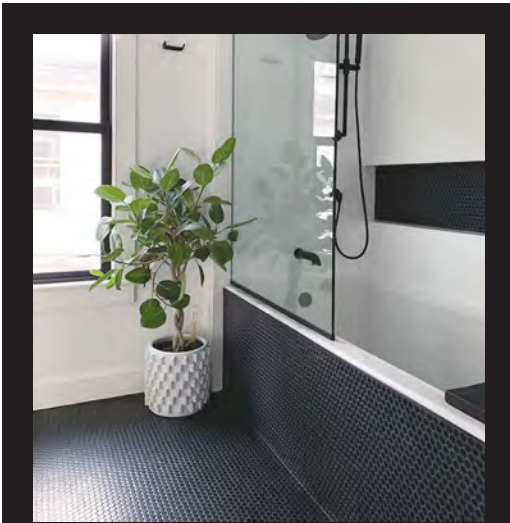


# Dead-Flat Bathroom Floor



When the floor has to look perfect, but existing conditions are anything but, a dry-pack mortar bed can save the job

BY TYLER GRACE



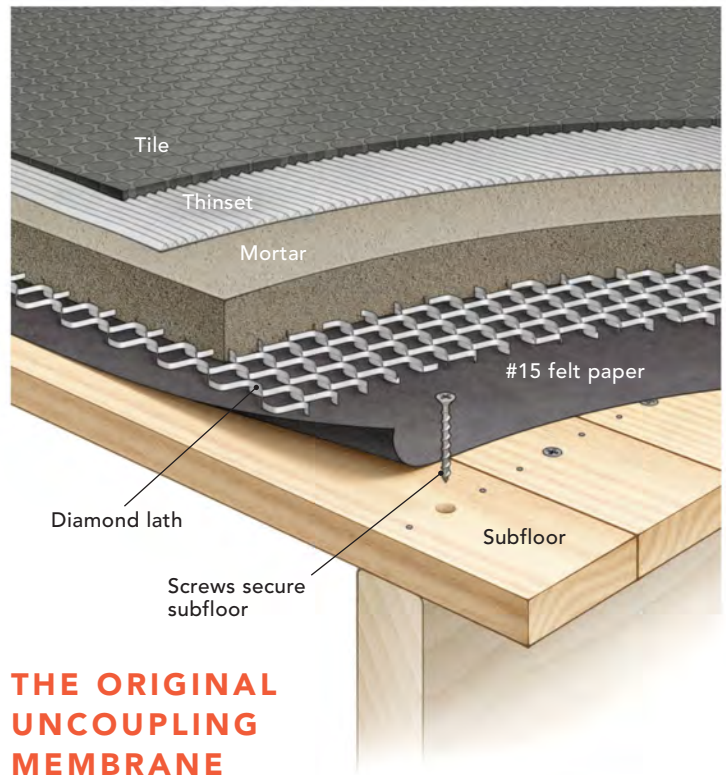
**G**oing in, we suspected that this bathroom remodel would have plenty of deficiencies, but none as bad as what we uncovered during demolition. After stripping layers of walls, flooring, and ceiling, we found out that nothing was close to plumb, level, or square, which are basic conditions for our work. Knowing this house was 130 years old, we were not surprised at what we found, but we still had to come up with a plan to remediate, or at least camouflage, the issues without creating unnecessary work.

After demolition, we assessed the condition of the existing structure and found a 1½-in. height discrepancy in the floor framing within a 5-ft. run. As always, the floor framing near the exterior walls (supported by the foundation) remained sound, while everything else sagged toward the interior of the room. We weren't able to jack the floor from below, but even if we had been, correcting that amount

of sag coupled with an additional layer of subfloor, underlayment, thinset, and tile would have made for an extremely large transition at the door, which we did not want.

## Dry pack is an easy choice

For a lot of remodelers aiming to establish a flat floor, self-leveling compound is the first choice. I don't like this approach for a lot of reasons, not least of which is the high cost of the product and its tendency to not actually come out flat. But even if I'd wanted to use it on this project, it wasn't a feasible option. With the floor 1¾ in. out of level from one side of the room to the other, we had to throw "level" out the window. Plus, self-leveling compounds are best topped with an uncoupling membrane, and many of the membranes that are on the market today do not allow for tiles smaller than 2 in. to



## THE ORIGINAL UNCOUPLING MEMBRANE

Although it has fallen out of common usage, there's a lot to love about a dry-pack mortar bed under tile. Comprised of a mixture of sand and cement, dry-pack mortar is installed on top of felt paper, which is covered by wire lath. The felt paper acts as a slip sheet, isolating the mortar bed from the wood subfloor and framing below it so any small movements within the wood structure remain independent of your tile install, keeping tile and grout intact for many years. The felt paper also prevents moisture from being prematurely drawn out of the dry-pack mortar and into the wooden subfloor, allowing the sand and cement to properly cure. Fastening the subfloor to the joists with screws strengthens the floor system.

