



Cracked Tile: Common Causes & Misconceptions

The Tile Council of North America's Product Performance Testing Laboratory routinely receives calls from homeowners, architects, and installers who are experiencing problems with an installation. Quite often, they believe a particular material is at fault and would like it tested. One of the most common issues we hear about is tiles' cracking or separating from the floor. The caller usually wants to be told the cause of the problem or who is to blame, but without a detailed, onsite investigation, these questions cannot be fully answered. This article presents ideas on possible causes of installation failure and suggests ways to prevent future failures.

What is wrong with the tile?

Oftentimes, a tile consumer with a cracking issue will blame the failure on the tile itself. While the tile is the part of

the floor system in which the damage is evident, it is not necessarily the cause of the problem. In fact, if the tiles were tested per the ASTM C648 test method for breaking strength and surpassed the

250 pounds-force specification for floor tiles in ANSI A137.1, then it is likely the tile is not the problem.

What might be the cause of the problem?

Although it is impossible to speculate the exact cause of cracked or debonded tile without a proper inspection, there are some causes that occur most commonly. In an installation over a concrete subfloor, movement or cracking of the concrete can cause cracking in the tile surface. These are called *reflective cracks*. Concrete will continue to shrink long after it is first cast, and it is possible for the concrete



Right: Cracked tile may be due to shrinkage of a concrete subfloor or deflection in a wood subfloor.

to crack due to shrinkage while it is curing.

When the concrete shrinks, it causes many shear and compressive forces on the thin-set, tile, and grout. If the shear force exceeds the strength of the bond, the tile may de-bond from the floor. This is also called *tenting*. Sometimes,

when the bond is very strong between the tiles and thin-set, as the shear force finally exceeds the bond strength, the tiles' de-bonding from the floor can make a very loud sound.

Another possible cause for cracked tile is excessive deflection in an installation over wood. Excessive deflection

in the substrate will cause compressive and tensile forces on the grout and tile. Typically, with excessive deflection, the grout will crack first. In more severe cases, the tile will also crack.

What can be done to prevent tiles' cracking or de-bonding?

When it comes to concrete, one simple, yet another important issue to consider is how long the concrete is allowed to cure before the tile is installed over it. The longer the concrete is allowed to cure, the better. If the concrete is allowed to cure for a long period of time, any cracks that

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form can be filled, and any curling (distortion of a slab into a curved shape around the edges) can be ground down. Many people suggest a minimum cure time of 28 days. Some thin-set manufacturers say 14 days may be sufficient, if premium latex-modified thin-set is used.

Another option when installing tile over concrete is to use a crack isolation or anti-fracture membrane. The membrane bonds to the concrete subfloor, and the tile is installed with thin-set to the membrane's surface. The anti-frac-

ture membrane is used to reduce or prevent movement in the concrete from being directly transferred to the tile.

Additionally, when installing over concrete, a lack or improper use of movement joints can cause problems. Movement joints are used to eliminate stresses that occur between the substrate and the tile. The 2008 *TCA Handbook for Ceramic Tile Installation* has guidelines for the use of movement joints. It is important to understand that all floor installations should have movement joints, and that the use of a crack isolation membrane does not replace or eliminate the need for movement joints.

Concrete will continue to shrink long after it is first cast, and it is possible for the concrete to crack due to shrinkage while it is curing.

Lastly, when installing over a wood subfloor, it is important to have appropriate joist spacing to minimize deflection. The 2008 *TCA Handbook* contains information about maximum deflection and joist spacing. In general, floor systems over which tile is installed must conform to the International Residential Code (IRC) for residential applications, or the International Building Code (IBC) for commercial applications.

Further information about this topic and other tile or installation-related issues can be found on Tile Council's website, www.tileusa.com. **TILE**



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About the Author

Katelyn Simpson works for the Tile Council of North America's Product Performance Testing Laboratory as a Laboratory Engineer. She is responsible for testing tile, stone and other installation materials to ASTM, ANSI and ISO standards. She is also involved in the development and revision of ASTM and ANSI standards. Mrs. Simpson earned her B.S. degree in Ceramic and Materials Engineering from Clemson University.