FIXING CERAMIC TILES ON YOUNG FLOORS

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INTRODUCTION

Ceramic tiles can be fixed on young floors as soon as the floor has hardened and is sufficiently dry. The German standard DIN 18157 "Installation of ceramic tiles by thin bed fixing" requires a minimum age of 28 days for the cement mortar floor, and in the ZDB a maximum floor moisture content of up to 2 % is set, which means an even longer drying time of several weeks. Current building construction practices do not allow such long waiting times, so that an adhesive mortar was developed, which considerably reduces these times.

HYDRATATION

The question now is: Why are special adhesive mortars required for fixing ceramic tiles on young floors?

The reasons are as follows:

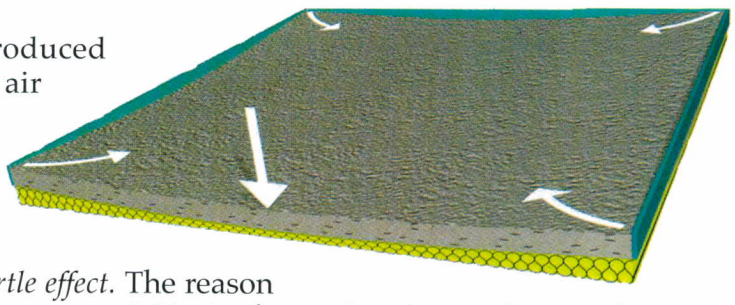
Cement mortar floors shrink during setting. Shrinkage is a result of the evaporation of excess water.

A cement mortar floor made with 300 kg cement/m^3 and a w/c ratio of 0.6 requires 180 l of mixing water/m^3. About 40 % hydrates with the cement. The rest is excess water that evaporates.

If the w/c ratio is 0.7, the excess water per m^3 mortar is 90 l. Excess water evaporation and consequent volume loss then lead to floor shrinkage.

FLOOR SHRINKAGE

The shrinkage coefficient depends on drying conditions. In slow drying, when the floor surface is protected against fast dehydration for example by covering it with sheeting or there is high relative humidity, the shrinkage coefficient lies at around 0.4 mm/m.



In fast drying, usually produced artificially by floor heating or air streams, shrinkage can be found of up to about 0.7 mm/m.

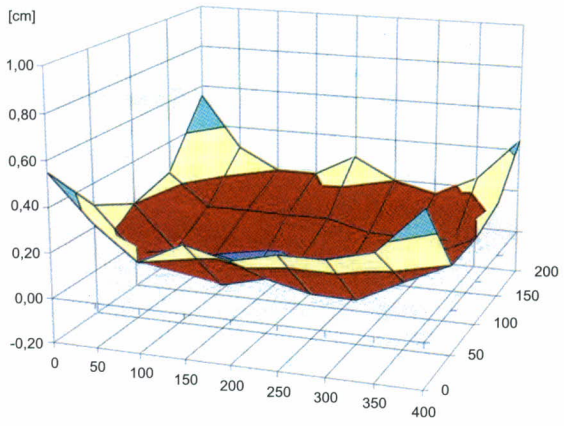
During drying, not only is a contracting mortar screed found, but there is also a *turtle effect*. The reason is that the excess water evaporates more quickly in the surface layers than in the inner region. This produces different stresses inside the screed.

In the test performed at our laboratories, a 400 x 200 cm mortar screed was installed and measuring points were set in a 50 cm grid.

During floor drying, deformation was monitored by a laser levelling system. 28 days after installing the floor, i.e., when it is usually considered possible to fix tile, the floor edges had lifted more than 5 mm. The floor still had 4 % moisture content.

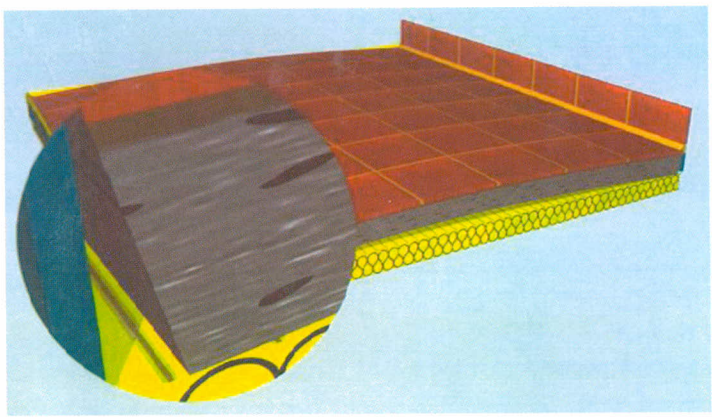
If ceramic tiles are installed on a regularly dried cement mortar, and the moisture in the deeper cement mortar layers dries, there will be an additional floor volume loss with the ensuing stresses.

The result will be convex curvature (turtle effect).



Cement mortar screed without ceramic tiles. Measurement after 28 days).

When the floor lifts in the centre, the edges press down on the underlying insulating layer, which gives so that the edges sink.