My general rule of thumb for an unbonded mortar bed with diamond lath stapled to the subfloor is a mix anywhere from 1¼ in. to 2 in. thick. You can cheat this some, but with the mix we use, I never go below ¾ in., which would compromise the strength of the bed, or above 2½ in., which requires additional reinforcement suspended in the middle of the mud bed.

be installed on top, which would be a problem with the penny tile spec'd for this job.

We could have tried to correct the compound sag within this space by measuring and cutting sleepers, or by removing all of the subfloor sheathing and sistering onto the existing framing from above. The cost and time to implement this method, combined with a high likelihood of subpar results, made it a short-lived option.

All signs and conditions led us to using dry-pack mortar. We did not need to add any additional subflooring or blocking, we were able to pitch the floor to create a flat base for our tile without being concerned with leveling, we did not have to correct any of the sag in the framing, and the material costs for this system were next to nothing.

Dry-pack mortar beds are simple in principle and execution. They consist of sand, cement, and water. You are able to pinpoint your

elevation for every area on your floor, and create a perfectly flat surface. Once you refine your skills, the process is actually fairly quick and increases efficiency on the back end. Setting tile on dry pack is a dream—you will not find a flatter floor. This floor, which was more involved because it was not level, took roughly half a day from start to finish with one person installing and one mixing.

In our case, we were initially about 1¾ in. out of level (at the worst points), and we brought the floor to within ¾ in. of level. This discrepancy is much less noticeable and makes for a manageable threshold at the room's entry. And we achieved a perfectly flat floor—the most important part of a tile install. Level is great, but flat is necessary. □

Tyler Grace is a remodeler in Haddon Heights, N.J. Photos by Justin Fink.

# DRY-PACK MORTAR 101

## THE TOOLS

### SCREEDS

For years I used levels to screed my mud. This approach works fine, and gets the job done, but I recently upgraded to an inexpensive set of metal screeds. The trouble with using a good level is that it gets banged up. Oftentimes, I whack my screeds around with a dead-blow hammer to set my elevation, and I have never been too keen on doing that with my levels. The screeds come in a variety of sizes, they are aluminum (so they do not rust), and they're perfectly straight. They clean up super easy, you can beat the heck out of them, and they can be found in many different sizes.



### TROWELS AND FLOATS

To place, pack, smooth, and clean the edges of the mortar bed, you need a finishing trowel. To burnish the mortar, you should also pick up a wood float. I also suggest buying a garden cultivator, which is a small handheld rake. It's the perfect tool for loosening packed mortar in low spots so that more material can be added and repacked.



### PIERS

Small piles of compacted mortar, called piers, are used to create the initial surface that the screed will rest on, allowing you to fill and flatten the area between them. The number of piers you need depends on the size and layout of the room and the length of your screed(s). It's common to use pieces of tile as a temporary cap on each pier, but recently I have switched to using metal electrical workbox covers. They're inexpensive and very thin, making it easier to refill the void they create once they are removed.



## THE MIX

Dry-pack mortar is made from sand, cement, and water.

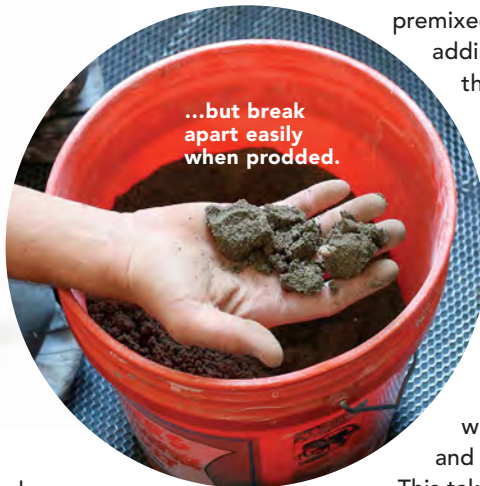
Early on in my career I used to mix all of my own dry pack. We would use five parts sand, one part cement, and enough water to make the mix stick together. That mix is still my ideal recipe. I love the way it pulls, packs, and finishes.

