This floor was out of level by a full inch in one direction **(1)**, and by 3/4 inch in the other **(2)**. Before the leveler can be mixed and poured, the author applies liquid primer to the underlayment **(3)**.

Photos by Roe Osborn

Pouring a Level Floor for Tile

BY TOM MEEHAN

Severely out-of-level floors are a fact of life in the New England homes that I work in. For a tile setter, these floors can be a nightmare—especially when the project calls for large-format tile that requires the subfloor to be within 1/8 inch of flat and level in 10 feet ("Working With Large-Format Floor Tile," Nov/17).

Recently, clients asked me to install large-format tile on the floor of an L-shaped bathroom that they were remodeling and expanding with a new walk-in shower. When I arrived at the project, the carpenters had already installed the plywood underlayment, but I could tell at a glance that the outside corner of the L was very high. A long level confirmed that the floor dipped a whopping 1 inch in about 4 feet in the direction of the toilet and shower **(1)**, and more than 3/4 inch toward the entry door **(2)**.

New options. In the past, my options would have been limited. If the deviations were 1/4 inch or less, I could have built up low spots with layers of thinset. In an extreme case such as this project, I would have had to do a full mortar bed, which is messy and time consuming. Instead, I opted to use one of the self-leveling underlayment products now on the market.

Self-leveling concrete products have been around since the late 1970s. The product I used, Ardex Self-Leveling Backerboard, is a polymer-modified, Portland-cement-based product that mixes with water and is then poured onto the low areas of the floor. It has high compressive strength, making it ideal for installation under tile floors, and it can be feathered into the high areas, maintaining strength and adhesion as it approaches zero thickness.

Before I could mix and pour the self-leveling compound, the subfloor had to be primed with Ardex P51, a milky liquid that I applied to the subfloor with a coarse broom **(3)**. Ardex says that the primer should be allowed to dry a minimum of three hours and a maximum of 24 hours before you mix and apply the self-leveling compound.

Self-leveling underlayment products are not cheap. We used four 50-pound bags for this particular floor at just under $50 per bag. In addition, the primer cost about $70 per gallon jug. This price may seem a bit steep to some, but the time it saved me was invaluable. And in one pretty simple and quick operation (shown in the photos on the following two pages), I was able to form a strong, solid substrate for the tile floor that was level, flat, and perfectly smooth.

Tom Meehan, co-author of Working with Tile, *is a second-generation tile installer who lives and works in Harwich, Mass.*

Liquid leveler will seep through any opening left uncovered. Here, expanding foam fills in around a plumbing stub, and tape forms a dam around the toilet flange **(4)**. The author drives a screw as a depth gauge for the liquid **(5)** and uses the screw to set the height of the gauge rake **(6)**. Because the existing threshold wasn't high enough to contain the leveler, the author screwed in a temporary dam between the door jambs **(7)**. A stone threshold will be added later to transition to the tiled bathroom floor.

The manufacturer requires that the inside of the mixing bucket be rinsed thoroughly to prevent the plastic from absorbing liquid from the mix **(8)**. A taller, narrower bucket is typically used for mixing the leveler, but this bucket was all that the author had on hand. Water for the mix must be measured accurately **(9)**. Instructions require that the leveler be mixed with a mixing paddle for no less than two minutes **(10)**. Then the mix must slake for five minutes and be quickly remixed before pouring.

Two crew members dump the initial bucket of mix in the corner where the compound will be the deepest **(11)**. The author wears protective boots as he spreads the first batch with the gauge rake **(12)**. The leveling liquid fills the lowest corner with the head of the depth screw (visible as a small white dot) flush with the surface of the leveler **(13)**. Smaller, subsequent batches fill the low area in front of the bathroom door **(14)**, and the author uses a squeegee to feather the liquid up to the high corner **(15)**. To leave the bathroom, the author had to take one step into the liquid, but it quickly filled back in around his footprint. The entire pour took only 15 minutes and the self-leveling liquid did the rest, providing a solid, flat, and level substrate for the tile floor. As a side note, the author covered the floor with an uncoupling membrane before installing the large-format floor tile.

Working With WarmBoard

BY ROB CORBO

Last year, we got a chance to use WarmBoard on two projects. The first was over a slab-on-grade foundation for an addition on an inner-city row house. Ordinarily, we like to build out additions over crawlspaces for better access to mechanicals, but to save money, our clients opted for a slab-on-grade foundation. The architect's design called for a radiant floor in the large family room that would span from the existing home into the addition, and the architect spec'd WarmBoard-S over the new slab.

Using WarmBoard allowed us to run the hydronic tubing on top of the slab, instead of embedding the tubing in the concrete and having to heat the slab's mass. The WarmBoard system includes a nailing substrate that simplified installation of a new engineered-wood finish floor spec'd for that room. The installation went well; so well in fact, the architect spec'd WarmBoard for a second project—a bump-out addition that we did after the completion of the first project.

