Sealing, cleaning and maintenance:

Natural stone products must always be sealed to prevent staining. Sealer should be maintained in order to sustain the original appearance and longevity of the product.
Sealing should only take place once the tiles are completely dry and are free from any dust or dirt. This may take up to three weeks but may vary depending on weather conditions.
Please speak to one of our sales consultants to ascertain your specific needs and requirements.

Natural Stone Characteristics:

Since natural stone is not a manufactured product, it is important to note the following characteristics:

- Variation in veining from tile to tile.
- Variation in texture from tile to tile.
- Variation in colour from tile to tile.
- Variation in absorption tolerances from tile to tile.
- Thickness tolerance of up to 4mm (marble, limestone, granite, travertine) or up to 10mm (slate, sandstone, quartzite).
- Size tolerance of up to 3mm.

Installation guide:

Care should always be exercised when handling natural stone products and particularly marble, limestone and travertine, which tend to be softer in nature.

- To absorb size tolerances, a minimum grout gap of 5mm is recommended (marble, limestone, granite, travertine) and 8mm (slate, sandstone and quartzite). Butt-jointing of tiles is never recommended.
- Marble, Limestone and Travertine products should always be tiled with a white based tile adhesive to prevent picture framing.
- All tiles must be fully buttered with adhesive during installation for effective adhesion to the sub-structure.
- A stain free grout is recommended with sandstone, slate and quartzite to avoid picture framing.
- Marble, Limestone and Travertine should not be cleaned with any acid-based cleaner.
- Certain granites contain elements of iron, oxides and magnesium and should not be cleaned with any acid based cleaners to avoid rusting. Please speak to one of our sales consultants for further information.
- Natural stone products are not recommended for use around salt chlorinated swimming pools.
- Elongated formats (i.e. 1200 x 600 / 800 x 400 etc.) cannot be laid in a brick bond or offset pattern . We recommend that it is laid straight to avoid natural characteristics such as thickness variation (lippage) and natural “bowing”.

Important Notes:

- Material is sold from samples and not open stock. Hence no sorting of material is permitted. Material needs to be accepted or rejected in its entirety.
- Mazista specifically notes that the material being sold is natural stone and henceforth has inherent characteristics such as but not limited to varying thickness, varying textures, varying colours, varying veining within one batch. The consumer therefore accepts the goods in the specific condition that they are in.
- No claims will be entertained once the tiles are installed.
- Due to nature of the stone, all marble and limestone tiles will have approximately 5% small chipping along the edges, within each crate.

Lippage – causes and prevention

Lippage of tile and stone installations is increasingly becoming a highly contentious issue in the industry. Often times, expectations far exceed the physical abilities of the tile or stone, or the physical characteristics of the surface on which the tile or stone will be installed to provide for a perfect installation.

Over time, the size of tile and stone modules has increased significantly; a trend which continues today. It was not too long ago when a large format tile was considered to be 300mm x 300mm tile. Now, some manufacturers are producing tile that is 1200mm x 1200mm or larger. With the increase in module sizes comes the increase for substrate tolerances which are much tighter than the industry guidelines require.

Tel: +27 11 998 2600 / 086 111 4284 Fax: +27 11 462 8609/3436 Cell: +27 82 885 1962 / +27 83 643 8988 sales@mazista.co.za
233 Hans Strijdom Dr, North Riding, Randburg PO Box 333, Honeydew 2040, South Africa **www.mazista.co.za**
Mazista Tiles (Pty) Ltd. 2003/020644/07 R.S. Blair, A.M. Clegg, M.J. Tully, M. Varga

The first question which needs to be answered is: What is lippage? Lippage refers to differences in elevation between edges of adjacent tile modules. These differences or perception thereof are influenced by many factors such as;

1. The allowable thickness variation of the tile modules when judged in accordance with manufacturing standards.
2. The allowable warpage of the tile or stone modules.
3. The spacing or separation of each tile module, which would influence a gradual or abrupt change in elevation.
4. Angle of natural or manufactured light accentuating otherwise acceptable variance in modules.
5. Highly reflective surfaces of tile or stone modules accentuating otherwise acceptable variance in the modules.

Lippage is a condition where one edge of a tile is higher than an adjacent tile, giving the finished surface an uneven appearance. This condition is inherent in all installation methods and may also be unavoidable due to tile tolerances.

