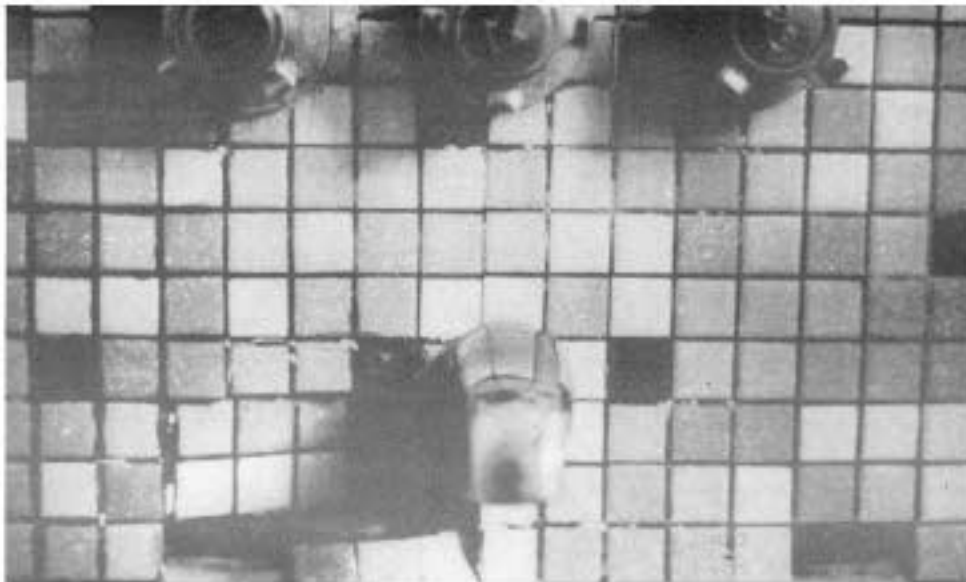




Near faucets, tub lips, shower bases, and corners are the first places to fail in many drywall-and-mastic tile jobs.

Thin-Set Ceramic Tile

New Approaches to Old-Fashioned Quality

by Harry T. Swanson

For more years than most of us can remember, ceramic tile was known as the material you used on bathroom walls and floors, or maybe in some industrial applications such as laboratories, industrial washrooms, commercial kitchens, and certain installations where the emphasis was on sanitation. Ceramic tile was the choice finish material because, while being decorative, it also was durable and easy to keep clean, and water would not hurt it.

In the early days, sizes for floor tiles were limited to one-inch squares and hexagons, six-inch squares, and some special sizes; for walls, 3x6-, 6x6-, and 4½x4¼-inch tiles were predominant. Surface textures usually were glazed for walls and unglazed for floors, to reduce slipping. Color arrived in floor and wall tile 40 or 50 years ago. (If you are old enough, you may remember when you could choose any color tile you wanted—as long as it was either black or white.)

A Little History

Until the mid-1960s, ceramic tile in the U.S. remained in its historical niche: the bathroom. With the post-World War II affluence, Americans began traveling abroad and noticed that in other countries ceramic tile was used for floors and walls, interior and exterior, just about everywhere in and on a structure—except the bathroom. (Today that has changed: Europe now puts ceramic tile in the bathroom, too.) Overseas, tile was considered a valuable finish and was used where it could be seen and would contribute to a durable, long-lasting building.

The American tourists returned home and looked for ceramic tile to use all around their houses. Foreign manufacturers moved in to satisfy the new demand for tile in the U.S. Domestic manufacturers at first were taken by surprise, but soon joined the parade.

New manufacturing processes made it possible to create all sorts of colors, patterns, designs, and shapes. Sizes went

from one-inch squares up to two-foot squares. Shapes became a veritable study in geometry, with squares, rectangles, hexagons, octagons, circles, random-size patterns, and shapes using a combination of straight lines and arcs. Most of the tile was used for flooring and was no longer just unglazed. It was hard, with durable glazed finishes that could even be made nonslip.

New Methods

Before WW II, Americans used the European method of installing ceramic tile: bearing the tiles into an inch-thick bed of sand/cement mortar called a

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"mud" bed. This system gave a durable, long-lasting, highly water-resistant tile installation. It also made for an installation that was thick, heavy, slow, and labor-intensive.

After the war, architects and builders looked for new and quicker ways to build structures to satisfy the demand for housing. Heavy mortar beds for ceramic tile did not fit in with the faster, lighter-weight structures that evolved.