In this article, I'll provide a quick overview on our experiences installing WarmBoard—a product we highly recommend using—over both concrete **(1)** and a wood-framed floor **(2)**.

For radiant heating, we've had luck over the years installing Uponor's Joist Trak aluminum heat-transfer panels to the underside of new and existing subflooring (packing the joist bays with insulation and enclosing with drywall, to drive the heat upward). But, with the switch to a reinforced slab with XPS sub-slab insulation, we had to come up with a different system for installing radiant heat.

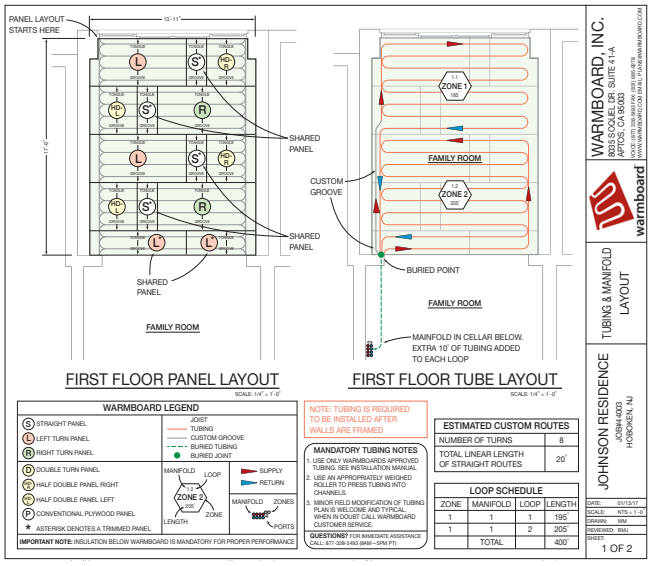
TWO PANEL CHOICES

WarmBoard comes in two thicknesses, 1 1/8-inch Warmboard-S structural plywood panel and 13/16-inch-thick Warmboard-R panel, which is an OSB product. The WarmBoard-S panel is usually installed in new construction or additions (serving a dual function as a structural subfloor and radiant panel) **(3)**, while the thinner WarmBoard-R is used more for remodeling projects **(4)**.

Both WarmBoard products have 12-inch-on-center channels routed into the surface to receive 1/2-inch radiant tubing. And both products come with a 0.025-inch-thick, factory-applied aluminum conductive surface over the panel. WarmBoard's literature claims this conductive surface is roughly five times more conductive

The author installed WarmBoard-S on two different, back-to-back addition projects: first, over concrete **(1)**, and then, over a framed-floor assembly **(2)**. WarmBoard comes in two panel types; WarmBoard-S **(3)** is a 1 1/8-inch-thick structural plywood subfloor that doubles as the radiant panel, while WarmBoard-R **(4)** is a thinner, OSB product for use as an overlay to an existing floor.

Photos 1, 2, 5, 8, 9, and 10 by Rob Corbo



As part of its service, WarmBoard provides panel and tubing layout plans **(top)**. The panel plan guides the installation of the 4x8 T&G WarmBoard-S panels, while the tubing layout plan notes the designated pathways for the ½-inch PEX. An installation kit is shipped with the panels **(5)**. This kit includes the plans, alignment pins to line up the tubing channels **(6)**, and routing templates to make custom grooves **(7)**.

than radiant systems embedded in concrete, and the system reportedly delivers a much faster response and more even temperatures.

MANUFACTURER-SUPPLIED DESIGN

For both projects shown here, we used WarmBoard-S. Over the framed floor, its thickness is needed as a structural subfloor, but even on the slab project, we wanted the extra thickness to help line up the new floor with the existing one. We also felt it would be a better nailing substrate for our finished floor.

WarmBoard-S comes in 4-by-8-foot panels with tongue-and-groove edges. (The Warmboard-R product comes in smaller, 2-by-8-foot panels.) To facilitate lining up the channel patterns on adjacent panels, WarmBoard-S comes in a few different panel types—straight, left, right, and double. (Warmboard-R only comes in only two panel types: "straight" and "turn.")

As part of its service, WarmBoard can supply you with a design tailored to your project's needs. This includes layout plans, one for the panel layout and one for the radiant tubing. We sent the company our project plans, and for around $200, it sent us a WarmBoard layout, detailing all the steps to assembling the system (see layout plan, top left). The cost was credited back to us once we purchased the materials.

Our small, bump-out addition over a wood-framed floor was simple in terms of a layout, and plans were not required. But for the larger slab project, the panel layout plan was an enormous help in puzzling through the panel installation. The layout plan shows the panel sequencing—where to install the left turn, right turn, and straight panels, and which "shared" panels to cut. It also clearly showed where we needed to start so the sequencing would work out.

