Waterproofing ICF Foundations

by Todd LaBarge

Whenever possible, I persuade my customers to use insulating concrete forms (ICFs) for their foundations — particularly if they intend to use the basement as a finished living space. I like ICFs because they can be assembled by the on-site crew, there are no heavy forms to haul and set, and rebar is easy to place. ICFs also have a high built-in insulating value and, unlike retrofitted rigid foam board, they align with the framing above.

Membrane System

As with a conventional basement foundation, ICFs must be waterproofed below grade. Because of the joints between the blocks, foam forms alone won't prevent water penetration. In the past, I've used Tuff 'n' Dri, a dealer-applied spray-on elastomeric coating that cures very quickly. But I wasn't completely happy with the coverage, and wanted to control the waterproofing process myself. So, on a recent job, I decided to install a sheet membrane waterproofing system over the ICFs, figuring that it would block water, and act as a barrier to termites and carpenter ants. To get into the foam, the bugs would have to chew through the waterproofing membrane first, a serious obstacle for any pest.

For this job, I chose the CCW-701 sheet membrane waterproofing system (Carlisle Coatings & Waterproofing, P.O. Box 1600, Sapulpa, OK 74067;

A peel-and-stick membrane along with good perimeter drainage will keep the basement dry

800/338-8701; www.carlisle-ccw.com), a 56-mil self-adhesive rubberized asphalt membrane with a 4-mil poly facing. The system includes the sheet membrane, installed over primer, which is optional on rigid foam, a couple of proprietary mastic fillers and termination sealants, and transition flashing "tapes." Part of a family of coatings and sealants compatible with rigid foam, this membrane system would enable me to seal even the smallest gaps. Believe it or not, termites can find their way into a building at this joint, so sealing between the concrete footings and the base of the foundation wall is a real benefit.

Dual-Purpose Footing Forms

An important part of any foundation waterproofing strategy is a perimeter footing drain, which ensures that any entering water gets safely carried off to daylight or a drywell. Rather than use round perforated drain tile, I like to form the footings with stay-in-place Form-a-Drain components (CertainTeed Corporation, P.O. Box 860, Valley Forge, PA 19482; 610/341-7000; www.certainteed.com). These lightweight perforated vinyl forms install easily and do double duty as a permanent perimeter drain. After pouring the footings, we steel-trowel

