Ceramic Prep for Concrete: Flat and Ready?

by Dave Gobis
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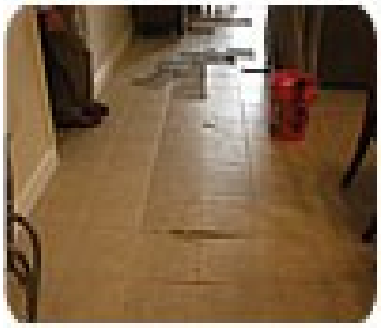
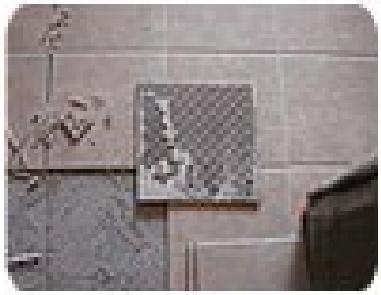
A flat surface free of bond breaking materials is an absolute necessity when using cementitious adhesives. Damp curing of concrete is necessary to provide the performance properties expected of any concrete slab. Most concrete slabs utilize a curing compound to seal the moisture in the slab, which helps it gain strength and prevents curling of the slab that will otherwise occur. Contrary to assertions made by some, there is no such thing as a curing compound that does not affect the bond of a thinset mortar. If a curing compound is present at the time of installation, it must be removed to the point of allowing water to penetrate the surface. Unless water is allowed to penetrate, cementitious bonds cannot be achieved. Other bond breaking materials commonly encountered on both new and existing slabs are soil, paint overspray, and adhesive residues. All of these are commonly found bond breakers, when investigating complaints about loose tile and cracked grout joints.

Floor grinders using dust containment systems with various attachments are really a necessity for anyone who does installation work over slabs on a regular basis.



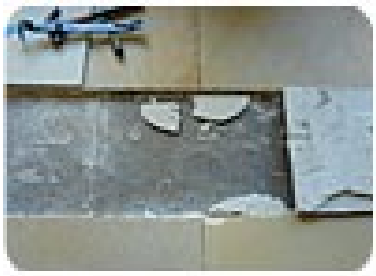
As soon as you see this, you know a tile is trying to occupy more space than it has available so you can be assured there are inadequate movement provisions in the installation. As the additional picture elsewhere in this article shows, there is also little thinset bonded to either the concrete floor or tile.



This tile is a piece removed from the tented tiles photo shown elsewhere in the article. The thinset did not stick to the paint overspray nor was much of it adhered to the back of the tile.

When preparing the slab to receive ceramic tile or stone, any bond breaking material or coatings need to be mechanically removed. Use of acids or solvents should be avoided as they can cause more problems than they solve. Acids in particular can be quite dangerous to you, your equipment, and the surrounding environment. Under the right circumstances, which are not uncommon, the vapors from using an acid can cause rust to form on every metal part in the vicinity and result in extremely costly repairs to all the metal components. Depending on the type used, acids also require flood rinsing and extraction to effectively remove so as not to serve as a bond breaker when thinset is applied to the floor. There aren’t many jobs around where using a hose in a structure for flood rinsing is a realistic expectation. It usually only takes one job with a metal attacked by acid to cure anyone of the desire to ever try it again. When solvents are used it is particularly difficult to remove and/or neutralize any residue which may affect the bonding abilities of a thinset mortar. They too must be neutralized and thoroughly rinsed to avoid bond failure. Mechanical removal removes these concerns while also providing a desirable roughened finish to achieve greater mechanical bond.

This job had a shiny slab with curing compound, and was formerly covered with carpet. There was no tenting here; normal foot traffic loosened the tile.



Shiny steel troweled concrete can prove as problematic as presence of sealer by preventing penetration of water. Many setting material manufactures recommend a “water drop test” which is simply placing a few drops of water on the concrete to see if they are readily absorbed. A cementitious bond cannot be achieved if the slab does not absorb the water. Ideally the water would be absorbed over a few minutes time. Anything longer than that indicates the bonding will likely be compromised; how much is directly proportionate to the degree of absorbtion. Up to a certain point, using a better quality thinset may help achieving an acceptable bond. However, if after 10 minutes the water drop still looks like a bead on car wax, the risk is too great and it unlikely that any thinset will bond to such an impervious slab. Manufactures and tile industry recommendations call for a steel troweled slab followed by a broom finish to provide an enhanced mechanical bond. This is similar to the purpose of a grid or some other type of pattern you find on ceramic tile products. While highly desirable, a broom finish is increasingly rare. It would be quite challenging for a concrete contractor to predetermine the location of all the tile areas on a big pour. If the surface is not broom finished, it becomes a judgment call on the part of the tile contractor to proceed with the installation over a smooth slab surface. I can tell you from testing I have done over the last several years on smooth versus rough slabs, the difference is quite substantial. Manufactures are quite clear on their recommendations of a roughened slab. If it is a residential or commercial project where standards are referenced as part of the contractual obligation of the tile contractor, then you proceed at your own risk. If a problem occurs, you can be sure a smooth slab will be at the top of the list on reasons for the problem. It always is on mine.