The different components and factors which can lead to lippage problems are;

Subsurface Tolerance: According to the TCNA, "For thin-bed ceramic tile installations when a cementitious bonding material will be used, including medium bed mortar: maximum allowable variation in the tile substrate – for tiles with edges shorter than 375mm, maximum allowable variation is 6mm in 3m from the required plane, with no more than 1.5mm variation in 300mm when measured from the high points in the surface. For tiles with at least one edge 375mm in length, maximum allowable variation is 3mm in 3m from the required plane, with no more than1.5mm variation in 600mm when measured from the high points in the surface. For modular substrate units, such as exterior glue plywood panels or adjacent concrete masonry units, adjacent edges cannot exceed 0.8mm difference in height. Should the architect/designer require a more stringent finish tolerance 3mm in 3m, the subsurface specification must reflect that tolerance, or the tile specification must include a specific and separate requirement to bring the subsurface tolerance into compliance with the desired tolerance."

This becomes even more critical as the size of the tile or stone being installed increases. Mosaics on a floor can literally accept most variation in the substrate tolerance due to its small size; large format tile (400mm x 400mm or larger) requires a subsurface tolerance that is even more stringent than the industry accepted 6mm in 3m. Essentially, the larger the tile or stone module, the greater the reflection of the unacceptable subsurface tolerance will show up as increased lippage in the finish. The subsurface tolerance is probably the tile contractor's biggest concern in regards to lippage, and, unless a procedure for levelling the floor is included in the contract, is not his fault. Substrates are often not suitably flat to achieve meeting both the owner's expectations and the industry tolerances for allowable lippage.

Grout Joint Width: With the advent of larger tile and stone module sizes comes the desire to have a smooth looking surface as well as one that is easier to maintain. Grout joints that are 3mm or less in width are not uncommon for large format tile; a fact which can greatly exaggerate lippage issues. Subsurface tolerances outside of the allowable range or warping of the tile are much more noticeable when grout joints are tighter. The chart below is the current guideline showing acceptable lippage for typical installations of tile.

Tile Type	Tile Size	Joint Width	Allowable Lippage
Glazed Wall / Mosaics	1" x 1" to 6" x 6" (25 x 25mm to 150 x 150mm)	1/16" (1.5mm) to 1/8" (3mm)	1/32" (0.8mm)
Quarry	6" x 6" (150 x 150mm) to 8" x 8" (200 x 200mm)	¼" (6mm) or greater	1/16" (1.5mm)
Paver	All	1/16" to less than ¼" (3mm to 6mm)	1/32" (0.8mm)
Paver	All	¼" (6mm) or greater	1/16" (1.5mm)

NOTE: The above chart does not apply to tiled floors sloping to drains. Lippage will be present when using tiles 6" x 6" and larger over interior and exterior conical surfaces sloped to drains. The larger the tile unit surface area, the greater the lippage. Cutting the individual units can reduce the amount of lippage but may not eliminate lippage. Using smaller units in sloping areas will reduce lippage.

While narrow grout joints may be desirable and expected, joint should not be less than the minimum recommended width as shown in the chart above. Grout joints which are too narrow not only accentuate lippage within acceptable tolerances, it may also create problems in preventing the proper filling of the joint with grout, make it more difficult to keep the grout joint clean, and create potential visual problems when movement joints, within the tile or stone installation, must be wider than the grout joints.

As stated in ANSI A108.02 4.3.8.1 "For running bond/brick patterns utilizing tiles (square or rectangular) with any side greater than 450mm, the grout joint shall be, on average, a minimum of 3mm wide for rectified tiles and, on average, a minimum of 4.5mm wide for calibrated (non-rectified) tiles. The grout joint width shall be increased over the minimum requirement by the amount of edge warpage on the longest edge of the actual tiles being installed. For example, a rectified tile exhibiting 0.75mm edge warpage on the longest edge, the minimum grout joint for a running bond/brick joint pattern will be 3mm + 0.75mm equalling 4mm, on average. Of necessity, in any installation, some grout joints will be less and some more than the average minimum dimension to accommodate the specific tiles being installed".

As stated in ANSI A108.02 4.3.8.2 "For running bond/brick joint patterns utilizing tiles (square or rectangular) where the side being offset is greater than 450mm nominal dimension, the running bond offset will be a maximum of 33% unless otherwise specified by the tile manufacturer. If an offset greater than 33% is specified, specifier and the owner must approve mock-up and lippage.