The "floor tube" layout plan also was a big help on the slab project. This plan specifies the number of zones, and on the slab project, we had two zones—Z-1 required 195 feet of tubing and Z-2 needed 205 feet. (Generally, for estimating the tubing, the maximum length for a zone is about 200 feet.) The tube layout drawing also specified "bury points" (holes where tubing submerges beneath the WarmBoard panels) and the manifold location. For the slab project, we had bury points near the house end of the slab where it planed into the framed first floor of the house over the cellar. The manifold was located in the cellar near the boiler.

While the different panels with standardized channels for tubing make up most of the floor, most projects will require some custom routing to make the layout work. The tube layout shows where this work is needed, and it is definitely the most interesting part of the installation.

For this work, WarmBoard sends an installation kit, which includes wooden templates for routing three different types of grooves—180-degree, straight, and offset. The kit also includes router bits, alignment pins, and other necessary accessories. Cutting is done with a router from the back of the panel with the aluminum side down. It takes a little figuring out the first time through, but it didn't take an inordinate amount of time for our lead carpenter, Danny DoCouto, to make the necessary modifications. As the shown on the tube layout drawing (see previous page), custom routing was needed on only four panels for the slab project.

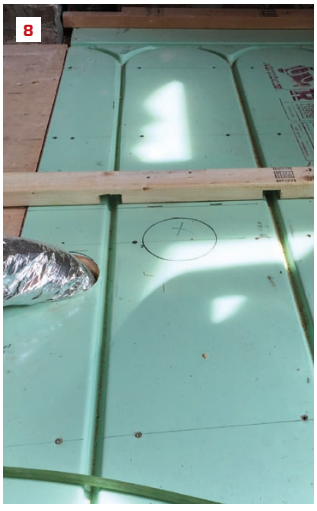
PANEL INSTALLATION

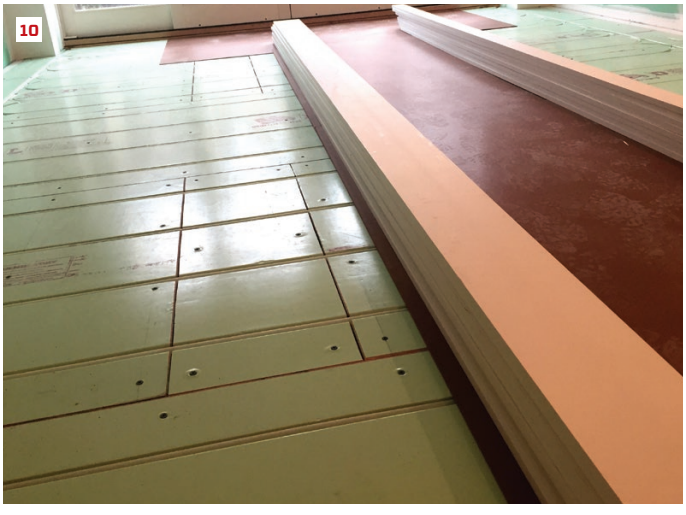
On the slab project, we first covered the concrete with 6-mil poly, then loose-fit the WarmBoard-S panels, cutting panels to size as needed. As we fastened down the panels, we used nails to gap the panels 1/8 inch on the 4-foot side. We also used the alignment pins from the installation kit to keep the channels in line. We fastened the panels with 2 1/4-by-1/4-inch flat-head Tapcons, spaced 6 inches on-center along panel edges and 12-inches on-center in the field. Over the framed floor, we secured the WarmBoard-S with panel adhesive and 2 3/4-inch screws, using the same fastener spacing.

Once all the standard-configuration panels were installed, we routed our custom grooves and secured those panels to the slab. We had to deburr the routed aluminum edges and clean off any adhesive squeeze-out in the channels while it was still fresh.

After mechanical rough-in, we covered the panels with hardboard for protection. We waited as long as possible before installing the tubing to avoid damage during the rest of the renovation. To make this happen, we dadoed the bottom plate for a powder-room wall on the bump-out addition. This way we could fish the tubing in just before we were ready for the finish flooring.

Rob Corbo is a building contractor based in Elizabeth, N.J.





Rough-in locations were marked on the panel with a Sharpie, and interior wall plates were dadoed to allow fishing the PEX tubing in later, so tubing could be installed as late in the remodeling process as possible **(8)**. PEX supply and return lines connect to the manifold in the cellar via "bury point" holes in the WarmBoard **(9)**. Engineered wood flooring acclimates in preparation for installation **(10)**. New flooring gets installed directly over panels. No rosin-sized slip-sheet required, and the installer has a clear view of the piping to avoid punctures **(11)**.