

BY MATT RISINGER



Photos by Alterstudio Architecture and Risinger & Co.

Tips for Building With Board-Form Concrete

Architects drool over it and clients love it, but frankly, board-form concrete can be a little daunting for a concrete sub or a builder. In this article, I am going to discuss some tips I've learned over the years from doing a number of architect-designed homes that have featured board-form concrete walls.

THINK "ART FORM"

Most poured-in-place concrete walls in residential construction are for basements, which have wall surfaces that are either underground or, if exposed on the interior, are considered part of an unfinished space. What we are talking about here is still a structural wall, but it is also a finished surface for aboveground walls.

It's really an art form, or a sculptural process, that accentuates the surface and intentionally highlights the pattern and grain of the form boards. In many ways, board forming is an old technique; it's how all poured concrete walls used to be done before we had aluminum and plywood concrete forms. But it has been revived by architects looking for a dramatic, textured wall finish.

NOT YOUR AVERAGE CREW

A good concrete crew is essential. This is not blow-and-go work, and you need a crew that will listen and

Board-form concrete walls mix well with glass and metal in modern house designs, such as this project Risinger built with Alterstudio Architecture of Austin, Texas (1). The grain and texture of the individual form boards telegraph in reverse onto the surface of the concrete (2). Since you get only one chance at the final pour, Risinger typically builds a mock-up on site (3), allowing the architect to experiment and allowing Risinger to get complete buy-in from the architect and the client.

come up with solutions. Concrete guys know an amazing amount about how concrete behaves and how to get it to do what you want. I'm lucky that I'm able to work with Chris Walcher and the crew at Boothe Concrete here in Austin. It helps that the end product is an art form that features their work. If the job goes as planned, it makes them look good, and the project becomes their art form that we're showing off.

MOCK-UPS

When you eventually go to pour the walls, you get only one chance to get them right, so it is always a good idea to make sure the architect and the client are completely on board with what the finished surface will look like. Is the board pattern what they expect? Does the surface provide the detail and the overall look and feel they envision?

The best way to answer those questions and get complete buy-in from everyone involved is with a mock-up. On this mock-up, we used both sides, modeling a different board width and orientation on each one before settling on a horizontal scheme for this project.

When building a small, freestanding structure for the mock-up, you have to build a super-stout structure, adding many more kickers to hold the bottom and a tighter spacing of wales than you might otherwise use. This also applied to the walls we were building for this project with intermittent, free-standing sections. For each one, the formwork had to be built like a small fortress. The last thing you want is a blow-out of a form to shift position while placing the concrete.

FORMWORK

When we're forming these walls, we need everyone to slow down. It takes two or sometimes three times longer to build these forms than it would using conventional concrete formwork.

We screw the formwork together to lock everything in place. Nails tend to loosen up a little and we don't want any creep in the formwork under the weight of the concrete. Using screws also makes it easier to surgically strip our forms afterwards.

We also miter inside corners, and double- and triple-check that everything is plumb and straight. When building the formwork, you need to always be thinking about what the inside of those boards will telegraph into the concrete. Sloppy work will be immortalized in the concrete for all to see for evermore.

Of all the lumber species we have tried, we have found that Doug fir leaves the most beautiful grain pattern and one that both architects and clients seem to respond to without our having to sandblast



On this project, freestanding board-form wall sections required lots of staked kickers and wales to hold the formwork secure (4). The form builders had to think like finish carpenters, using blue tape to protect the finished slab (5) and mitering inside corners (6).

or otherwise treat each board to accentuate the grain.

When we place the boards side by side, we join the edges with a bead of silicone. This helps keep the water in the mix and keeps the concrete from seeping out between individual boards.

When placing walls over a structural slab that will be used as a finished floor surface, as we did in the house shown in this article, we are careful to tape along the bottom of the wall. We want to prevent the wall concrete from bleeding out over the slab, and we also don't want silicone on the slab, as this can disrupt the slab finish. You almost have to think like finish carpenters, which is a real shift from the usual process of forming and placing concrete.

