Building a Freestanding Deck

Solid bracing and strong connections are the keys to a durable, bounce-free structure

by Jim Finlay

As the owner of an Archadeck franchise in suburban Boston, I've been building residential decks full-time for 18 years. Usually we fasten the deck to the house with a structurally attached ledger, and the house wall provides lateral and horizontal bracing as well as vertical support. But sometimes circumstances force us to build a self-supporting freestanding deck. I don't mean that the deck is all alone out in the yard—just that it doesn't rely on the house for bracing or support. Typically, it touches the house and appears to be connected, but the framing underneath is structurally independent. In this article, I'll discuss the methods we use to stabilize a freestanding deck.

Why a Freestanding Deck?

The house shown on this page is clad with brick veneer. You can't make a structural attachment to brick veneer, and going through the brick to attach

a ledger to the framing behind it is not a practical option. In such a case, a freestanding deck makes sense. But there are other reasons we might choose not to tie a deck to a house. Take, for example, a garrison colonial, where the second-floor framing cantilevers a foot or two past the wall below. Those overhangs are almost never designed to support the additional weight of a deck. We have in fact attached a deck to such a cantilever—we did so for a job just last year. But that was a rare case where the house had been engineered from the beginning to support a future deck, and the house framers had configured the joists, the band joist, and the framing connections for that purpose. Interestingly, they attached the house band to the floor joists with upside-down hangers—since the cantilevered joists supported the band, and not vice versa. But with a conventionally framed garrison house, attaching a deck to the cantilever would be downright dangerous.

I also hesitate to attach decks to concrete block foundations. Concrete is very strong in compression, which makes it good for supporting vertical weight. But it's weak in tension, and bolts set into the 1-inch-thick concrete of a hollow-core block have little withdrawal strength. We've attached decks to block walls on occasion, though; the trick is to install a horizontal 2x6 cleat on the inside, then run bolts all the way through the ledger, the blocks, and the cleat, to tie them together. The cleat acts like a big washer that spreads the withdrawal load across 10 or 12 feet of wall. But we can't always access the back of the block wall; sometimes it's a frost wall that's backfilled on the inside, or often there's a finished basement we'd rather not disturb.

In such situations, it's safer and easier for us to support the deck with another set of braced columns and a beam outside the house, resting on footings set below the frost line. Doing this may add cost, but it avoids some structural traps and

Figure 1. ThruLok screw bolts (A) provide a quick way to assemble built-up girders. They self-tap, like many wood screws (B), and are secured on the back with a wing nut (C).

gives us total control. We can pre-engineer our structure, and we don't have to guess about the house wall's construction or its capacity.

When you separate a deck from the house, you lose some inherent stability—you can feel the difference while you're framing the deck. Sometimes my carpenters will put a few screws into the side of the house to temporarily stiffen the framing while we're working. But for long-term structural stability, we can't rely on a few screws; we have to build the stiffness into the deck's own structure.

Every freestanding deck needs a system of connections strong enough to prevent it from collapsing or breaking apart. But avoiding catastrophic failure isn't enough—beyond being safe, the deck should also *feel* safe. Walking on a deck should feel like walking on the ground. The connections should be tight enough to make the deck act and feel like a single, rigid structure.

Decks can move in three directions: vertically up or down; horizontally parallel to the house wall; and laterally away from the house. Our goal is to provide support and bracing in all three directions (see "Bracing Details," page 44).

Vertical Support

We support our decks on 6x6 columns, which rest on footings set 4 feet below grade (the frost depth in our area). Built-up pressure-treated lumber beams sit in notches in the tops of the columns and are through-bolted into place. In the past we used standard galvanized bolts for this connection, but recently we've switched over to FastenMaster ThruLoks, which self-tap like screws but have a nut on the end that cinches the joint tight (**Figure 1**).

Figure 2. Instead of concrete tube forms, the author uses helical screw piers from TechnoMetal Post (A), which can be installed with a small gas-powered machine and barely disturb the landscape. The piers are capped with a metal post bracket (B); four HeadLok screws secure the post (C).

Screw piers. A while ago I began using a helical pier system from TechnoMetal Post (technometalpostusa.com). These piers have a number of advantages over the more traditional poured concrete Sonotube piers. First, there's almost no disturbance of the soil with this approach—which can be very important to the mason if there's a stone patio under the deck (**Figure 2**). So, for example, before we switched over to helical piers, we would have dug a dozen 4-foot-deep holes for concrete footings for the project shown on the first page of this article. Whether we used a mini-excavator or a Bobcat with a backhoe—or even dug by hand—we would have been left with a lot of large holes to deal with (the hole for a 12-inch Sonotube is at least 18 inches across). We would have had to backfill them with good soil or gravel, then attempt to compact around the piers. A mechanical compactor can compact 6 to 10 inches of material at a time, but it's not going to successfully compact a 4-foot-deep hole. The fill around the footings would inevitably settle over time, which would not make the stone mason happy.