The introduction of gypsum board for walls and plywood for floors forced the tile industry to develop suitable "thin bed" or "thin set" systems to apply ceramic tile to these substrates. Thin-set refers to any tiling system in

which tiles are bonded to a substrate with ⅛ inch to ¼ inch of adhesive. The adhesive may be a latex- or epoxy-based mortar, a water-resistant mastic, or any thin-bed adhesive.

The big push at this time was to use tile on floors in all sorts of rooms or even on outdoor plazas and sidewalks. Since the market growth was in floors, the effort went into developing systems for installing tile there—not in bathroom tub and shower enclosures. The bathrooms took a backseat and borrowed the techniques developed for floors. That created some of the problems we have today in our bathrooms.

The Ravages of Water

What's wrong with our bathrooms? In the Northeast, most residential and commercial bathrooms for the past 40 years or so have been built with tile installations using the thin-set method. The walls were usually wood studs and gypsum board, and the floors either concrete or plywood. (Metal studs have replaced wood in recent years in commercial buildings and in some residential.)

Problems have developed because tile installations are not waterproof. With frequent wetting, and without adequate drying cycles, water saturates the grout between the tiles. Water also goes into cracks in the grout in the corners, into cracks where the tub lip or

shower-stall base meets the tile, behind the escutcheons around the faucets, and even around the soap holder if cracks have developed. The water does not harm the tile: it affects the setting system and the substrate on which the setting adhesive is applied.

If the substrate and thin-set system are sensitive to water, you will have a structural failure. We have seen tiles falling off walls with disintegrated gypsum board, holes punched in rotted gypsum board by someone hitting it with an elbow, even wood studs behind gypsum board rotted to thin sticks. Expansion and contraction of the wood substructure caused by wetting and drying cycles causes grout to fall out of the joints, which exposes the system to still more water.

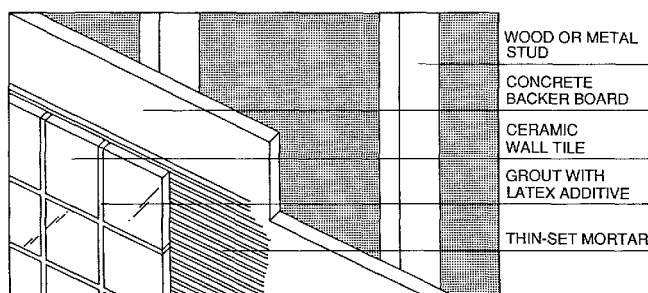
Subfloors, too, are not as strong as they were when heavy mud beds were used for the tile. The flexing of those floors under live loads of occupants and tubs full of water can cause distress in the floor and wall abutting. Finally, the tiles usually were installed with tile adhesives that eventually broke down under constant wetting. This, combined with a water-sensitive board, ruined many bathroom tile installations.

Tile bathrooms suddenly were not as problem-free as we thought. The consumer, architect, and builder looked for solutions to ceramic-tile walls and found, instead, various types of plastic tubs, shower bases, and wall surrounds. These were promised to be easy to install, inexpensive, and trouble-free. While they lived up to the first two promises, they did not prove to be trouble-free: they are susceptible to scratches, and they don't hold up well against cigarettes, abrasive cleansers, careless workers, and so on.

The Cement-Board Solution

A bathroom, like a roof, gets the toughest exposure in a building—to water. So more time, attention, and money should be budgeted for proper construction that can resist water. It is possible to build a modern bathroom with thin walls and floors and have a permanent ceramic-tile installation like the good old days. But you must be willing to spend a few more cents per square foot to do it.

To build a ceramic-tile bathroom right, you must start with the structure. The studs, either wood or metal, should be on 16-inch centers. For a tile substrate, forget about using gypsum wallboard—either plain or the water-resistant green board. Use instead portland-cement backer boards. These boards, introduced about ten years ago, are the tile industry's answer to getting the benefits of the old sand/cement mortar bed in a lightweight, prefabricated board. The 7/16-inch-thick boards are made of portland cement and aggregate, and are reinforced with fiberglass-mesh faces. Since they are



portland-cement products, water won't hurt them and you have a permanent substrate on which to set tile.

Cement backer board is made by several manufacturers and comes in a variety of sizes from 3x5 feet to 4x8 feet. The panels are lightweight (compared to the one-inch mortar used in an old-style mud job) but at three pounds per square foot, they weigh a bit more than drywall.

Although the first-generation material was somewhat hard to work with because of its heavy reinforcing mesh, the newer cement boards cut, drill, and fasten with the same tools and skills used with drywall. They are scored and snapped like drywall, and they can be

proper-size notched trowel and the tile is applied and beat in to get a firm bond.