Form ties are critical. We typically use fiberglass wall ties, even though the more common choice is a steel rod. However, when these are cut flush, the steel stands out against the concrete surface and will rust over time. The fiberglass ties we use (Super Ties by RJD Industries) are grey and blend in, becoming almost invisible once they are snapped-off flush with the surface.

CONCRETE TIPS

We spec a 5-sack, 3,500-psi mix. This is a strong concrete with a high cement ratio. You want that rich cement paste in there to pattern the wood. With this mix, we can run a 5-inch slump instead of the usual 4-inch slump so it will flow well and reduce the chance of honeycombing.

We usually get to the higher slump using plasticizers as an additive to the mix. A plasticizer allows you to keep the water content low, so you get a strong mix, without sacrificing workability.

On pour day, we pump the concrete through a steel wall pipe. You want to be able to reach all the way to the bottom of the form and place the concrete in lifts before pulling the pipe up and pouring another lift. Our crew places the concrete in 2-foot lifts, working all the way across the wall before moving on to the next lift.

Vibrating the concrete is probably the most crucial step. We use two guys with long vibrators that reach all the way to the bottom of the formwork. The trick is to be consistent, but you do not want to over-vibrate, as that will bring aggregate to the surface. To get the detail of the wood, you actually want a high percentage of cement paste at the surface, not aggregate. There is never a guarantee that you will avoid honeycombing, but we give it our utmost and have had good luck for the most part.

Matt Risinger owns Risinger & Company, in Austin, Texas.



On the mock-up for this project, Risinger experimented with different form ties (7). Once snapped-off, a steel tie (8) is conspicuous compared with a fiberglass tie (9). Cutting fiberglass ties flush to the surface can be done quickly with minimal damage to the surrounding surface (10).

Attaching a Deck to a High-Performance House

BY TED CUSHMAN

Since last fall, *JLC* has been following a high-performance custom home project on Peaks Island, in the Portland, Maine, harbor. The designers, Portland architects Kaplan and Thompson, are aiming for compliance with the strict Passive House standard for energy performance. The project's ambitious energy goals, in combination with the building's unique architectural features, have posed a series of technical challenges for lead carpenter Mark Pollard and his crew from Thompson Johnson Woodworks.

The home's parallelogram footprint made foundation work a head-scratcher (see "Customizing an ICF Foundation," Nov/16), and an unusual window-wall bump-out with a reverse-slope shed dormer roof was an even more complex three-dimensional puzzle (see "Roof Framing Challenge," Mar/17).

The latest tricky situation is an outdoor wood deck, which will ultimately serve both as an outdoor gathering place and as a bridge from the main house to an accessory guest house a few feet away.

Supporting the deck at the house isn't simple; the problem is how to provide a structurally sound connection, while still keeping the home's airtight insulated envelope intact.

The home's wall system starts with an inner 2x4 wood frame sheathed with Zip System OSB, taped at the seams with Zip Tape for airtightness. Fastened over this inner airtight framework is an outer insulated shell of wood I-joists run vertically, with the cavities insulated with dense-blown cellulose. There's no precedent for attaching a deck ledger to the flange of a vertical wood I-joist. But attaching a deck ledger directly to the floor framing would have created an excessive thermal bridge.

