

Ceramic Tile Troubleshooting

by Michael Byrne

There are few materials as durable as ceramic tile. A piece of glazed tile is, after all, a layer of glass fused to a layer of stone and should last a lifetime or more. Yet many ceramic tile installations — whether traditional mortar bed or modern thin-bed jobs — fail early in their service. And although no two installations are alike, the list of things that typically go wrong is fairly consistent, and applies even to jobs using the finest materials.

If this article tried to explain the proper way to install tile in all situations, it would be as long as an encyclopedia. Instead, it will address eight of the most common problem areas, show how these problems are caused, and offer antidotes.

Mistake One: The Wrong Tile

The easiest way to ruin a tile installation is to choose the wrong tile for the job. Unfortunately, this is where many jobs turn sour. For example, a wall tile set on a well-traveled floor will scratch. Or absorbent tiles in a wet location will get saturated. Although there is currently no universal system for rating tiles, some general guidelines will help.

Nearly any tile will suffice on a dry wall. For a wet wall, however, such as a tub or shower enclosure, choose a vitreous tile. Vitreous (high-fire) tiles are harder and absorb less water than non-vitreous.

Vitreous tiles are generally a good choice for floors and countertops as well. But here you must check the glaze, too. A soft glaze can scratch, or even wear away completely, depending on the foot traffic.

You also need to consider appearances and the customers' expectations. For example, unglazed



Using a 1/2-inch drill at low speed, the author mixes a batch of grout. Mixing too fast will weaken the grout.

quarry tile is very tough and will satisfy all the sanitary and durability requirements of a meat packing plant or chemical manufacturer. But many homeowners are disappointed with the product because it shows footprints, and is prone to dusting, even with frequent waxing and cleaning.

Mexican pavers, on the other hand, a relatively soft non-glazed tile, wear well in residential settings. Although they, too, require sealers or waxes and frequent cleaning, over time the appearance of the tiles improves.

In most cases, your tile dealer can tell you whether a given tile will hold up under the intended use. If he's not certain, ask for a sample to test. Then subject the tile to the same conditions it will face when installed — scraping pots and pans, scuffing from shoes, etc. Finally, see if it cleans up to your client's satisfaction using standard cleaning techniques.

Mistake Two: Ignoring the Specs

When a tile job fails, it seems like everyone involved has enough

time and resources to redo the job properly. Wouldn't it be easier to do it right the first time? Usually, this means consulting the *American National Standard Specifications for the Installation of Ceramic Tile*, or the *TCA Handbook* (both available from the Tile Council of America



For industry specs on tile materials and installation, follow the recommendations of the TCA Handbook and ANSI standards.

(P.O. Box 326, Princeton, NJ 08542).

All materials approved for use on tilework carry an ANSI number to show that the material meets or exceeds minimum acceptable performance levels. If a product is not listed by ANSI and isn't designed for use with ceramic tile, don't use it.

The *TCA Handbook* is the industry's basic reference for setting tile. It shows sectional views of the most popular installation types, and tells how to properly design, construct, and prepare the substructure.

If you ignore these books and choose the wrong materials, like water-resistant drywall or blueboard for wet areas, or particleboard or lauan plywood for floors, the job is doomed, once again, before any tiles are installed.

Mistake Three: Storing Materials Carelessly

The best tile materials won't perform their job if they are stored



Wrong tile for the job: The glaze along one edge of this wall tile is worn completely through — because it was mistakenly installed on a floor.

Even the best materials won't deliver a good job if you make these common tile mistakes



Freezing and exposure to the elements can undermine many tile materials — like this bag of mortar left in the weather overnight.

improperly. Take, for instance, latex or acrylic mortar additives. When properly installed and cured, they protect against freezing conditions by keeping moisture from penetrating into the mortar. In addition, they allow mortar to expand and contract as the building moves from moisture or temperature changes. But before they are mixed and cured, freezing can ruin many additives.

For this reason, it is important to do something very simple: Read the printed instructions very carefully. And although some installation materials can survive freezing or overheating, a good rule of thumb for all tile work is to shelter all materials from rain, overheating, and freezing. In fact, keep all materials (including the substrate) at room temperature, and provide supplemental heating or cooling if necessary.

If you have a problem with an installation material, consult the manufacturer. Don't be afraid to appear stupid. (That will happen automatically if you forge ahead with your own creative solution.)



Bad substrates equal failed tile: Don't even think of tiling over a crumbling slab with structural cracks 1/8 inch or wider.