Some manufacturers recommend a bagged thin-set cement/sand mortar mixed with water for the setting bed. We prefer a latex-modified thin-set mortar. This is made by adding a proper latex additive—instead of water—to a one-to-one mix of portland cement and fine sand. Or you can add a different latex additive to a bagged thin-set mortar mix. The latex will give you four times the bond strength of the mix made with water, and longer open time on the wall to place the tile. It also provides superb resistance to wetting from any water that may reach it.

Another thin-set option is mortar

may move from summer to winter in northern climates.

You need the cement board only in the wet-space areas, such as the tub surround or the interior walls of a stall shower. You can use gypsum board in the rest of the bathroom and apply ceramic tile with the latex-modified thin-set mortar or with a water-resistant ceramic-tile adhesive.

There are such adhesives on the market—organic mastics, for instance—that will bond to a cement backer board, but they are only resistant to moisture and will not stand up under heavy shower usage. In addition, organic mastics will crystallize and turn brittle over time, especially near a radiator or over a heating vent. Once the material is brittle, a little flexing of the studs can pop it loose. Mastics are recommended only for light-duty residential bathrooms.

In wet areas, do the job right and use cement backer board and latex-modified mortar. This will cost a little more than gypsum board and tile adhesive—maybe \$30 to \$40 more for 50 square feet around a tub—but the owners will have a bathroom safe from the ravages of water.

Something New

Pre-grouted sheets of tile that can be applied to walls are available—at a premium. The joints are filled with silicone and the installer must use the same material to fill the joints between the abutting sheet edges. Pre-grouted tiles started in commercial work, but as labor costs rise, they are becoming competitive in residential work. These pre-grouted tiles provide good sanitation and hold up well.

We have not mentioned ceramic tile for bathroom floors, since this article focuses on walls. But the thin-set systems are available for setting tile on plywood or concrete, and instructions are available from manufacturers of setting and grouting systems. Detailed instructions are available from the Tile Council of America and the American National Standards Institute covering step-by-step methods for installing tile by the thin-set system.

For now, at least, the ceramic-tile industry has solved the problem of installing tiles in the bathrooms of today's thin, lightweight structures. It was a roundabout route, but bathrooms are back on track. Once again, contractors can assure consumers that ceramic tile can be used with confidence, just as it was back when tile was set in an inch of wet mortar. ■

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Tile installations are not waterproof. With frequent wetting—without adequate drying—water saturates the grout and goes into cracks. It does not harm the tile but can break down the adhesive and substrate.

screwed or nailed without predrilling. Knockouts for plumbing can be made with a swat of a hammer. For extensive cutting, a masonry blade in an electric jigsaw is helpful.

Install the cement backer board according to manufacturers' instructions. If you use this board on metal studs, they must be 20-gauge or heavier to give a rigid wall that will support the weight and not flex. On wood studs, you will generally nail up the board with 1½-inch galvanized roofing nails on six-inch centers along the edges of the board, and eight-inch centers in the field. Leave a 1/8-inch gap between abutting boards. (Note: For tub surrounds, the 3x5-foot board works fine without much cutting.) The joints and corners are covered with two-inch fiberglass tape set in the same thin-set mortar/adhesive you will set the tile in. Once up, the board is ready to receive tile.

Use Latex-Modified Mortar

Before tiling, it is a good idea to wipe the face of the board with a damp sponge to remove dust particles. The thin-set mortar is applied with the

with epoxy or epoxy-latex additives. Although epoxy resins yield an even stronger and more chemical-resistant bond than the latex-modified mortars, they are generally too rigid to use on walls, which flex a little under live loads and due to the change of the seasons. The epoxy-based mortars, however, are ideal for floors and countertops (for example, bonding tile to plywood) where the added strength and chemical resistance (to food wastes, for instance) will serve well.

We also recommend adding latex to the tile-grout mixture. It will make a stronger bond, complete the cure to impart maximum hardness and reduce cracking, and reduce by half the moisture absorption of the grout.

To help keep water out of the substrate, you should place the board ¼ inch above the surface of the tub and the shower base and caulk this space. Do not grout it. Also do not grout the corners. They should be caulked along with the top of the walls, if the tile is run up to the ceiling. Flexible caulked joints at these locations will isolate the tile walls from the rest of the room, which



To ensure good contact between tile and thin-set mortar, a tradesman sets each tile with a hard rubber mallet and a "beating block."