Once we have the slab clean and bondable, it is time to determine if it is in compliance with the tolerances recommended or needed. In the real world it is highly unlikely that a slab will be ready to receive ceramic tile without some corrective measures. As tile grows ever larger, such as the 2’ x 4’ size which stimulated this article, floor tolerances for waviness (floor profile) become evermore critical. A tolerance of no more variation than ¼” in 10’ with no more variation than a 1/16” in 12” has long been the industry recommendation for flatness. This recommendation from the tile industry is shown in the recommendations published by the American Concrete Institute (ACI) under ACI 302. That recommendation has worked for a tile size of up to roughly 16” with a ¼” grout joint. When the tile size exceeds that dimension, the lippage (a condition where one tile is higher than the adjoining unit) standard will likely be exceeded dependent on grout joint width. Understanding the design criteria for concrete and associated tolerances needed for large tile is a difficult subject to master. To make a long and complicated issue fit in the space allowed for this article, as a general rule of thumb you can assume that anything over a 12”x12” with a grout joint of less than ¼” is going to require some floor flattening unless you are fortunate enough to have a higher than normal or customary tolerance of ¼” in 10’. Likewise, you can be virtually assured that anything over 16” in size is going to require some type of remedial measures regardless of grout joint size to bring the slab into an acceptable condition for a flat tile installation

Here is where things can get both challenging and expensive. There seems to be a long-held and practiced belief that this fractional difference in slab tolerances can be made up with a regular thinset mortar applied to the back of the tile, often by using spots of mortar as opposed to fully embedding the tile. There are several issues here. First, a standard thinset mortar, one which is not classified as a medium bed thinset mortar, is not designed to level or true a floor tile; it is a bonding adhesive, not a leveling product. It is generally agreed by all manufacturers that when a standard thinset mortar exceeds a thickness of between ¼ to 3/8" there will be both a loss of bonding value and excessive shrinkage which may even cause bond loss. A medium bed thinset mortar may be used to make up for minor inconsistencies in floor tolerances. Medium-bed mortars are defined as such by their manufacturers. They are intended to be used as bond coats 3/16" to 3/4" thick after the tile is embedded; they are designed as direct bond adhesives into which the tile is fully embedded, and also are not intended to be used in truing or leveling underlying substrates or the work of others; they are still adhesives.

Pouring and placing what are known as super flat slabs is possible. All one has to do to verify this as a true and accurate statement is to go to your local warehouse store or big box home improvement center. Because these types of facilities use high-masted forklifts, their floors must be flat to safely operate their equipment. The cost for this type of slab placement is very expensive however because this type of equipment is used through-out these types of facilities it is a necessary expense. With tile floors typically being used to cover only a portion of a floor in a given structure, it is difficult to justify the additional expense of using a super flat concrete tolerance throughout the facility when only a relatively small portion is to be covered with tile. As a result, from an overall cost perspective, the floor area to receive large module ceramic tile will quite likely require remedial measures. Whether these measures are to be grinding, floor patching, or use of a self leveling topping is very difficult to say, but it is unrealistic to bid any job using large tile and small joints thinking otherwise.

All this makes it very difficult to accurately bid a job. As tile grows ever larger, the complexity of accurately assessing what will be required to remediate the slab to accept the tile not knowing the conditions you will face is immense. The cost of floor prep can easily exceed the per square foot price of installing the tile. Floor flatness is something that should be checked and verified before starting any tile installation. Actually surveying the floor prior to installation, while not typical, may be warranted if the job is large enough. There are companies that can provide concrete profile readings using portable test equipment. Whichever means you may choose, always check the floor and make a plan using appropriate products and methods for the conditions encountered.

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