Tile/Stone Talk

Successful Tile and Stone Installations Without Lippage

By Gregory Mowat

Lippage is a condition where one edge of a tile is higher than an adjacent tile. Acceptable lippage in installations is conformance with the flatness requirements.

Flatness, according to ANSI A108.02, is measured for ceramic tile installations for all edges shorter than 15", ¼" in 10' horizontally with no more than 1/16" variation in 12" when measured from the high points in the surface, and ¼" in 8' vertically from the required plane.

According to the *2012 TCNA Handbook for Ceramic, Glass and Stone Tile Installation*, flatness is measured for ceramic tile installations with at least one edge 15" in length, maximum allowable variation is ⅛" in 10' from the required plane, with no more than 1/16" variation in 24" when measured from the high points in the surface, and ⅛" in 8' vertically from the required plane according to ANSI A108.02. Flatness is measured for smooth finished natural stone flooring to 1/32".

Subsurface requirements for flooring include for mortar setting bed installation, tolerance is ¼" in 10' from the required plane, and subsurface requirements for walls include for mortar setting bed installation, tolerance is ¼" in 8'.

For thinset installations, tolerance is ⅛" in 10' from the required plane. Subsurface requirements for walls for thinset installations, tolerance is ⅛" in 8' from the required plane.

Edge warpage in tile and stone is a common cause of lippage. And, adding width to grout joints does not always solve lippage. If lippage is identified in running bond offset, the mock-up and lippage and offset must be approved by the specifier and owner when over 33%, unless specified by the tile manufacturer.

According to the Marble Institute of America, lippage is the result of three factors: the geology of the stone; the techniques utilized in fabrication; and the quality of the installation.

The physical characteristics (geology) of the stone used affects the flatness of the finished stone. Stones react to the pressure of the grinding heads, heat caused in the abrasion and polishing stages, and the quantity of water used in cooling the stone.

For example, true geological marble in tile form will curl 1 mm or more from the face reacting to the moisture content of the stone and face temperature. The face of the stone becomes warmer (higher temperature) than the bottom face. The stone reacts to this temperature variation by twisting, when there is sufficient mass to dissipate the temperature variation rapidly through the stone. Speed is the key factor. Faster running production lines (over 375 lineal feet/hour) will yield more finished product than a similar line operating at 90% of that speed.

However, almost all of the tile produced on the faster line will twist and warp from the flat center, compared to almost none at the lower speed.

When you open a box of marble tiles and the corners are abraded off, with no other chips in the box, you know why.

A quality of installation includes using a proper joint, quality setting materials with the proper viscosity, and experience and knowledge of the tile setter all come into play.

Almost all stones are fabricated to be installed with a 3/32" joint. The 3/32" joint allows for square tolerance, size tolerance (length and width), thickness tolerance and warp/twist tolerance.

To minimize lippage problems in your next installation, carefully examine the tiles for flatness. Put two tiles face to face and look through the joint produced. If you see light, the tiles are not flat. Next, place one tile face up on a flat surface. Put the other tile face down directly on top of the first tile as evenly and smoothly as possible. Then lift the tile from the edges gently.

Flat tile will cause suction to another tile with the bottom tile

This warped tile was caused when this tile was manufactured.

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Use a 3/32" grout joint to allow for square tolerance, size tolerance, thickness tolerance and warp/twist tolerance.

moving slightly as the top tile is raised. Next, measure the tiles. Place four tiles together to form a square or rectangle (if one dimension is larger than the other). Test the outer edge with your fingernail. The more you catch the further out of square and the larger the joint must be between tiles.

When installing, the setting material must have sufficient strength and body to hold the tile in suspension until it is set in place. Spot setting with mortar and not achieving 95% minimum contact and coverage is not acceptable.

The Marble Institute of America recommends using a moisture barrier on all floors on-grade prior to stone installation. Where the stone is bonded directly to a moisture barrier, the requirement is the waterproof membrane is to meet ANSI A118.10. The single largest reason for on-grade stone tile floor failures is a lack of a moisture barrier-waterproof membrane meeting ANSI A118.10.

For natural cleft stone tiles, use a ⅜" to ½" wide joints. Obtain joint width recommendation from your distributor or adhesive manufacturer for thermal, bush-hammered, and other irregular stone surfaces.

The thin-set method should only be used with accurately gauged tile over a flat surface. Substrates that are subject to deflection must meet or exceed a total load deflection o L/ 720, with a maximum allowable deflection of 7/32" for stone floor tiles.