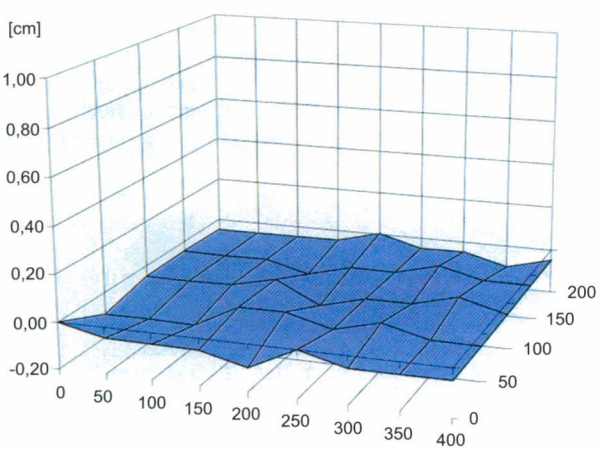


The grout between the floor and the wall cracks. Even the elastic grout pastes that allow an expansion of up to 25 % are unable to absorb these movements and fail.

This problem occurs especially in fast drying floors. In slow drying, as mentioned above, there is a clear drop in the shrinkage coefficient and in deformation behaviour. It is furthermore to be noted that floor quality is heightened by slow drying, with regard to compression resistance and bending tensile strength. Slow drying is achieved in particular by good curing.

Floor curing can be performed by laying wet jute cloth or polyethylene sheeting over the floor. High humidity also contributes to good curing. Curing takes place for at least a week. As an alternative to these traditional methods, ceramic tile installation can be used.

Ceramic tile installation protects the floor from rapid water evaporation, as the moisture can also evaporate through the joints. This slows down the drying process.

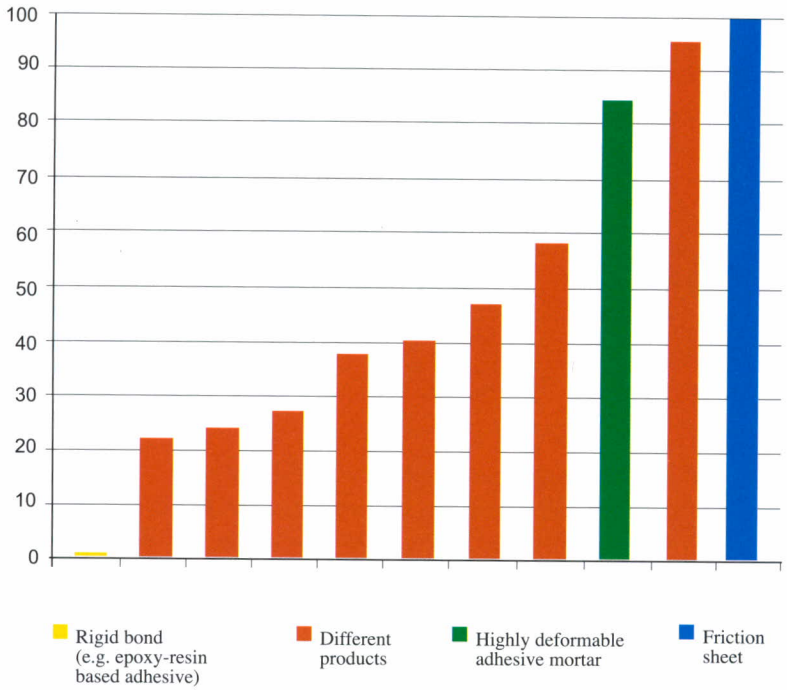


Cement mortar floor covered with ceramic tiles after 2 days. Measurement after 28 days.

STRESS ABSORPTION BY THE ADHESIVE MORTAR

A laboratory test in which ceramic tiles were fixed on a cement mortar floor 2 days the floor had been installed showed that it is possible to prevent floor deformation by this method. On re-measuring after 28 days, no deformation was found in the floor. The tiles were fixed with a highly deformable, dispersed resin-based adhesive mortar, which was especially developed for these cases.

Tile installation lowered the shrinkage coefficient to a minimum. This shrinkage requires an adhesive mortar with a high deformability, which can absorb the stresses caused by drying so that its properties are not impaired in the contact zone between the adhesive mortar and the tile.



Not all adhesive mortars are sufficiently deformable. The stress absorption capability of various adhesive mortars was determined at PCI Augsburg, monitoring surface stresses.

During another test, a concrete test specimen was used on which a tile was fixed on one side, and surface stress was applied by a press. The extent to which the adhesive mortar used in fixing the ceramic tile was able to absorb the stress was established.

The table shows the stress absorption capability of the different types of adhesive mortar. Comparing the highly deformable, dispersed resin-based adhesive mortar (especially developed for this use) with a friction sheet (theoretical value) and a dispersed adhesive (exclusively used for walls), the conclusion can be drawn that the deformable adhesive mortar exhibited the best deformability properties.

The floor naturally needs to be made according to the applicable regulations. Large-size surfaces at to be divided, if possible, by movement joins.

Each field size shall not exceed a maximum of 40 m^2. The maximum length of each field side is 8 m and the side ratio shall not exceed 1:2.

Summing up it may be stated that it is not only possible but also desirable to fix ceramic tiles on young floors, as this prevents fast floor drying with the entailing shrinkage and deformation. Depending on the size of the tile fixed and the corresponding joints, drying of the remaining moisture has been found to take 2 or 3 years.

Assuming a drying time of 2 years and an excess water of 60 l/m^3 (=3l/m^2 in 5-cm-thick floors) yields a water evaporation of 4 $ml/m^2/day$.

RESULTS

These theoretical considerations have been confirmed in practice.

About 1.3 million m^2 of ceramic tiles have been installed on young floors using PCI tile fixing systems with a high deformability capability.

It has thus been possible to install functional ceramic tiling without costly waiting times.