturer's corded cutter and bender (the Metabo HPT VB16Y). Although it has cut the cord, the folks at Metabo HPT maintain this battery-powered version performs even better than the VB16Y, attributing this enhanced performance to a new brushless motor as well as the powerful 36-volt MultiVolt battery.

In use, the new bender/cutter delivers on this promise. After I measure, mark, and align rebar up to 5/8 inch thick (that is, #5 rebar), the cutter breaks the piece cleanly in a few seconds. The manufacturer claims that the tool will deliver up to 270 cuts in #5 grade 60 rebar on a single charge (I did not test this).

The bending feature is even more impressive. Here, Metabo promises a whopping 520 bends in #5 rebar per charge. Like the cutting operation, the bending function takes just a few seconds per bend.

The precision of these bends, however, is the main selling point of this tool. It has a dial that you can set to any angle from 0 to 180 degrees. But it doesn't stop there. You can fine-tune the bends a degree or two at a time with the dial until you get the exact angle you need. There are other, less-expensive electric bending tools available, but none of them offer this kind of precision.

The crisp 90-degree angles I got really sped up the process on a footing I did recently. In the past, I'd bend the steel, place it in the trench, and invariably have to take it out and rebend it to make it fit the footing. I'd often go through this time-consuming and annoying routine a few times before I'd get it right. With this bender, the steel followed the corners correctly on the first go-around.

The Metabo HPT VB3616DA is the only battery-powered cutter/bender on the market. The list price for the cutter/bender, two 36-volt 4.0-Ah batteries, a charger, and a case is $2,400. This is $400 more than the corded version, so if you anticipate having power readily available on all your jobs, you can save money by going with the original, corded model. If you're willing to fork over the additional $400, though, you'll avoid the hassle of running a cord and still have plenty of power for any residential job. metabo-hpt.com

John Carroll, author of Working Alone*, is a builder who lives and works in Durham, N.C.*

Powered by either a 36-volt MultiVolt battery or an AC adapter (sold separately), the Metabo HPT rebar cutter/bender cuts and makes precise bends in up to #5 rebar.

Photos: John Carroll

BY CHRIS MILANESI

Building Durable Equestrian Jumps

1


2


3


I've specialized in the design and construction of jumps used in competitive horse trials—or "eventing"—since 1974. An Olympic sport, an eventing competition is best described as an equestrian triathlon where paired horse and rider teams compete in three riding disciplines: dressage, stadium jumping, and cross-country jumping. (I've had the great fortune of being part of the equestrian building team for both the 1984 Los Angeles and 1996 Atlanta summer Olympics).

During the dressage phase, the rider and horse must illustrate a graceful partnership through a sequence of movements on level ground, while the show-jumping portion tests the pair's precision as they clear a course of fences. Cross-country jumping challenges the bravery and fitness of the horse and rider as they navigate a series of obstacles and varied terrain. The team must complete each riding discipline and competitors accumulate penalty points in each phase. The pair with the lowest score wins.

Portable jumps. The biggest part of my business as an equestrian contractor is building the cross-country jumps used in eventing competitions. There are two types of cross-country jumps, permanent and portable. Permanent jumps feature items such as lined ponds, ditches, and fixed structures (typically log posts set into the ground with a horizontal log strapped to them). Portable jumps vary from 24 to 42 inches high by 8 to 16 feet long and are moved around with tractors **(1)**.

Built to withstand a blow from a jumping horse and to live outside year round, portable jumps are made out of durable materials such as pressure-treated wood, common residential siding products, and with increasing frequency, synthetic trim and roofing—cellular PVC and faux slate and shakes.

I construct the jumps out of heavy-duty ribs made from 2-by and 4-by pressure-treated stock attached to 4x6 skids (two long pieces of pressure-treated wood that are essentially the foundation of the jump). I use a mixture of screws, metal clips, plates, and ties from FastenMaster and Simpson Strong-Tie to tie everything together before I sheathe the structure **(2)**.

Keeping up to date. I make it a point to attend JLC Live yearly to visit manufacturer's booths, on the lookout for new connection hardware and fasteners as well as new, durable building materials I can use to highlight my jumps. I recently completed a barn structure using Versatex PVC trim. I routed grooves in the pressure-treated 2x6 roofing to simulate three-tab shingles, prior to applying a stain finish **(3)**.

Chris Milanesi is an equestrian contractor from Old Chatham, N.Y. He is a long-time JLC *subscriber and JLC Live attendee.*

Photos: (1) Joan Davis, Flatlandsfoto.com; (2, 3) Chris Milanesi

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