But as I get older, do larger jobs, and try to simplify my life, I have moved toward buying premixed bagged mortar and just adding water. I've found that these premixed mortars come richer than I prefer, with a higher ratio of cement. More cement in the mix makes it cure harder and stronger, creating a surface that does not wear as much prior to tiling, but in my experience it makes it a little more difficult to work. It does not pull as well and sticks to itself a bit more.

This takes a little getting used to, but the trade-off of not having to dry-mix sand and cement is worth it to me. Regardless of what ratio of sand and cement you use, who makes it, if it's premixed, or if you're mixing your own, one thing remains constant: You need just the right amount of water. If you don't add enough water, the cement will not bind to the sand, and your bed will not lock together. If you add too much water, the final product will shrink when curing and create cracks and weak spots throughout your floor. It will also not remain flat. Lastly, I have found that too much water makes the mud much harder to work. The only way to be sure is to test the mortar while you mix it. The consistency should be the same as you would want when building a sandcastle on the beach. If you squeeze it in your hand, it should pack together and leave your hand dry, but also easily break apart if you drop it or poke it with your finger.



Dry-pack mortar should pack together when squeezed...



...but break apart easily when prodded.



For a video of this process, visit [FineHomebuilding.com/magazine](http://FineHomebuilding.com/magazine).

## THE METHOD

It takes some trial and error to get the hang of this process, but the concept is as simple as placing, packing, and screeding the mortar mixture, using surrounding finished areas or small piers of compacted mortar as a registration surface for the screed. It's a forgiving process, because material can easily be added or removed, and the mixture has a very long dry time, so there's no race against the clock. Here are the basic steps.



### FILL

I aim to spread the mix roughly 1/2 in. to 3/4 in. higher than the existing screeds to ensure that once packed, it's not too low. Do not spread more mix than you can comfortably reach across and spread; my sweet spot is 16-in.- to 24-in.-wide sections.



### PACK

Using a finishing trowel, slap the mud with a firm, even pressure across every square inch. This hand pressure compacts the mud into a cohesive slab, hence the name "dry pack."



### SCREED

Pull a screed across the mud using a back-and-forth sawing motion, but don't let the ends of the screed dig in. After the first pass, use longer strokes to smooth the surface.



### BURNISH

After screeding, use a wood float to burnish the top layer. The square edges get rid of any highs and lows in your bed, and rubbing in a circular motion fills any small voids.



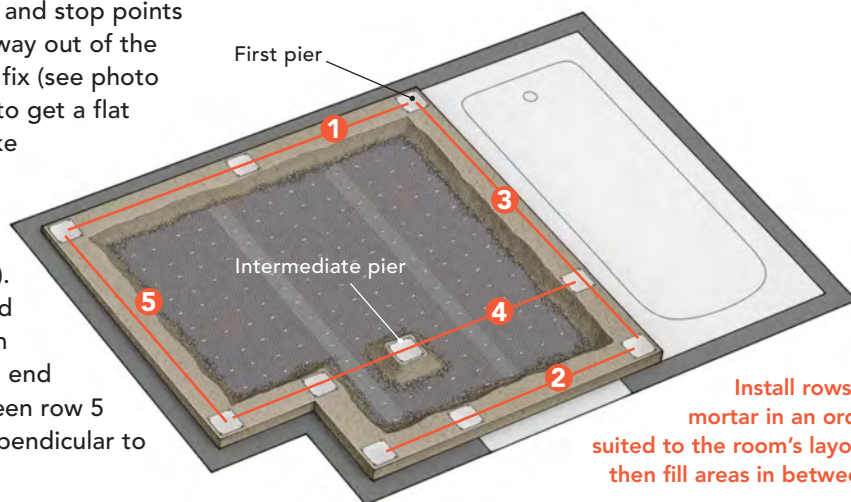
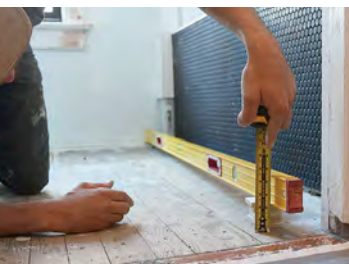
### SMOOTH

Last, slick down the top layer with a finishing trowel. This embeds the loose sand and brings a small amount of water to the surface, creating a thin crust that acts as a temporary wear layer until the floor is tiled.