Multi-Layer Foundation Waterproofing

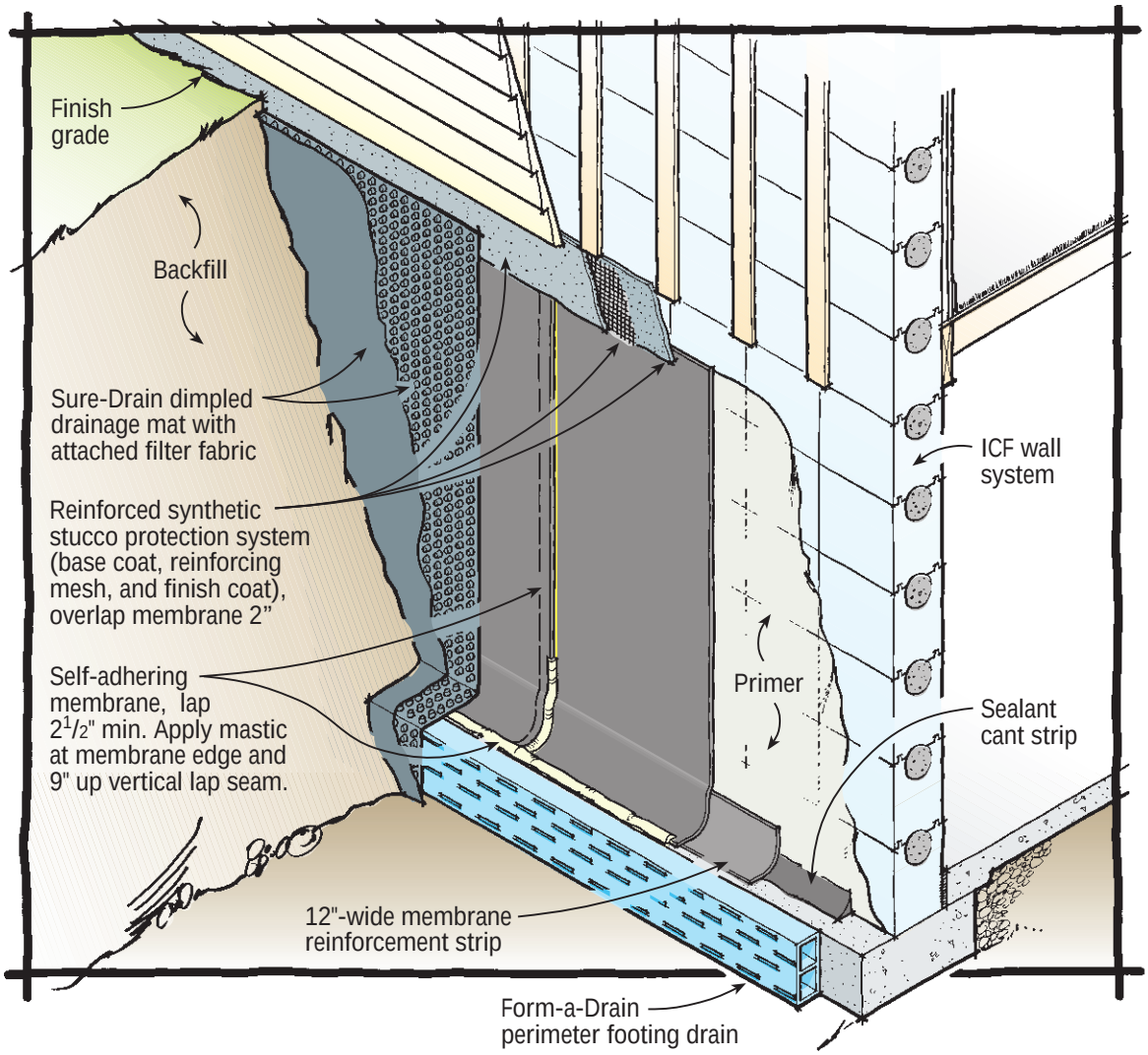

Figure 1. Trimming the membrane short of the perimeter drain prevents water in the drain from backing up beneath the membrane.

the concrete to ensure a smooth surface for the membrane.

Prepping the Corners

It's difficult to force the membrane into a sharp 90-degree corner without leaving unsupported voids behind it. Since any unsupported areas might rupture from backfill pressure, the first step in applying the membrane is to form a 3/4-inch cant-strip, or fillet, by applying sealant at vertical wall junctions and at the footing. This eases the 90-degree transition for the membrane, and seals the most vulnerable part of the wall against leaks (see Figure 1). The manufacturer gives the option of forming a 1 1/2-inch concrete cant to ease the transition, but I chose the sealant because I thought it would be more leakproof and easier to apply. The sealant is a trowel-consistency two-component polyurethane that is mixed on site with a paddle chucked in a drill. Each one-gallon container must be mixed and used all at once; you can't save unused material or mix partial batches. We applied the sealant with putty knives and tooled it with a rounded mason's trowel to form the fillet. This worked well enough, but a bulk caulking gun would probably be faster and waste less material.

Priming for Better Adhesion

According to the manufacturer, the membrane can be applied to fresh, clean rigid foam without priming, unlike concrete, which must always be primed first. But since the surface of foam blocks becomes dusty with prolonged exposure to sunlight, it seemed like a good idea to prep the ICFs to ensure a good bond. After a light wire-brushing to remove the dust, we used a roller to coat the foam and the exposed concrete of the footing with water-based Carlisle primer. On the first pass, we neglected to brush out the accumulated primer that dripped onto the footing from the roller. These spots didn't dry as quickly, and since the membrane wouldn't stick to the wet primer, we had to back up and brush out the excess, then wait for it to dry. After this, we made sure to brush out all of the drips after rolling each section.

Figure 2. Twelve-inch-wide membrane strips reinforce vulnerable corner transitions and ensure a good bond over the cant strip.

Having applied a similar membrane to concrete before, I found that the primer really improved adhesion. The primer is considered cured when it's dry to the touch, but the open time is only about 12 hours, so it's best to coat only what you can cover with membrane in the same day. If there's any problem, though, you can always recoat.

