Photos by Wade Paquin

Two inches of closed-cell spray foam provides not only good insulation but also a superior air and water barrier. The author has found that spray foam works best when applied over a compacted crushed-stone base.

Spray Foam Under the Slab

BY WADE PAQUIN

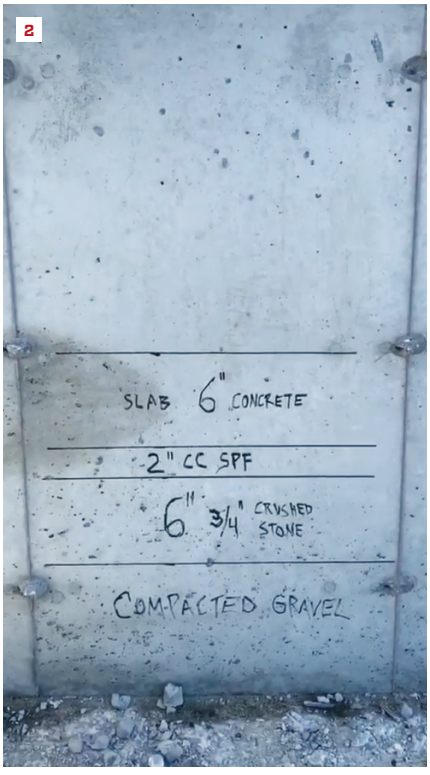
For the past eight years or so, we have been using closed-cell spray foam insulation (CCSPF) underneath our basement slabs to provide both insulation and air sealing. We don't do this on every project, but on most of the homes we build or renovate extensively, we will spray a minimum of 2 inches of spray foam (yielding at least R-14) directly on top of a crushed stone base, and then we place our concrete slab on top of it.

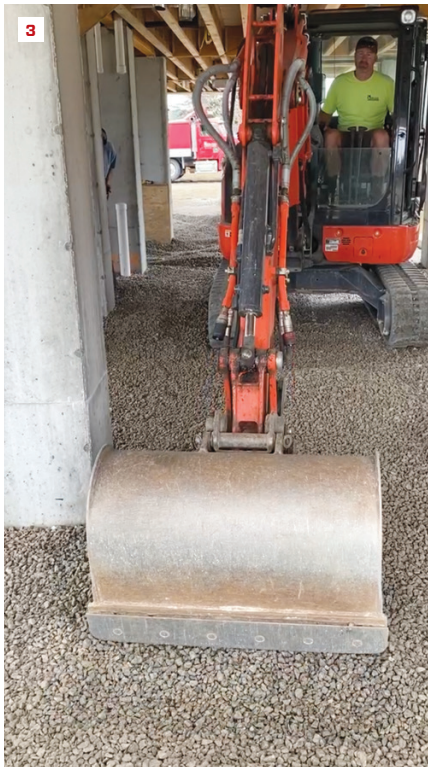
I like this method because it is a quick and easy way to insulate under a slab. On a recent job, for example, we insulated a 2,200-square-foot slab in just a couple of hours. If we had done this with 2-inch-thick rigid board—properly cut and properly taped, especially around all the concrete columns on this job—we would have spent nearly two days on just the installation.

That said, on this particular project, the cost of labor vs. the higher material cost of using CCSPF was a wash. On other projects that are not as complex, the higher material cost does make the job more expensive, but we save a lot of time and aggravation. More importantly, there are a number of performance benefits that I like: The foam locks into the subbase to create a monolithic base; there are no seams, or joints, so it's a continuous air barrier; and closed-cell foam is impervious to water and air, so it's a great moisture and vapor barrier. One added benefit that a lot of people don't think about, but is important in some locations, is that it is a great radon blocker, too.

