Step by Step With Foam Forms

Hands-on installation details for three stay-in-place concrete-forming systems

KEEVA

Fear of callbacks and lawsuits keeps contractors from experimenting with every new building product that comes down the pike. But foam concrete-forming systems are making headway against this conservatism. These "stay in place" systems use proven materials like rigid foam insulation and concrete to form and insulate structural concrete walls in one step.

In this article, three experienced builders describe the on-site techniques they've developed to use these new forming systems.

KEEVA WALL:

Insulated concrete post-and-beam

by Tony Bowler, Hageman, Idaho

If you can imagine building a wall out of giant Legos shaped from expanded polystyrene (EPS), then you already understand the principle behind the Keeva form system. Each 4-foot-long Keeva block measures 12 inches high and 8 inches wide and has a row of 5-inch-diameter holes on 8-inch centers running down the center. When the blocks are stacked, the holes align, one above the other, creating a 5-inch-diameter void from footing to top plate. At floors and at the top plate, we lay in U-shaped bond beam blocks.

When the stacked vertical holes and horizontal channels are filled with rebar and concrete, the result is a concrete post-and-beam structure tightly encased in EPS foam. The system is easy to install and uses one-third less concrete than a full wall; it costs a competitive $4.50 per square foot installed.

Wet-Set Footings

Because the first course of Keeva blocks are wet-set into the footing (see Figure 1) and can't be moved later, we take great care to get the footings and first course level and square. To guarantee accuracy, we attach batter boards directly to the footing forms, setting the tops exactly 11 inches above the forms using a laser level. Then we stretch mason lines across the batter boards to outline the shape of the building.

Three men working together pour and screed the footing, then set the starter course of blocks 1 inch into the wet concrete, aligning the outside corners with the string. We install 150 to 200 linear feet of footing and starter course per hour. With the starter course laid, we insert vertical rebar hooks into selected "post" cells and call it a day.

Stacking the walls. It works best to start laying the blocks at the corners and work toward the middle, staggering vertical joints. Keeva blocks interlock and are self-aligning, and no bracing is necessary at corners. By pressing down and gently slapping the blocks, the interlocking tabs friction-fit together. We build 1,200 to 1,500 square feet of wall per day.

Posts. Determining which cells will receive concrete is similar to laying out a conventional frame, but we always get an engineer's evaluation. Below grade, every cell is filled with concrete and steel. The resulting 8-inch-on-center posts resist the lateral loading of the backfill. For single-story walls above grade, we fill every third cell (16 inches on-center); second-story walls can be on 24-inch centers. Cells beside windows or doors and cells at every corner are always filled.

Beams. We pour a bond beam at each floor level and at the top of the wall, using special U-shaped blocks. Horizontal sections of rebar in the bond beam intersect rebar in the vertical cells.

To adjust walls to an exact height, we trim the last standard course of Keeva blocks by pushing them through a hot wire stretched across a plywood jig. Cells that won't be receiving concrete are stuffed with foam plugs, and the bond-beam blocks are friction-fitted onto the plugs.

Attaching floors and roofs. The concrete posts run uninterrupted from footing to top plate, so floors are hung on ledgers bolted to the concrete bond beams (Figure 2). Horizontal anchor bolts are positioned during the pour; later, treated 2x6 spacer blocks are fitted into cutouts in the foam to keep the ledger from crushing the foam.

At the top of the wall, we bolt pressure-treated 2x6s to the bond-beam course with standard 1/2-inch anchor bolts. The roof structure resists both hurricanes and earthquakes because it's attached directly to reinforced concrete all the way to the footing.

Window and door openings. After the blocks have all been stacked but before the pour, we lay out windows and doors using a felt-tipped marker. An unbroken expanse of wall is more stable during the pour, so we cut out the windows and doors after the concrete is installed. Above the openings, we add additional steel to strengthen the header. To prevent concrete from filling the window area, we block the cells at the header with friction-fit plugs. We fill the blocks under the windowsill by cutting a hole in each cell at the correct height and pumping it full of concrete.

We cut out window and door openings using an electric chain saw. After shimming the windows in the openings, we use polyurethane foam to secure them in place. Since doors take such a beating, we install them in wooden bucks fastened to the concrete with powder-actuated "red-heads" (ITW Ramset/Red Head, 1300 N. Michael Dr., Wood Dale, IL 60191; 708/350-0370).