Helical piers are a great solution because there's simply no excavation to disturb the soil. On the same project, the mason came in before we started, dug out the topsoil, put in a 6-inch-thick aggregate base, and compacted it. There was no deck in the way, so he could easily prep the entire 30-by-50-foot area before the pier driver came in. Each pier has a 2-inch-diameter galvanized steel shaft with a screw at the end; the pier driver, powered by an 8-horse motor and hydraulic pump, screws the piers into the earth to a depth of 4 feet or more, disturbing only the 6-inch-diameter spots where the piers enter the ground. At that point we can come in and build our deck, or the mason can lay the patio—the sequence doesn't matter.

Another advantage is that helical piers provide verified support for the load-bearing columns. When I draw a footing plan, I calculate the design load for each footing and give this data to the helical footing subcontractor. The pier machine has a dial that measures the torque as the screw helix spins into the earth. There's a direct relationship between this torque and the soil's bearing capacity. Depending on the helix diameter and the soil characteristics, the screw footings can support from 2,482 pounds to more than 8,000 pounds. The installers always exceed my support requirements because it's so easy to do: They just keep turning the helix in until they reach the torque associated with the bearing capacity that I need, then go a little beyond. On completion, they give me a signed report that specifies the guaranteed load-bearing capacity of each pier they install. I don't even need a footing inspection.

The installers can angle the piers as needed to avoid rocks; occasionally they hit solid ledge, which is fine as it provides

Figure 3. The author's crew installs Y-bracing (A) to resist side-to-side movement parallel to the house. Lateral braces resist movement away from the house; these are installed from each post to the side of a joist (B) or to a block between joists (C).

great support. Often they'll go all the way down to the full 7-foot length of the tube; sometimes the soil is so dense they stop at 4 feet. They cut off the excess shaft length with a small portable band saw, then either bolt or weld a steel post-bracket to the end.

Uplift protection. We attach the columns to the steel brackets with four HeadLok screws, creating a continuous load path that not only supports the weight of the deck but also resists wind uplift.

Y-Bracing

Diagonal 2x6 Y-braces running from the columns to the deck's beams keep the beam-to-column connections square and stable (**Figure 3**). Archadeck's standard details call for such Y-bracing whenever the deck height exceeds 8 feet, but I typically use Y-bracing starting at 6 feet. The Y-braces are installed at 45 degrees and are usually 3 to 4 feet long, depending on the space available; if they're too short, they're less effective.

An attached deck typically has just one carrying beam, to support the outer ends of the joists. A freestanding deck has at least two beams—one next to the house and one near the outside edge of the deck. I place Y-braces at every column-to-beam connection. The Archadeck specs call for each end of the brace to be fastened with a lag screw and two 16d nails. On my decks I substitute a slightly stronger connection, using two LedgerLok screws at each end.

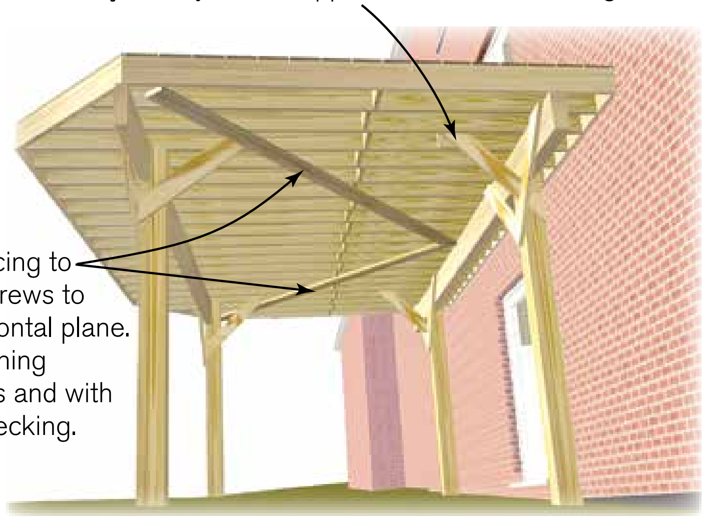
To brace the deck laterally against movement away from or toward the house, we also typically install diagonal 2x6s from each column up to a joist. Ideally the brace aligns with the side of a joist, or lands no more than a 2-by thickness away. But sometimes my carpenters don't think of the bracing when they lay out the deck joists, so that the brace ends up in the middle of the space between two joists; in that case, we fasten the upper end of the brace to solid blocking.