Green-colored marbles and serpentine are very water sensitive causing them to warp or curl when exposed to water or a water-based adhesive (cementitious mortar).To avoid having stones warp from the moisture in the setting materials, an epoxy adhesive bond coat (without water), may be required.

Agglomerate tiles and Lagos Azul limestone tiles are moisture sensitive and will warp with exposure to unbalanced water. Contact your adhesive supplier's technical department to learn more about this.

Stone tiles may come with modified backs with a mesh reinforcement. The adhesive used to attach the mesh is not standardized, but is commonly an epoxy, polyurethane, or polyester-based adhesive that do not bond reliably to Portland cement mortars. Fiberglass mesh reinforced stone tiles require epoxy bonding mortar.

Lippage will occur over time when a mesh reinforced back is set with Portland cement mortar, as the tile will progressively lose bond to the underlying mortar. Take caution when installing marble tiles with veins in wet areas and on building exteriors.

Marbles are classified according to soundness based on the level of repair or reinforcement commonly required to facilitate the marble use.

The Marble Institute of America has soundness classifications of A, B, C, and D are in descending order of reinforcement and/or repair requirements. These classifications have no bearing on the commercial value of the stone. The lesser soundness classifications of C and D include many of the aesthetically prized, decorative marbles. The C and D stones typically have too much repair or reinforcement to be used in wet or exterior areas.

New in the marketplace are hybrid stones – a thin stone laminated to a thin porcelain tile. A usual method for correcting lippage with stone tile installations is grinding and refinishing the stone surface. If the stone tile surface of a hybrid is ground to remove scratches and/or lippage, there is a possibility of exposing the underlying tile surface.

Wall washing type lighting or any source of lighting that is parallel to a tile installation will tend to accentuate the visual presence of

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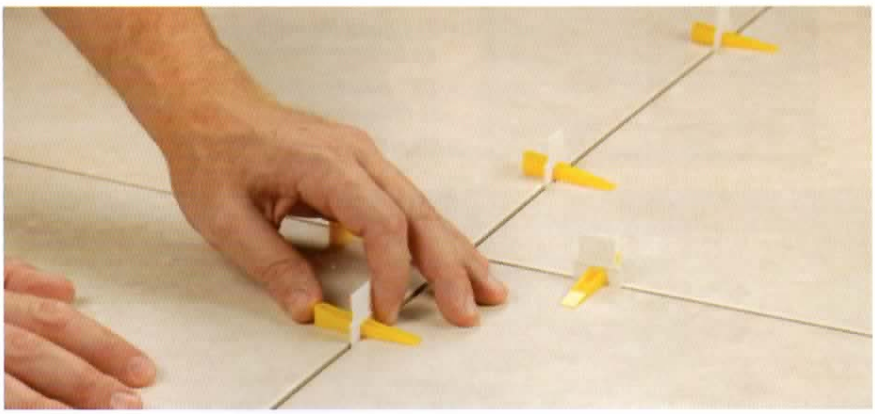
Tile produced on a faster production line will twist and warp.



Tile leveling wedges and tile clips from QEP. Photo courtesy QEP.

lippage, even in acceptable tile work. Reflective light on a polished marble or granite tile will accentuate any lippage.

Some methods for testing lippage include using a level, and rolling steel ball bearings across the floor. If lippage is present, the bearing will bounce.

You can also test using a flashlight, your fingers, a credit card or business card.

For successful flat tile installations, verify the substrate is in required tolerance. Where subsurface is not in tolerance, level the subsurface or have the subsurface corrected prior to installation of any ANSI A118.10 Load Bearing, Bonded, Waterproof Membrane, A118.12 Crack Isolation Membrane, Radiant Heat System, Sound Control or tile.

Know your stone or ceramic tile products. Each product may have unique installation instructions with the specified adhesive products. If in doubt, contact the distributor or the adhesive manufacturer's technical department. Use medium bed mortars for installation of large format tiles (with one tile edge 15" or longer) and thinset for tiles less than 15".

The Tuscan Leveling System is recommended by Custom Building Products, Laticrete, and Mapei. Photo courtesy Pearl Abrasive.

For large format tiles, read the first 30 pages and the inserts in the *Tile Council of America Handbook for Ceramic, Glass and Stone Tile Installation* and the first 45 pages of the *American National Standard Specifications for the Installation of Ceramic Tile-Material & Installation Standards.* **PROINSTALLER**

About the Author:
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