Reinforced Corners

The installation instructions call for cutting lengths of membrane into 12-inch-wide by 3-foot-long strips. After the sealant fillet has cured (about 24 hours), these strips are applied to the wall-to-footing and wall-to-wall intersections, 6 inches on either side, around the entire foundation perimeter. The strips ensure a good bond for the membrane over the fillet and reinforce the corners. We primed an area of wall and footing to be covered that day and let it dry. Then we worked the reinforcement strip from the wall onto the sealant and out over the footing. To ensure a good bond, we overlapped the ends of the strips 2 1/2 inches, and rolled them down with a 2-inch-diameter rubber roller. For this phase of the job, the foundation perimeter

Figure 3. Where the membrane meets door or window buck, special flashing tape (not yet installed in photo) seals the transition into the opening.

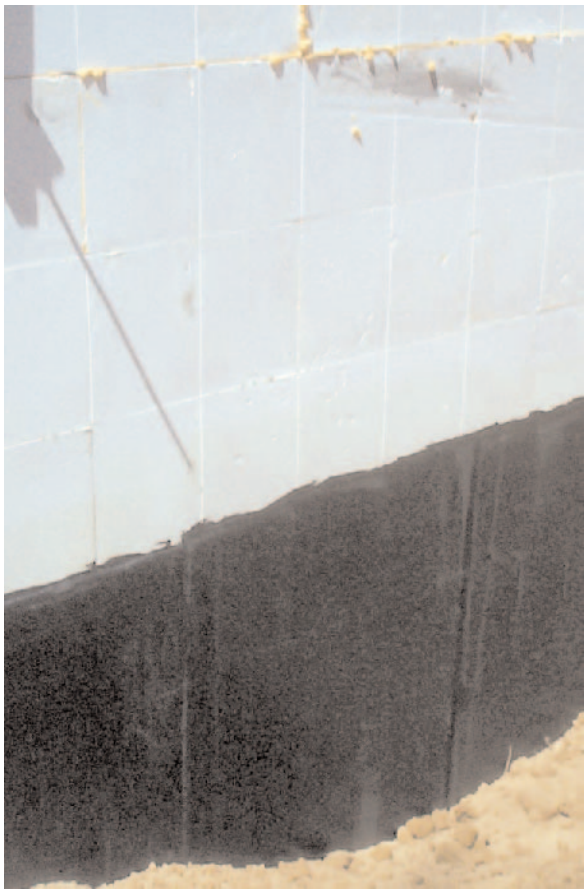

Figure 4. Membrane overlaps are pressure-bonded using a hand roller, then treated from bottom to top with proprietary sealant. Horizontal membrane terminations are caulked with mastic to complete the barrier system.

measured about 203 linear feet, and took two people about three days to complete (Figure 2, previous page).

Applying the Membrane

The next step was to apply the full-height sheets of membranes to the wall, from about 6 inches below finish grade, to 2 inches beyond the edge of the footing. This would later be coated with stucco. Whenever possible, we tried to work on the shady side of the building, to keep the sun off the black membrane. Whenever a sheet heats up, it tends to soften and stick to itself, making it nearly impossible to separate.

The easiest way to apply the 8-foot-tall sheets was to work in teams. One person would attach the first 12 inches of the membrane to the upper wall and hold it there, while a helper peeled away the protective paper backing and smoothed the sheet down the wall and over the footing. The long edge of the membrane is premarked on the outside face with a yellow guideline for a 2 1/2-inch overlap, and has a plastic release-strip that covers a 1/2-inch-wide sticky edge. With the first sheet in place, we attached the next sheet like the first one, beginning at the top and aligned with the yellow line. After peeling the paper and bonding the membrane to the wall, we lifted the long edge and removed the release strip. Using a rubber seam roller on the overlap ensured a firm bond between sheets.

We trimmed the excess just short of the inner edge of the Form-a-Drain to make sure that ground water couldn't come up behind the drain and get under the membrane.

Applying the membrane to the inside corners was pretty tricky: Not only does the membrane have to be folded into the corner, but also out over the footing in two directions. After first completely removing the paper backing, and folding the sheet lengthwise, sticky face out, two of us worked the membrane out from the corner onto the wall and footing. Because an unbacked sheet tends to flop around and stick to itself, we lost a couple of lengths before we got the hang of it.