Mistake Four: Not Preparing the Substrate

Drywall compound and dust, flaking paint or floor coatings, dirt, mud, and ground-in half-eaten sandwiches are commonly found in two locations: the local landfill and the job site on which you are working. We all know about the problems with landfills, but we don't all know that these substances are bond breakers that can prevent the best adhesives from holding on to the substrate. Additionally, there may be substances intentionally applied that are incompatible with tile materials. Among these are floor waxes and sealers, and curing compounds used with concrete floors. Any such dirt or coating must go.

In addition, each setting bed, whether concrete, cement backer board, or mortar, must be plumb, level, square, and flat. Tiles will remain fixed to an out-of-plumb wall just as tightly as they will to one that is plumb, but the appearance will suffer. Best results are achieved by following ANSI Standards and the *TCA Handbook*.

Mistake Five: Omitting Expansion Joints

Of the many tile failures I've inspected, few were without problems with expansion joints. Industry studies of installer callbacks report similar findings. Yet I continually find that many architects, builders, and installers do not understand this most basic detail.

Expansion joints are safety valves that protect tiles from damage due to the *normal* and *natural* movement inherent in every structure due to live loads and environmental conditions. They are needed because of the laws of nature — even where there are no building codes or on jobs done “the way my father used to.”

Even where you will find them,

in the mall or other commercial spaces, expansion joints are often done wrong, creating cracked or broken tiles along the joints or cracks in the tiles running parallel to the joints. And the sealant used to fill the joint will usually be discolored, unsightly, or missing.

Yet, at least in theory, expansion joints are relatively simple to design, install, and maintain. They are fully described in the *TCA Handbook* (section EJ171), with their required spacing and frequency. The handbook requires them not just in large, commercial spaces, but wherever “tile work abuts restraining surfaces such as perimeter walls...” This includes residential baths, counters, and kitchens.

A good example of this is shown in the photo below. In his haste to complete the job on time, the general contractor had the baseboard molding installed against the subfloor, and told the tilesetter to butt the tiles tight to the molding. When I was called in to inspect the tile work, the GC was complaining that the adhesive was bad, the customer claimed the tiles

were no good, and the installer swore he did the job according to contract plans and specs.

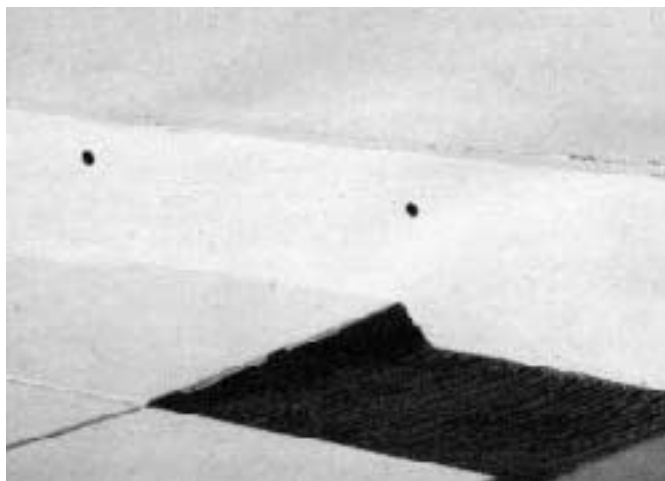
In the end, the customer was satisfied, but not before the contractor removed and replaced all the tiles, adding a new cement-board underlayment, and removing and reinstalling all the first-floor baseboard molding.

It would have been easier to follow EJ171 the first time.

Mistake Six: Improper Tile Application

In spite of their reputation for durability, tiles are relatively fragile until they are bedded in adhesive, and surrounded by grout. If not supported properly, tiles are weak and easily broken.

For a good bond, there is only one acceptable method of application, regardless of the amount or type of adhesive or setting bed. That is to use a clean, sharp-notched trowel to spread and comb out the adhesive, followed with a beating block and hammer to seat each tile, leaving a minimum 3/32-inch layer of adhesive between tile and setting bed.



Place a flexible expansion joint wherever tile meets a restraining surface, such as a partition. If not, the tile may buckle when the wood substrate shrinks.



A beating block was used to properly seat the tile on the right, resulting in full coverage of adhesive. The tile on the left was simply positioned and pressed into place.

Generally, the larger the tile, the larger the trowel notches, adjusting for specific job conditions. In addition to choosing the right trowel, you need to hold it at the correct angle. This takes dexterity and practice, but the basic method is simple: Firmly spread the adhesive with the trowel's smooth side first (the sound and feel of the trowel grating against the setting bed are good indicators of enough pressure). Next, add more adhesive to at least equal the depth of the notches on the trowel, and then use the notched side to produce the thin ridges of adhesive. Keep the notches in contact with the setting bed at all times, and, as above, use sound and feel as indicators.