As a compromise, the builders chose to mount the deck to the house with Maine Deck Bracket hardware. The aluminum deck brackets are highly conductive, but they're spaced at 48 inches on center. And at most of the attachment points, they're bolted into a 5 1/2-inch LVL girder, with cellulose insulation in the floor joist

Attaching a Deck to a Superinsulated Fat Wall

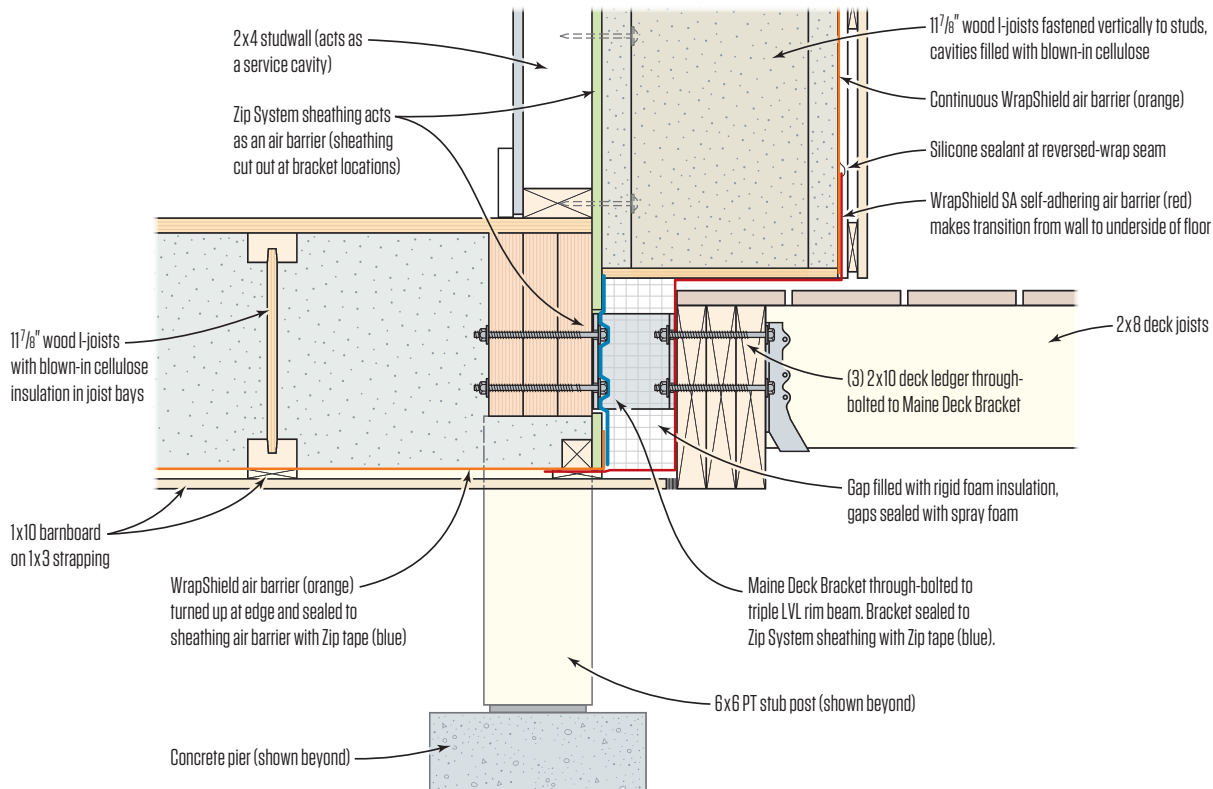


Illustration by Tim Healey

cavities behind that. Above the girder is the wall plate for the insulated 2x4 wall. So heat has to take an indirect path on its way out of the structure. And the crew insulated the space between the deck ledger and the house floor system with extruded polystyrene (EPS) foam, sealing any gaps with gun foam.

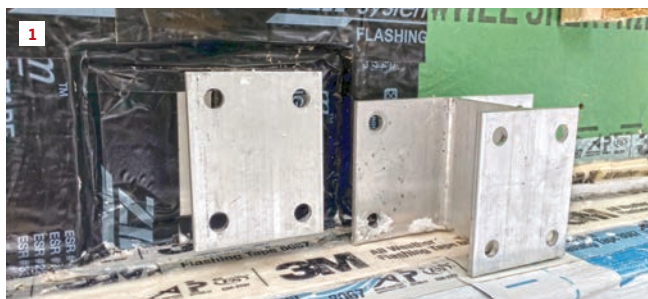
Aside from the thermal bridging problem, the team also had to address the other key problems in any high-performance envelope: air infiltration and vapor transmission. In that regard, the juncture where a wall meets a floor is always an important detail. Attaching a deck to the wall, particularly with a stand-off bracket, adds to the complexity of that problem.