The pour. We use a pump to fill the blocks with a 2,500-psi 3/8-inch-aggregate concrete mix. A plasticizer brings the concrete to a 6-inch slump, which makes the concrete flow easier without adding excessive water. We make two passes on an 8- to 10-foot-high wall. Once filled, we spot-check the wall for plumb and straightness, install braces where necessary, set the anchor bolts, and clean up.

Blowouts can be repaired on the spot without slowing down the rest of the pour. Remember, we only have to deal with the concrete in a 5-inch-diameter column, not in an entire wall.

Wall finishes. Keeva blocks will accept any type of siding, but I prefer synthetic stucco, such as that made by Retro-Tek (3865 Hoepker Rd., Madison, WI 53704; 800/225-9001), applied directly to the polystyrene. For panel or lap siding that will be mechanically fastened, a wood furring strip or a 20-gauge galvanized metal channel can be attached to the concrete with a powder-actuated fastener. Interior walls can also be stuccoed; for drywall, we use a frame of metal 2x2s that also serves as a chase for wiring.

The Keeva wall has an overall R-value of 24. The envelope is so tight, we install an air-to-air heat exchanger, the cost of which is offset by downsizing the heating and cooling plant. □

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Figure 1. *On the first day, the crew pours the footing, embeds the first course of Keeva blocks in the wet concrete, and sets the vertical rebar hooks. Once the starter course is set, the crew can lay 1,200 to 1,500 square feet of wall per day. Concrete poured into selected cells results in a concrete post-and-beam structure, with columns on 8-, 16-, or 24-inch centers.*

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Figure 2. *Ledgers for the floor systems are fastened to concrete bond beams in the wall. After the concrete hardens, treated-wood spacers are inserted into holes cut in the foam to keep the ledger from crushing the foam.*

LITE-FORM

Figure 3. *Heavy-duty plastic ties are critical to the Lite-Form foam panel system: They connect the panel ends, support the rebar, and hold the panels together during the pour. Because the plastic is so dense, the ties also provide a nailer for drywall and siding.*

LITE-FORM

Figure 4. *To speed construction, the author preassembles Lite-Form panels into 8-foot-high wall and corner sections up to 16 feet long. Starting at the corners, the panels are set against a 2x4 kicker nailed to the footing.*

LITE-FORM

Figure 5. *The foam forms are braced with vertical 2x4s fastened to the wall ties with angle brackets and screws. Plywood gussets hold 2x12 planks that both stiffen the wall and provide scaffolding during the pour. Note the mason's line "stitching" the form sections together.*

LITE-FORM:
Stay-in-Place Sheet System

by Ernie Casados, Pampa, Texas

When I first saw the Lite-Form insulating concrete-form system, I wondered how in the world rigid foam forms could hold the weight of wet concrete and take the stress of the vibrator during a pour. But after using the system on several structures, I wouldn't even consider using standard forming systems again.