Warpage: Warpage of tile is natural and is calculated as a percentage of the length of the edge or diagonal being tested. The tolerance range for warpage of tile varies based on size and type of tile, as well as whether the tile is natural, calibrated or rectified. Natural tile (referring to pressed floor tile only) is defined as tiles that are not sized or sorted mechanically. Calibrated tile is defined as tiles that have been sorted to meet a manufacturer's stated calibre range. Rectified tile is defined as tiles that have had all edges mechanically finished to achieve a more precise facial dimension. The following chart shows allowable warpage for several types of tile;

Tile Type	Warpage Edge Minimum	Warpage Edge Maximum	Warpage Diagonal Minimum	Warpage Diagonal Maximum
Mosaic	-1.00%	1.00%	-0.75%	0.75%
Quarry	-1.50% or -0.18" (-4.6mm)†	1.50% or 0.18" (4.6mm)†	-1.00% or -0.17" (-4.3mm)†	1.00% or 0.17" (4.3mm)†
Glazed Wall Tile (Calibrated)	-0.30% or -0.04" (-1.0mm)†	0.30% or 0.05" (1.0mm)†	-0.30% or -0.05" (-1.3mm)†	0.30% or 0.07" (1.8mm)†
Glazed Wall Tile (Rectified)	-0.30% or -0.04" (-1.0mm)†	0.40% or 0.05" (1.3mm)†	-0.30% or -0.05" (-1.3mm)†	0.40% or 0.07" (1.8mm)†
Pressed Floor Tile (Natural)	-1.00% or -0.12" (-3.1mm)†	1.00% or 0.12" (3.1mm)†	-0.75% or -0.13" (-3.3mm)†	0.75% or 0.13" (3.3mm)†
Pressed Floor Tile (Calibrated)	-0.75% or -0.08" (-1.3mm)†	0.75% or 0.08" (1.3mm)†	-0.50% or -0.08" (-2.0mm)†	0.50% or 0.08" (2.0mm)†
Pressed Floor Tile (Rectified)	-0.40% or -0.05" (-1.3mm)†	0.40% or 0.05" (1.3mm)†	-0.40% or -0.07" (-1.8mm)†	0.40% or 0.07" (1.8mm)†
Porcelain Tile (Calibrated)	-0.75% or -0.09" (-2.3mm)†	0.75% or 0.09" (2.3mm)†	-0.50% or 0.08" (-1.8mm)†	0.50% or 0.08" (2.0mm)†
Porcelain Tile (Rectified) smaller than 24" x 24" (600mm x 600mm)	-0.40% or -0.05" (-1.3mm)†	0.40% or 0.05" (1.3mm)†	-0.40% or -0.07" (-1.8mm)†	0.40% or 0.07" (1.8mm)†
Porcelain Tile (Rectified) larger than 24" x 24" (600mm x 600mm)	-0.40% or -0.05" (-1.8mm)†	0.40% or 0.05" (1.8mm)†	-0.40% or -0.07" (-1.8mm)†	0.40% or 0.07" (1.8mm)†

† Whichever is less. For more information on the above chart please refer to ANSI A137.1 American National Standard Specifications for Ceramic Tile.

The test method used to determine warpage of tile is ASTM C485 "Standard Test Method for Measuring Warpage of Ceramic Tile" and is calculated by dividing the measured amount the tile deviates from flatness by the length of the edge or diagonal. In the rare instance where tile has a high percentage of warpage, the tile should not be considered commercially viable for floor installations. It should be known that all tiles are warped to some degree because shrinkage of tile is an inherent characteristic during the firing process. How a tile shrinks is dependent upon many factors and no two tiles are exactly alike, so they cannot all shrink exactly the same.

Edge Treatment: The finished edge of the tile may also play a role in the final appearance of a floor in regards to lippage. Tile finished with a square edge is more likely to accentuate lippage as compared to a chamfered edge tile.

Reflective (Polished) Surfaces: Installations with highly polished tile or stone modules may appear to have unacceptable lippage when their reflective surfaces make any unevenness visible. Any variation in the substrate, amount of setting material or warpage in the module, even within allowable tolerances will be visible in the finished installation. The use of a self-levelling underlayment or the wet set method of installation may help to prevent some of the factors which can create lippage.

Layout: Choosing the right pattern layout for tile or stone is important in regards to lippage. For instance, setting large, rectangular tile in a brick pattern can be challenging. Extra attention must be given to subsurface preparation in trying to reconcile 6 junction points for each tile.

Overwhelmingly, the majority of lippage is caused by an uneven substrate or the improper application of thin-set while trying to compensate for irregularities in the substrate. Generally, it is well worth the time and expense to flatten the floor first with a self-levelling underlayment or a properly screeded mortar bed.

There are a few methods to help prevent or minimize lippage issues during installation;

1. Uneven substrate surface – Make sure that the subfloor is within acceptable tolerances based on the tile size and layout pattern. Where applicable, check the floor preparation section of the specification and make sure the architect or designer is aware of any concerns.
2. Varied tile thickness – Examine tile thickness from the tile manufacturer stating that they meet industry standards. Tiles which are of uneven thickness can be wet set into a mortar bed

It is much easier to take the necessary steps to help avoid lippage before or during installation than it is after lippage has been noticed in a finished installation.