After positioning the tile, it must be seated with the beating block. Unless the tile is properly bedded with 100% coverage of the adhesive, the effort is wasted (see photo at bottom of previous page).

The beating block does not require the same hammer blows you would use to drive a nail, but rather firm gentle taps. The idea is to seat the tile in adhesive, and level it against neighboring tiles. If the process fails to achieve full adhesive coverage, apply more adhesive with a slightly larger-notched trowel.

Mistake Seven: Wrong Grouting Techniques

Grouting has three stages: mixing, placement, and finishing. A slipup or shortcut during any step can wreck the appearance or performance of even the most carefully installed tiles. A good grout job, on the other hand, can help to mask slight surface irregularities between tiles — although it can't improve the grip of a weak adhesive.

Grouting involves too many variables to cover in this article (see "Ceramic Tile Grouting," 11/91), but let's look at the three most critical points: air entrainment, erosion by clean-up water, and finish techniques.

Air entrainment in grout. Since hand mixing infuses very little air into grout, it produces the strongest mix. But most installers use power equipment, which can potentially entrain air into the grout mix. Since grout depends on its density to protect the tiles and resist water, care is needed when mixing.

Installers use different types of mixing devices. Small paddles are designed for use with liquids like paint, and require high speeds. This whips thousands of tiny air bubbles into the mix, perforating and weakening the cured grout, and leaving innumerable entry points for water.

For better quality grout, use a paddle with large, thick blades like the one in the photo at right. These typically run at about 300 rpm in a 1/2-inch drill.

Eroding the fresh grout with cleaning water. For portland cement-based grouts, water is vital for the proper hydration of the mix. In fact, damp curing is necessary to ensure that the grout reaches its maximum strength (damp curing is not required with some latex or acrylic grouts). But the use of excess cleaning water is the enemy of grout, and can wash out the cement particles that bind the mix together.

The best way to control cleanup water is to use a specially designed grout trowel. I prefer the Groutmaster trowel (available from American Olean and most tile suppliers).

Sloppy finishes. The last step in any tile installation (other than putting sealant in the expansion joints) is the finishing of the grout after initial cleaning. If done right, this "final inspection" can make the difference between a mediocre job and one that looks polished. All that is required is a slightly dampened sponge or soft cloth and the tip of a margin trowel or utility knife.

The goal is to get each joint identical, with corners sharp and crisp, and margins squared off.

The time to begin is when all that remains on the face of the tiles is a light cement haze. Buff the tiles with the cloth or sponge, and eye each joint for consistency, packing low spots, and paring down the highs. Make certain that an equal amount of corner or edge is revealed on each tile. Also, a sharp edge on the perimeter joint makes life much easier for the painter or paper hanger to cut a crisp edge.

Mistake Eight: No Protection During Curing

Many installers, even experienced tilesetters, think that curing doesn't start until the grout has been placed. Actually, each tile installation has at least two critical curing periods: after the adhesive has been placed, and after the grout has been placed. If a waterproofing or crack-isolation membrane is included, there will be



A mixing paddle for ceramic tile should have large, thick blades and run at about 300 rpm in a 1/2-inch drill. Smaller, faster blades will entrain air in the mix and weaken the grout.

three. And if expansion joints are within a traffic or use area, there will be four. Here's why.

First, all adhesives, sealants, and mortars (including mortar beds, thin-set mortars, and grouts) go through three phases: the plastic phase when they can be applied and generally moved about, the setting phase when they begin to harden, and the cured phase when they may accept normal traffic or use.

During the setting phase, the molecules in the material are starting to lock into place, essentially by growing bristles that intertwine. Until the material has fully cured, the bristles are fragile and can be damaged by pressure, for example, from someone's foot. Once this happens, the bristles don't grow back, and the bond is permanently damaged.

So much for amateur chemistry. The point is that movement is a problem. Even thick walking boards placed over freshly installed tiles cannot protect the setting adhesive, mortar, or grout. The only way to be sure is to eliminate traffic during the setting phase. Installers should use barricades and written notices to protect the tiles, and themselves.

Tile installation is not complicated to the professional who follows the accepted standards, uses approved materials, and who realizes that the ceramic tile trade, like all others, requires ongoing study and attention to detail. ANSI Standards, and the *TCA Handbook* have taken most of the guesswork out of tile installation, but it is up to the installers to put the information to good use. ■

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For More Information

For more information on tile materials and installation, contact:

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