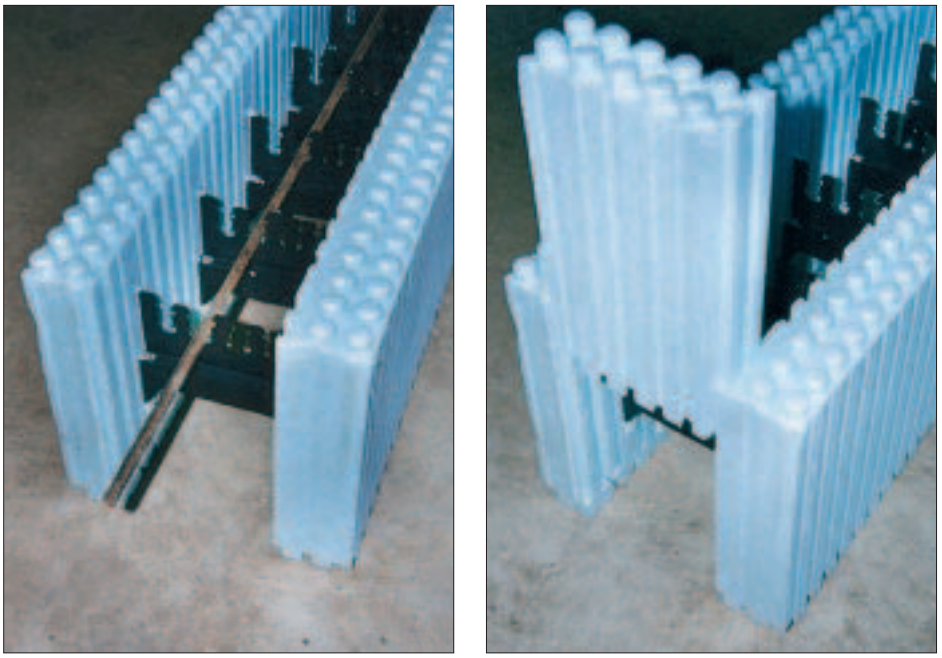
Erecting the Forms

If you've ever set plywood concrete forms, you'll be comfortable erecting Lite-Form. The forms are fabricated by local dealers, who use gang-saws to cut standard 2x8-foot expanded or extruded polystyrene foam panels into planks 8 inches high by 8 feet long (foam brands vary, but all must meet Lite-Form's specs). The plastic ties and water-stop washers at the heart of the system fit into kerfs sawed into the top and bottom edges of the 2-inch-thick foam planks (Figure 3). These ties hold the panels apart, connect panels to one another, provide support for horizontal and vertical rebar, and serve as a nail base for drywall and siding. (With Lite-Form's newest product, called Styro-Form, preassembled 2x8-foot blocks are held together with hinged ties, allowing the blocks to fold flat for easier storage and shipping.)

Footings. We pour a conventional footing reinforced with two pieces of #4 horizontal rebar, then stab in #4 vertical rebar 3 feet on-center. Once the footing cures, we nail down a 2x4 kickplate to establish the outside building line and to act as a buttress for the bottom of the forms.

Stacking the panels. It's possible to assemble the forms one 8-inch panel at a time, but we save time by preassembling 8-foot-high corner and straight sections up to 16 feet long (Figure 4). Where possible, we combine a corner with a straight section.

First, we set the corner sections against the 2x4 kickplate; then we fill in with straight sections, cutting them to length with a handsaw if necessary. The straight-wall sections are "stitched" to the corner sections using nylon mason's line looped several times around the wall ties. After the exterior walls are in



GREENBLOCK

Figure 6. *Grooves on the outer surface of a Greenblock form provide good surface bonding for finish coatings; dovetail grooves on the inner face accept end plugs. The knobs on top of each panel interlock into the bottom of the next course.*

place, we nail a second 2x4 plate into the footing to capture the other side of the forms.

Windows and doors. We cut rough openings for windows and doors with a handsaw, then insert wooden bucks made of 2-by treated lumber between the inner and outer foam panels. The bucks are held in place with 3-inch-long insulation nails driven through the foam and are braced with 2-by spreaders.

Bracing. To brace the forms, we set vertical 2x4s with diagonal kickers every 8 feet on the inside of the formed walls. We use metal angle brackets and drywall screws to fasten the braces to the plastic wall ties.

To straighten the top of the wall and provide scaffolding for the pour, we screw 3/4-inch plywood gussets to the side of the vertical bracing, then screw 2x12 planks to the tops of the gussets (Figure 5).

Dealing With Blowouts

The concrete we use is a 3,000-psi (six sacks of cement per yard) pea-gravel mix, with a 5- to 6-inch slump. We've poured lifts as high as 12 feet, but 4-foot lifts are typical. It wouldn't be honest to say we've never had a blowout, but blowouts aren't serious, because the repair is so easy. Prior to pouring, we make a couple of blowout repair kits from two 16-inch-long 2x4s and a piece of 1/2-inch threaded rod 14 inches long inserted through a predrilled hole. If a form begins to bulge, we shove the threaded rod through the forms, slide the 2x4s over the ends, and tighten the nuts to pull the wall back in place.

Look, Mom, No Wood

In some of our houses, we pour a concrete floor over steel decking. The steel I-beams supporting the floor rest in 4-inch-deep beam pockets blocked out with foam plugs at the plate line. After the concrete has cured, we chip out the plugs and set the beams.