Half of the one-story house sits on a superinsulated full basement, and the other half is a “raised floor” sitting on a pier foundation. The raised-floor part is framed with a triple-LVL carrying beam at the house perimeter; the part over a basement is framed with engineered rim board. The bracket attachment varies in those two locations. To secure the brackets to the rim board at the basement wall, the carpenters drilled through the rim board and attached the brackets using galvanized bolts, with washers and nuts on the inside. But where the brackets are attached to a built-up LVL beam spanning between piers, the nominal 6 inches of framing allows the use of lag bolts.

In either case, it turns out, the Maine Deck Bracket eliminates the need for a complicated connection through the rim joist to manage lateral loads, as required in recent versions of the International Residential Code. But while the hardware may simplify structural issues, it also forced Pollard and his crew to come up with a new set of details to achieve their building-science goals. And building the system on site to meet both the structural and the energy objectives was, Pollard says, “a drawn-out sequence of events.”

The home’s primary air control layer is the Zip System sheathing on the inner 2x4 wall. Joints between panels in that Zip sheathing are sealed with Zip Tape—including where the sheathing laps down over the floor system. But the Maine Deck Bracket’s code approvals require the aluminum bracket to be bolted directly to structural framing, with no sheathing in between. So at every bracket attachment point, the crew had to cut out the sheathing to expose the main house framing.

Where the sheathing was cut out for the brackets, says Pollard, the crew had to seal up the penetration with Zip Tape. That’s tricky, says Pollard, “because now you have to fold that tape in three dimensions, from the sheathing back to the framing, and then back up over the flange of the deck bracket. It’s not fun.” To be sure of an airtight result, the crew first applied Zip Tape lapped from the sheathing down over the beam. Next, they



Above, from top: A view of the Maine Deck Brackets attached at the floor above the perimeter foundation (1). The brackets attached to the Zip-sheathed inner wall of the raised-floor portion of the house (2). Wood I-joists in place above the deck brackets (3). A view from below, showing the vapor-open WrapShield underfloor membrane (4).

Photos: Mark Pollard/Thompson Johnson Woodworks

bolted each deck bracket to the beam over the tape—and then they applied more tape over the deck bracket flange and the bolt heads.

The next step was to install the deck ledger beam. “Each ledger beam is a tripled-up piece of preservative-treated wood,” explains Pollard. “So we put up one 2x10 piece, clamped it to the brackets, marked the holes, drilled them, then took it down and screwed two more 2x10s to it, and then drilled all the way through.”

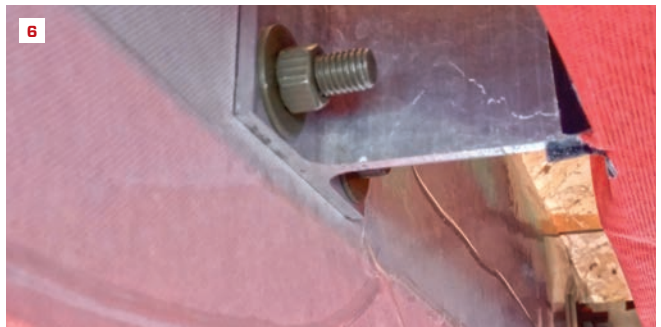
Both the walls and the raised floor of the building have an outer layer of WrapShield airtight, vapor-open membrane applied outboard of the insulated cavity. To maintain continuity of this membrane at the wall-to-floor transition, the crew had to connect the air barrier membrane under the floor to the air barrier membrane on the wall exterior, bringing the membrane behind the deck ledger beam. So before attaching the beam, says Pollard, “we took some of the WrapShield self-adhered membrane and stapled it to the back of the deck ledger beam, leaving 8 inches poking up over the top and poking down past the bottom. Later, that piece would get wrapped up and adhered to the WrapShield on the I-joists at the top, and get wrapped down underneath and adhered to the WrapShield under the floor system, to complete the air barrier.”