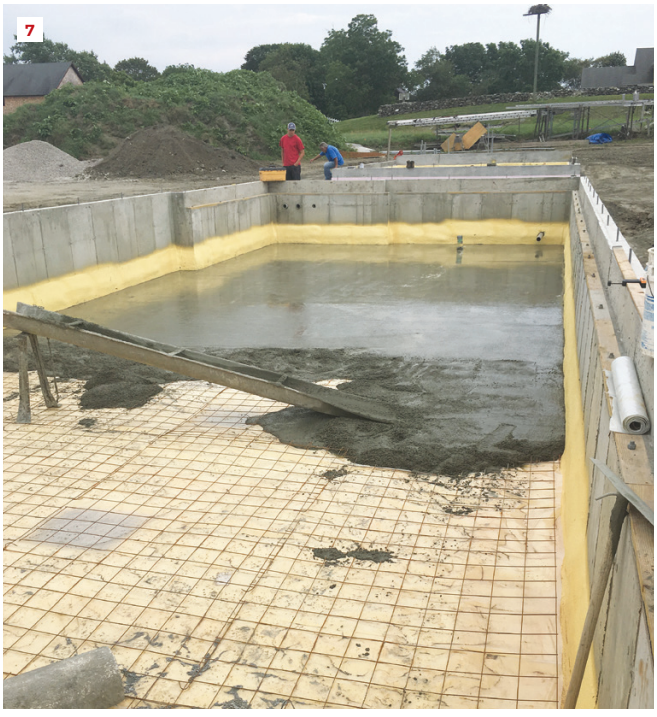
BASE FOR THE FOAM

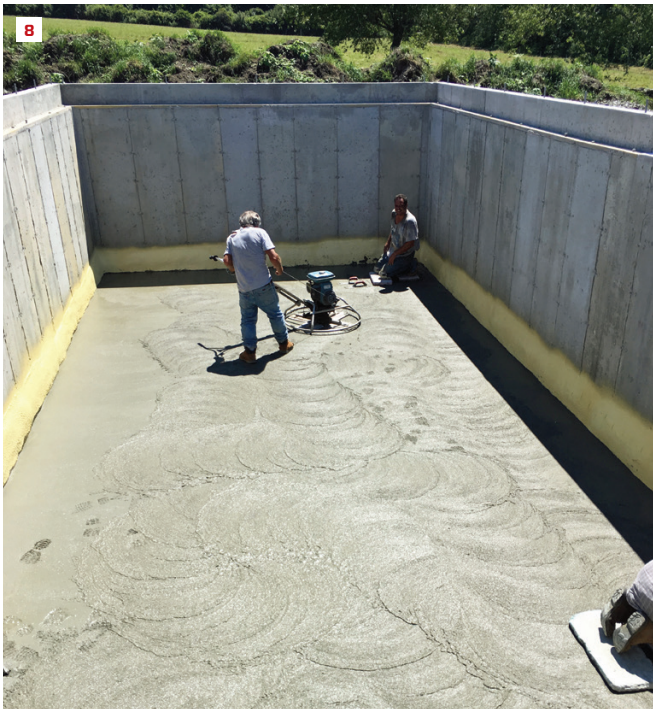
I've learned over the years to apply the spray foam directly to a crushed stone base, instead of to a gravel base. The reason for this is that the stone base has voids between the





Elevation lines on this foundation wall show the layers of the typical basement slab for the large custom homes built by the author **(2)**. Over the compacted gravel subbase, crushed stone is spread and compacted smooth **(3, 4)** before the foam is applied **(5)**. Note the foam is brought up the wall **(6)** a good 12 to 16 inches to get it well above the slab surface to tie in with the wall insulation and ensure a continuous seal.





While this slab on an older project uses wire mesh, the author has gravitated towards using fiber-mesh reinforcement to simplify the pour. Both will provide good reinforcement but must be coupled with saw-cut control joints (after finishing) to avoid cracking. With a solid base, reinforcement, and proper curing, the author avoids any visible cracks in the slab surface.

aggregate pieces that allow the foam to penetrate. This accomplishes two things:

1. As the foam expands, it fills the voids in the stone base, keeping the insulation layer anchored down and creating a monolithic substrate.

2. The combination of the stone and its voids helps the SPF installer maintain a relatively flat, even 2-inch installation.

If we were to apply the foam to sand or dirt that has a top layer of particles, the tensile strength of the foam curing will lift and curl on the edges. Applying to crushed stone helps keep the foam flat, which in turn helps the installer maintain a fairly flat surface of foam.

CONTROL JOINTS

One practice we do, which is needed on all slabs regardless of whether or not, or how, they are insulated, is to cut control joints in the slab to relieve any stress cracking or hairline cracks in the slab surface. Spacing of the control joints varies by the shape of the slab, but in general, for a 4-inch slab, joints should be 8 to 12 feet apart. The National Ready Mix Concrete Association recommends that spacing should never exceed 15 feet.

We typically also use expansion joints around the perimeter along the wall (to isolate the walls from the slab) and wrap expansion joint material around any interior concrete columns.

CONCRETE

We like to use a 3,500-psi, or even a 4,000-psi, mix with fiber-mesh reinforcement. We have been moving to fiber mesh for a number of years, getting away from using wire-mesh reinforcement. The wire mesh works well, and we've used it often in our slabs, but we like the fiber mesh better. Without needing to install the wire mesh and all the extra chairs required, we significantly simplify the pour. (Depending on the slab, we may also install rebar, as required by engineering.) Fiber-mesh reinforcing is a lot easier and cleaner than wire, yet provides a strong concrete mix. Coupled with the base, the foam, and those control joints, you end up with a successful slab pour and good long-term performance.

I am often asked, "Can the foam support the weight of the concrete?" The answer is absolutely, yes. The CCSPF has a PSI of 28.5, which is more than sufficient. In fact, when the entire process is done correctly, it can be used under a garage slab. We have used this overall application in several garages—and with two vehicles on a slab, there hasn't been even so much as a hairline crack.

Wade Paquin runs WKP Construction, a custom home building and renovation firm based in Newport, R.I. Follow him on Instagram at @wkp_construction and on the BuildShowNetwork.com.