Details

The foundation on this job included a 6-foot slider. The opening was formed with pressure-treated 2x10s, which remained in place after the concrete cured to serve as nailing backers (Figure 3). To seal the edges of the opening, I applied a Carlisle through-wall flashing tape (a 32-mil version of the membrane) over the face of the 2x10 and folded it out onto the wall membrane to seal the opening. The vinyl flange on the door unit was then spread over this flashing layer, with a second layer of flashing tape on top to seal the fins to the wall.

After all the sheets were bonded, we sealed the edges with system mastic, using a quart-size caulking gun. Mastic is required at the horizontal top and bottom terminations, as well as 9 inches up the vertical seams from the footing. To be safe, we ran it continuously from bottom to top (Figure 4). It's extremely important to make sure the seam overlap bonds tightly, never depending on the mastic alone for the seal.

To seal around electrical service penetrations, I made an X-shaped incision in the membrane covering the holes, and folded back the flaps. Then I ran PVC conduit sleeves through from the inside, troweled sealant into the voids around the conduit, and stuck the membrane flaps to the conduit on the outside. I wrapped a 6-inch wide "wristband" of membrane over these and caulked the remaining gaps and membrane edges with the seam sealant. To guard against water entering through the conduit itself, I made sure to pitch it to drain, and packed more sealant around the electrical cables for good measure. We brought water lines in later, and thoroughly packed them in with sealant on both sides of the wall (Figure 5).

Positive Drainage

To complete the system, I installed Sure-Drain, a flexible plastic dimple sheet with an attached ground-filter fabric. Sure-Drain forms the primary water barrier by directing ground water down the wall to the Form-a-Drain, and protects the membrane from impact during

Figure 5. Water lines, drilled through the wall at a later date, are sealed with two-component urethane adhesive sealant, which cures to form a tough, elastic plug.

Figure 6. To direct ground water to the perimeter drain and protect the membrane from impact during backfill, fabric-filtered drainage mat is applied over the membrane.

backfill. We installed it over the membrane just below finish grade, extending down the wall and out over the perimeter drain. The installation instructions direct you to bond the Sure-Drain to the membrane using contact cement, but I wasn't thrilled with the results — in the end, I just held the dimple sheet in place with dirt and temporary wood braces (Figure 6, previous page).

I worked with the excavator during the backfill operation, making sure that the Sure-Drain stayed tight against the wall, and fishing out roots, branches, and large stones from the backfill to prevent damage.

Figure 7. Backfill pressure holds the drainage mat firmly in place. Stucco protects the exposed portion of the ICF foundation, and covers the upper edge of the membrane.

Figure 8. Using a stainless steel trowel prevents rust stains in stucco.

Above-Grade Protection

The above-grade portion of an ICF foundation needs to be protected from physical impact and UV degradation. I used Coraflex (Sealoflex, 2516 Oscar Johnson Drive, Charleston, SC 29405; 800/770-6466; www.sealoflex.com), a reinforced synthetic stucco system with an elastomeric topcoat, made for EIFS applications. I applied the stucco before installing the siding to make the process as simple as possible and to eliminate the need to protect the siding.

Base coat. We shoveled excess backfill away from the foundation, exposing the top 12 inches of the foundation and the upper edge of the membrane. After roughing up the surface of the foam and taking out any irregularities with a rasp, we formed the basecoat using Corabase Onepak, which comes dry in 50-pound bags and is mixed with water to a trowel consistency. With one person mixing and two people using 1/4-inch-square notched stainless-steel trowels, we coated one 3x10-foot section of the wall at a time. While the base coat was wet, we embedded reinforcing fabric mesh, making sure to press it thoroughly into the compound. Each embedded section overlapped the previous one by at least 2 inches to ensure continuity of the reinforcement.

We also extended the base coat about 2 inches over the Carlisle membrane (Figure 7). The base coat adhered firmly to the membrane, adding redundant protection to the upper membrane edge.

Finish coat. After the base coat cured for 24 hours, we applied Coraflex, a premixed colorized elastomeric topcoat containing a fine aggregate for texture (Figure 8). To prevent rust stains, we used a stainless steel trowel. To apply the topcoat, pull the material as thin as the aggregate size permits without dragging (about 1/8 inch thick), and catch the waste with a hock for redistribution. The result is a hard, protective, attractive surface that will remain impervious to water and resistant to pests for years to come.

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