Stiffening the Walking Surface

To stiffen the joists in the horizontal plane, I like to run the deck boards diagonally. A deck that's built with all the decking at right angles to the joist is like a collection of rectangles. Subjected to a sideways force, those rectangles can skew into parallelograms. But if you run the decking at a 45-degree angle to the joists, the members form triangles, which are inherently rigid. We often angle the deck boards for aesthetic reasons anyway—most customers like the look—but it also locks the platform together and keeps the joist system from racking.

V-brace. We've used this method for years, but with the development of composite decking there's a new wrinkle. Much of the new synthetic decking is made with grooves in the sides of each board, and the boards are attached with little clips held in place with screws driven into the joists. It's not a positive connection, though. Under a horizontal force, the deck boards can slide in

Bracing Details



The author installs diagonal braces at the column-to-beam connections on freestanding decks to prevent the structure from racking side-to-side parallel to the house or laterally away from the house. 2x6 V-bracing under the deck joists stiffens the deck in the horizontal plane.

those clips and the deck can rack out of shape. So with grooved decking, or in cases where our client has asked for a conventional perpendicular layout, we attach what we call a "V-brace" to the underside of the joists (**Figure 4**). We run a 2x6 diagonally from one corner to the opposite corner—or, for larger decks, from one corner to the middle of the deck and then back to the other corner. The brace gets screwed to the underside of every joist it crosses, forming lots of rigid triangles.

None of this is required by code, which does not go into that level of detail for decks. We do it for stability, because we want our decks not only to be strong but to feel solid.

Figure 4. Whenever the decking is installed perpendicular to the joists instead of diagonally, the author uses 2x6 V-bracing to resist racking. The V-braces are attached to each joist with two screws. V-bracing is also used with many brands of grooved composite decking, which is typically installed with clips that do not resist horizontal forces.

Alternative Bracing Methods

While Y-braces are the fastest method for bracing the column-to-beam connections, sometimes there are reasons to avoid them—most often because the brace blocks a view. This was the case on the project mentioned earlier (and shown on the first page); the deck was built over a concrete-paver patio, and had a rubberized membrane drainage assembly under the wood decking to shelter the patio from rain. Two ground-level doors, including an 8-foot slider, provided access to the patio, and there was a window as well. The usual array of closely spaced posts with Y-bracing would have interfered with the view into the yard, so we used a different approach: We installed the lateral braces—those running to the deck joists, perpendicular to the house—but omitted the parallel Y-braces and instead used L-shaped and T-shaped steel ties to reinforce the column-to-beam connections (**Figure 5**). We attached the ties with 5/8-inch-diameter lag screws.

Figure 5. In cases where Y-bracing will obstruct views from doors or windows under the deck, the author substitutes rated metal T-straps at column-to-beam connections.

Long span with light steel. At the outer edge of the patio we went a step further and eliminated a column that would have obstructed the view from the patio door. The maximum span I could get between columns with pressure-treated wood, using a triple 2x12 beam, was 11 feet 9 inches. That was okay next to the house, because it put the columns on either side of the 8-foot slider. But further out, a 12-foot span would put a column right in the middle of the patio. I considered a 1/2-inch-steel flitch plate sandwiched between two 2x12s; that would work to span 16 feet, but would cost more than

Figure 6. Using a LiteSteel beam enabled the author to eliminate a view-obstructing post in this deck project (A). Two-by squash blocks (B), secured with ThruLok bolts (C), cinched the connection to the notched post.

$600 and require a crane to lift the nearly 500-pound beam. Instead I used a galvanized LiteSteel beam (litesteelbeam.com), which gave me an 18-foot clear span, cost only $340 delivered, and—this is the best part—weighed only 210 pounds. My two carpenters could handle that (**Figure 6**).

We fit the C-shaped beam into notches on the columns, filled the space between the flanges with PT-wood stiffeners, and through-bolted the entire assembly with 7-inch ThruLoks. We then ran the joists on top of the beam and tied them to the steel beam with the usual Simpson H-series connectors, using self-tapping hex screws (**Figure 7**). We made sure to isolate the treated-wood joists from the galvanized beam with Vycor peel-and-stick flashing, to prevent the copper in the wood treatment from corroding the steel.

All of these braces—Y-braces, lateral braces, V-braces—definitely add time and effort to a deck project. We use these techniques whether we're stabilizing a freestanding deck or building a more conventional attached deck. In the long run, the extra work is worth it: If you properly brace your deck against forces in three dimensions (vertically, horizontally, and laterally), it will better withstand the force of the fourth dimension—time.

Jim Finlay owns Archadeck of Suburban Boston, located in Burlington, Mass. This article originally appeared in JLC *(jlconline.com).*

Figure 7. Carpenters set the joists for the freestanding deck; the band will remain spaced away from the brick veneer wall. Where joists cross the LiteSteel beam, strips of flashing membrane separate the pressure-treated lumber from the steel.