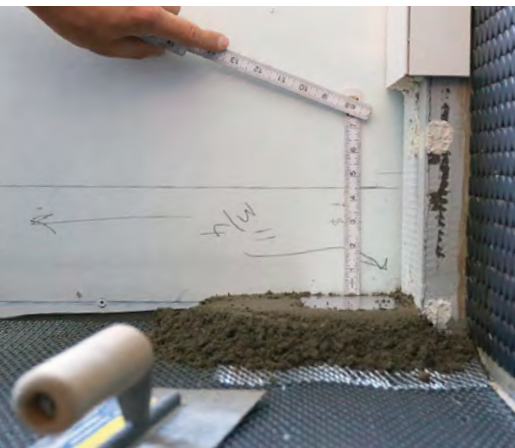
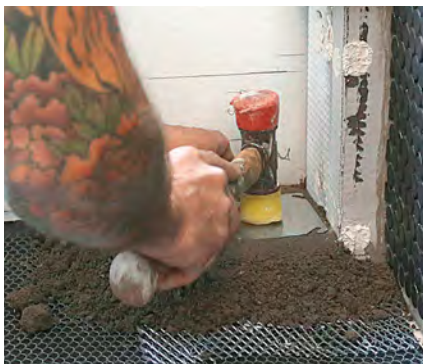
# ESTABLISH A SEQUENCE

If you're aiming to make your floor level, your start and stop points really only depend on how you need to work your way out of the room. In this space, we were too far out of level to fix (see photo left), so the goal was just to get a flat floor. The plan was to make mortar row 1 and row 2 parallel to each other, and both of them level (albeit on different planes). We then pitched row 5 and row 3, again keeping them parallel to each other. The end

goal was to be able to hold a level anywhere between row 5 and row 3 and have it read level. Turn the level perpendicular to that (row 1 to row 2), and it was not level.



Install rows of mortar in an order suited to the room's layout, then fill areas in between.



**CREATE A BENCHMARK** The first pier sets the stage for everything after it. Pour a small pile of mortar and smack it with the finishing trowel until it's compacted. Then, place a metal electrical cover plate atop the packed mortar and adjust its height with whacks from a rubber mallet until the first pier is at the desired height, which is established based on a reference point on the wall.

## FILL BETWEEN THE PIERS

Once the first and second piers are in place, add and compact a row of mortar to the area between them, and use the piers as reference points for screeding it flat.

## WATCH THE EDGES

After screeding each row of mortar, skim the finishing trowel lightly along the surface of the mud to lift and remove mortar that tends to build up along the walls.





## DEALING WITH DOORWAYS

When packing a row of mortar across a doorway, as in row 2 of this job, the process is the same as along a wall, but the last step is to set a screed on edge across the opening, and use it as a guide for cutting a clean edge into the packed mud. Once cut, add a temporary scrap-lumber threshold so the mortar won't be accidentally damaged.



**MAKE A CONNECTION** Establish row 3, along the edge of the tub, to connect rows 1 and 2. This new row will then make it possible to create row 4.



**ADD A GO-BETWEEN** Set a long screed between rows 1 and 2 so that an intermediate pier can be established in line with the outside corner of the bump-out (photo above). This pier will be used to establish rows 4 and 5 (photo right).