This exterior WrapShield membrane forms a redundant air barrier, Pollard says: “The Zip System is our primary air barrier. The WrapShield is a backup.” But without the well-sealed WrapShield to the exterior, the insulation in the I-joist wall cavities and in the under-floor joist cavities would be exposed to wind-washing, which could degrade its performance. So while the well-sealed membrane is not essential to keep outdoor air out of the conditioned indoor living space, it is important for the performance of the insulated wall and floor.

But before sealing the splice between the underfloor membrane and the wall exterior membrane, the crew had to insulate the spaces behind the deck ledger, between the metal brackets. They did this with pieces of extruded polystyrene, cut to fit. “We notched out for the deck bracket mounting bolts,” says Pollard, “and then squirted low-expansion foam in to fill any voids.”

“So that on the back deck,” says Pollard, “there are 12 inches of cellulose in the floor system, there are 12 inches of cellulose in the walls, and there are about 3 inches of EPS between the ledger and the sheathing. That gives us around R-12 or R-13 at that floor perimeter location. So it was a compromise. But it saved us from either having to build a freestanding deck with more footings and piers, or ending up with a more significant thermal bridge at the edge of the floor.”

Ted Cushman is a senior editor at JLC.



Above, from top: The tripled-up ledger beam bolted onto the deck brackets (5). The space behind the ledger, which the crew would insulate with rigid foam and gun foam (6). Plywood attached to the bottom of the wood I-joist buildout, with WrapShield membrane adhered (7). The fully framed deck, with the continuous wall and floor membrane installed (8).

Custom Tapered LVL Roof Rafters

BY TED CUSHMAN

When **Andrew James Gregor** designed this custom renovation in the dry hills east of San Francisco, he wanted to keep the building's profile low, while making the most of the site's expansive views. He also needed to capture and store rainfall on the roof to help with irrigating the landscape.

Gregor's solution was a series of nearly flat roofs stepping down the hillside, with wide eaves to shade the house. The eaves also had to direct rain back toward the house, with gutters at the wall-to-roof intersection directing the rain into a collection system.

Gregor chose LVLs for the rafter system. Wood I-joists would have been cheaper, he says, but LVLs offered the opportunity to build a roof that sloped in toward the house from the wide, overhanging eaves at every side. Unlike wood I-joists, whose strength depends on keeping each member's top and bottom flange intact, LVLs can safely be ripped at the edge, as long as the reduced depth of each piece still satisfies the structure's load requirements.

An architect by training, Gregor used the LVLs to accomplish a visual purpose. "One of the things that annoys me about flat roofs is that they pitch at different angles around the building, and the angle is really weak—like three degrees," he says. "It ends up looking like a twist. So I designed this roof with a fascia that is absolutely level all the way around, and the pitch is all inside the roof." By ripping the LVLs individually on a custom taper from 12 inches in the center to 8 inches at the wall plate, Gregor created a slope of $\frac{1}{4}$ inch per foot in both directions. But at the fascia, the LVLs widen to full width to create a level visual line.

The most complex framing came at the corners, where sloping the overhang inward from both roof edges required tapered blocking and outriggers, assembled into a cross-hatched grid. "My crew called it 'the diamond,'" Gregor says. —T.C.

Custom-ripped LVL rafters create a slope toward the gutter from both the center and the edge of the roof (1). At corners, tapered blocking forms a grid the framing crew called "the diamond" (2). At the fascia, a steeper slope back toward the wall maintains a straight, level sight line (3). Each LVL rafter was individually scribed and cut (4).



Photos: Andrew James Gregor/Blue Dog Construction