To complement the high-tech exterior walls, we use light-gauge steel framing on the interior wall partitions and the roof structure. Since we use steel siding and brick, the only lumber used in our houses is in the window and door frames and the plywood roof decking.

With the Lite-Form system, we can achieve about R-26 walls, and in our area, the utility costs of a 3,000-square-foot house hovers around $100 per month. The local power utility has even offered us a rebate of 60¢ per square foot on electric service, and since there is nothing in the structure of the house that will burn, home insurance premiums are one-third less. The most remarkable thing about the system is that we can build the house described for $60 per square foot or less. □

GREENBLOCK:
Metric Foam Foundation Blocks

by Ron Camille Springfield, Ill.

The Greenblock system is a simple-to-erect foam concrete-forming system that produces energy-efficient, cost-effective walls and foundations. A Greenblock "unit" consists of two 10-inch-tall by 39-inch-long panels connected by polypropylene webs that hold the panels 5 1/2 inches apart (Figure 6). The webs are embedded in the foam every 5 inches on-center and provide a dense fastening surface for wall coverings.

Using the System

The panel facing the weather is 2 1/2 inches thick; the other is 2 inches thick. Knobs running along the top edge of each panel lock into the bottom of the next course of blocks. Vertical grooves on the outside face of each panel provide a bonding surface for any wall coating; dovetail grooves on the inside face bond to the concrete and also lock in foam end caps and blockouts.

Footings. With any stacked modular system (including concrete block), problems at the footing translate to the top of the wall. Rather than use the top of the forms to ensure a level footing, we drive grade stakes every 6 feet in the center of the footing forms. We pour a five-sack concrete mix with a 6-inch slump that self-levels to the top of the grade stakes.

The 18-inch-wide and 9-inch-deep footing has two #4 horizontal bars 2 inches off the bottom, and we set in #5 vertical rebar hooks on 15-inch centers. Any steps in the footing are made in 9 7/8-inch lifts to match the metric height of Greenblock.

Stacking the wall. After the footings have set, we snap chalk lines on the footing to mark the outside perimeter and nail a 2x4 kickplate to the line. We fit the first course of blocks tightly to the kickplate and hold it in place with short pieces of 2x4 fastened every 4 feet or so on the basement side of the blocks.

We start laying each course of block at the corners and work toward the middle of the wall, staggering the vertical joints. If the blocks don't meet

GREENBLOCK

Figure 7. *Lumber braces on 6-foot centers support the floor ledgers, with anchor bolts in place, until the concrete is poured. The vertical bracing also serves to support scaffolding brackets.*

GREENBLOCK

Figure 8. *End caps slipped into the dovetail grooves on the inside face of the blocks create a bulkhead at wall drops and window and door openings.*

on a full module, we simply cut one of the blocks to length with a handsaw to fill the gap.

Reinforcing. Notches in the webs eliminate the need to tie horizontal rebar — we simply snap in one #4 bar every other course, making sure they lie against the vertical bars. Special top blocks taper out at the top, creating a 9 1/2-inch shelf; when reinforced with two horizontal bars, this wider top course stiffens the wall and provides bearing for brick veneer or a beam flange.

For a basement or crawlspace, we set 1/2-inch anchor bolts along the top of the wall during the pour. If we plan to take the block higher, we use 18-inch-long pieces of vertical rebar (we omit these at door and window openings).

Floors. Floors hang inside the Greenblock wall system on ledgers bolted into the concrete (Figure 7). Before pouring the walls, we remove a 3x8-inch chunk of foam every 15 inches at the level of the ledger; the concrete will fill these pockets and support the bolts. We notch the tops of the vertical bracing to accept the ledger, then drill and set the ledger with the anchor bolts attached. The ledger carries across door openings, but we leave it out at stairwells.

Doors and windows. We lay out door and window openings on the footing or floor and leave out blocks to create the opening. To close up the sides, we slide foam end caps into the dovetail grooves in the forms (Figure 8), ripping header and sill blocks on a table saw to adjust for height.

Doors and windows are anchored to wooden bucks set in the wall openings. We use a 2x10 to support the header, and as an extra measure against blowouts, we secure the jamb bucks with plywood pieces screwed to the buck and to the nearest plastic web. After the pour, we drive 20d spikes through the bucks and end caps into the green concrete.