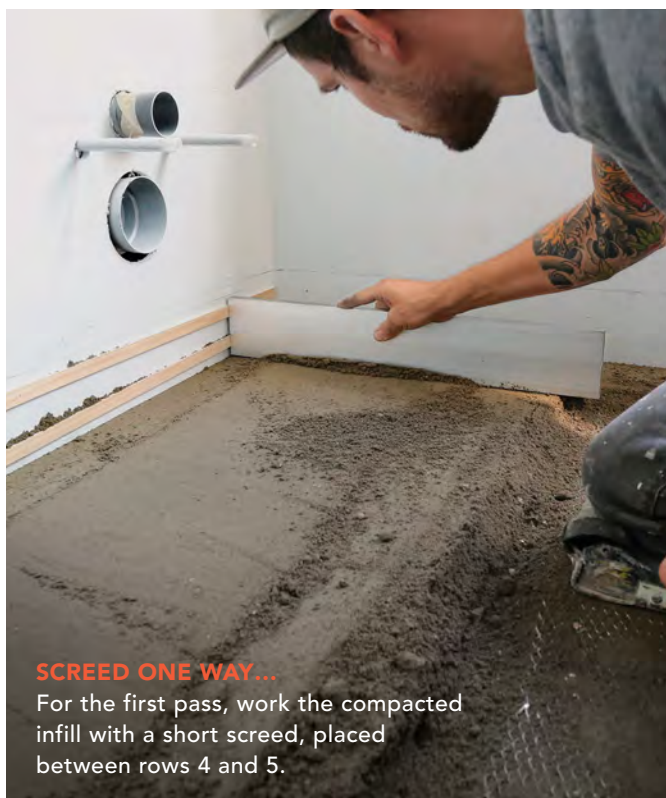
# FILL IN AND FLATTEN

With all the rows in place, the metal plates can be removed, and filling work can begin.



## START AT THE BACK

Starting in the back corner of the room, set the infill mortar slightly higher than the rows around it to leave room for compaction.



## SCREED ONE WAY...

For the first pass, work the compacted infill with a short screed, placed between rows 4 and 5.



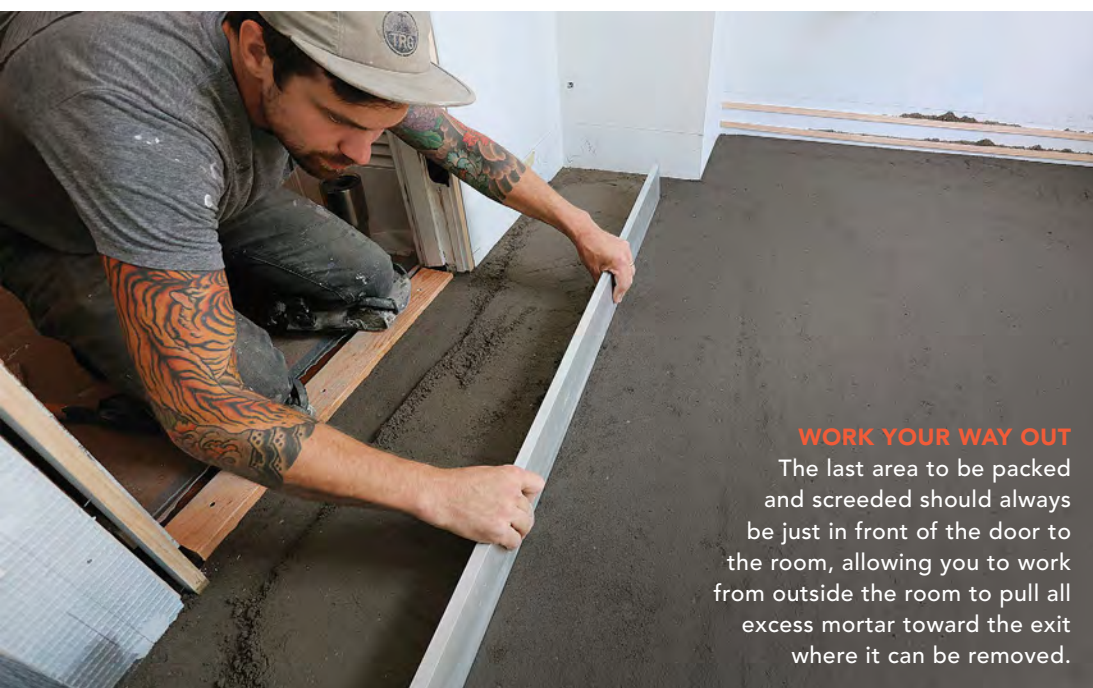
## ...AND THEN THE OTHER

To blend the area, switch to a long screed and move out from the nook.



### GO BIG

After the first section is filled and finished, it becomes a reference surface for filling the main area of the room. Here, work with a longer screed, in sections no larger than you can comfortably reach from a kneeling position.



### WORK YOUR WAY OUT

The last area to be packed and screeded should always be just in front of the door to the room, allowing you to work from outside the room to pull all excess mortar toward the exit where it can be removed.



**LOW SPOTS** If you notice that any areas need additional material, rake the area loose, add more mud, re-pack it, and re-screed it. If you were to add material to the compressed mud without raking it loose, it would be compacted in separate lifts, and would create a false bond that could lift or separate while curing.



**VOIDS** If any areas have small holes or a piece of aggregate has created a divot, you can forcefully throw a handful of sand into the top layer of your mud. This embeds the sand particles into the mud and again ensures that you do not have a false bond that may separate when curing. Follow up by burnishing the surface with your wood float again.