The pour. The concrete we use is a special six-bag mix with 3/8-inch pea-gravel aggregate. It leaves the plant at a 6- or 7-inch slump. With foam forms, we can pour in subzero temperatures, and because the webs are on tight 5-inch centers, we've never experienced a blowout.

Two workers can stack and tie an 8-foot-high 20x40-foot basement in one day and pour it the next. Of course, we don't have to stop at 8 feet: We've taken structures up two stories using Greenblock and poured them in lifts as high as 12 feet.

Wiring and plumbing. I try to keep plumbing out of exterior walls, but the Greenblock system allows us to put plumbing right in the concrete or in a channel cut in the foam. For Romex wiring, we cut a groove in the foam with a hot knife and cover it with spray foam. We can also set rigid conduit in the concrete if we have to. Since Greenblock houses are monolithic, they are extremely air tight. Hvac systems can be downsized by half, and we recommend an air-to-air heat exchanger to provide fresh air.

Trim out. The dense polypropylene flanges provide a handy anchor for any exterior or interior wall finish, including brick and wood or vinyl siding. Or we can apply stucco directly to the foam.

On the interior, we usually screw drywall directly to the flanges, but again, stucco can be applied directly to the foam. To attach base and crown moldings and door and window trim, we use small finish screws driven into the web flanges.

Why Greenblock?

I chose Greenblock primarily because the finished product is so superior to the concrete and wood framing alternative. The only drawback is that the average house costs roughly $4,000 more than one framed in wood. But my clients usually agree that the long-term energy benefits are worth the extra cost. ■

Foam Form Manufacturers

The main advantage of stay-in-place foam forming systems is simple setup with no need for traditional steel or plywood forms. Many manufacturers also claim that a foam-concrete wall is energy-efficient, resistant to fire and sound transmission, and holds up well in earthquakes and high winds.

For more information, contact the Insulating Concrete Form Association (960 Harlem Ave., # 1128, Glenview, IL 60025; 708/657-9730; fax 708/657-7928), or one of the following manufacturers:

AAB Building System Inc.
840 Division St.
Cobourgh, Ontario K9A 4J9 Canada
800/293-3210

AFM Corp.
P.O. Box 246
Excelsior, MN 55331
612/474-0809

American Conform Industries
1820 S. Santa Fe St.
Santa Anna, CA 92705
800/266-3676

American Polysteel Forms
5150-F Edith NE
Albuquerque, NM 87107
800/977-3676

Branch River Foam Plastics
15 Thurber Blvd.
Smithfield, RI 02917
401/232-0270

Core-Form Industries
7245 W. 116th Pl., #4
Broomfield, CO 80020
303/460-1346

Cubic Structures
4931 Meinders Rd.
McFarland, WI 53558
608/838-6607

EnerGCorp Inc.
4203 W. Adams
Phoenix, AZ 85009
602/447-0733

Ener-grid
6847 S. Rainbow Rd.
Buckeye, AZ 85326
909/653-3346

Greenblock EPS Building System
P.O. Box 749
Woodland Park, CO 80866
719/687-0645

I.C.E. Block
570 S. Dayton-Lakeview Rd.
New Carlisle, OH 45344
800/423-2557

Keeva International Inc.
1854 N. Acacia
Mesa, AZ 85213
602/827-9894

Lite-Form Inc.
P.O. Box 774
Souix City, IA 51102
800/551-3313

Polycrete Industries Inc.
435 Trans Canada
Longueil, Quebec G4J 2P9 Canada
514/646-3825

Quad-Lock Building Systems
3873 Airport Way, Suite 525
Bellingham, WA 98226
360/671-3911

R-Forms/Owens-Corning
10999 Prosperity Farms Rd.
Palm Beach Gardens, FL 33410
407/624-2515

Reddi-Form Inc.
593 Ramapo Valley Rd.
Oakland, NJ 07436
800/334-4303

Therma Manufacturing Inc.
645 University Ave.
Los Gatos, CA 95030
408/395-8183

3-10 Insulated Forms
P.O. Box 460790
Omaha, NE 68128
800/468/6344

U.C. Industries
3 Century Dr.
Parsippany, NJ 07054
800/828-7155

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