

# RECTIFIED CERAMIC TILES 3



## 3 RECTIFIED CERAMIC TILES

The manufacturing process of ceramic and homogeneous tiles has undergone considerable changes in recent times. More automated methods have been employed in production and a wide range of tile products with different characteristics are available on the market for various uses. The following section identifies some new developments in tile production and in particular rectified tiles, which can be used to achieve better workmanship quality.

### 3.1 TYPES AND CHARACTERISTICS OF TILES

#### a. Ceramic tiles

**Ceramic tile** is a mixture of clay and quartz ferrous sand materials along with water. The special clays are mined from the earth, shaped, coloured and then fired in kilns. They can be coloured and the surfaces can be glazed either in a high gloss or matte finish. Most ceramic tiles have either a white or red body colour underneath the glazed finish.

#### b. Homogeneous tiles

**Homogeneous tile** is a form of ceramic tile composed of fine porcelain clays but fired at much higher temperatures than ceramic tile. This process makes homogeneous tiles denser, harder, less porous and therefore less prone to moisture and stain absorption than ceramic tiles. They have a consistent property throughout the entire section of the tile. For these reasons, most homogeneous tiles are suitable for both indoor and outdoor use. However they are harder to cut due to their density and hardness.

#### c. Glazed tiles

The body of ceramic tile, called bisque, may be coated with or without a glaze depending on its intended purpose. The glazed coating comprise of liquid coloured glass which is applied and baked to the surface of the bisque under very high temperatures. The liquid glass coating can be fashioned with texture and design. The main features of glazed tiles are ease in cleaning and protection of the bisque from staining.

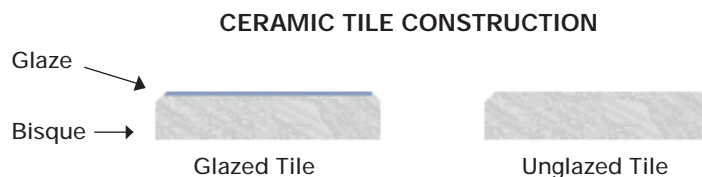


Fig. 3.1 – Body of glazed and unglazed tile.

#### d. Rectified tiles

A rectified tile has all its edges mechanically finished to achieve a more precise dimension. Unlike a typical factory-edged tile, a rectified tile is created by cutting the tile to size after the firing process. This creates precise 90 degree angle smooth edges. As a result, the tiles can be laid with consistent grout joints. Most tiles (homogeneous and ceramic) can vary in size (up to 1.0%) after the firing process but this can be substantially minimized by sawing or grinding the tile after firing.



Fig. 3.2 – Size variation can be substantially minimized in rectified tile.

### 3.2 AN OVERVIEW OF TILE PRODUCTION

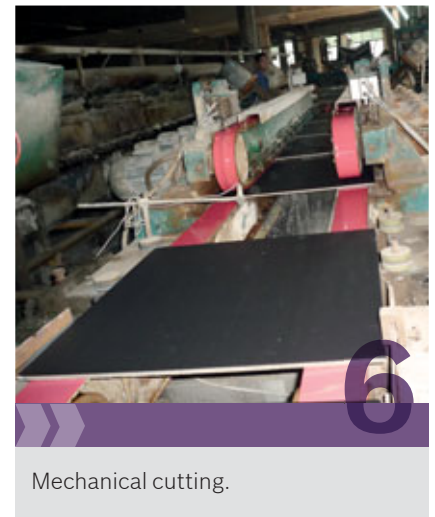
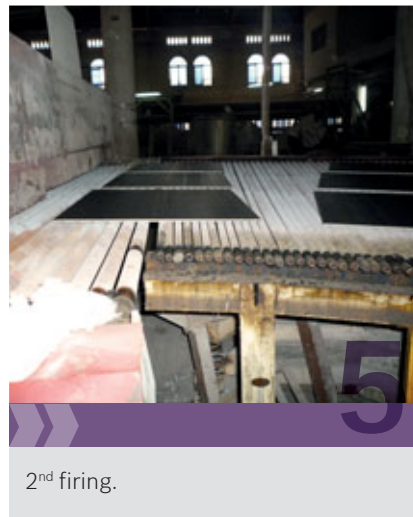
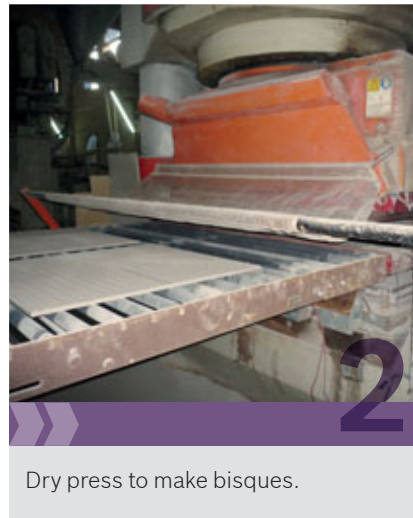


Fig. 3.3 – Overview of tile production.



### 3.3 IMPACT OF MANUFACTURING PROCESSES ON TILE QUALITY

#### a. Size variation

Other than poor workmanship, inconsistency in tile joints is due to dimensional variations among the tiles. This variation occurs mainly during the kiln firing as the bisques tend to shrink during this process and the shrinkage may not be constant in all tiles. This result in different tile sizes and the variation can be up to 1% of the tile size depending on the manufacturing process and the kiln atmosphere.

The inconsistent joints can be substantially reduced by using rectified tiles which require the additional process of cutting and grinding after kiln firing. The rectified tiles with controlled tile dimensions and straighter edges make the joints consistent and aesthetically pleasant.

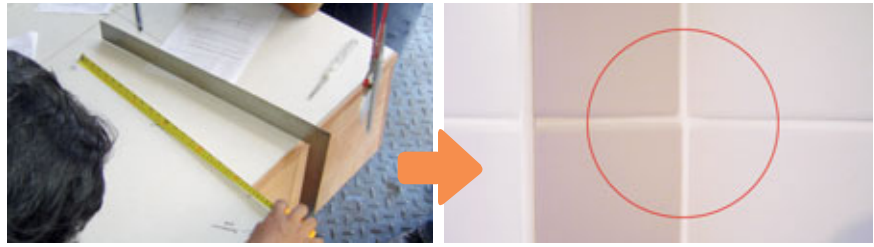


Fig. 3.4 – Size variation will lead to inconsistent joints.

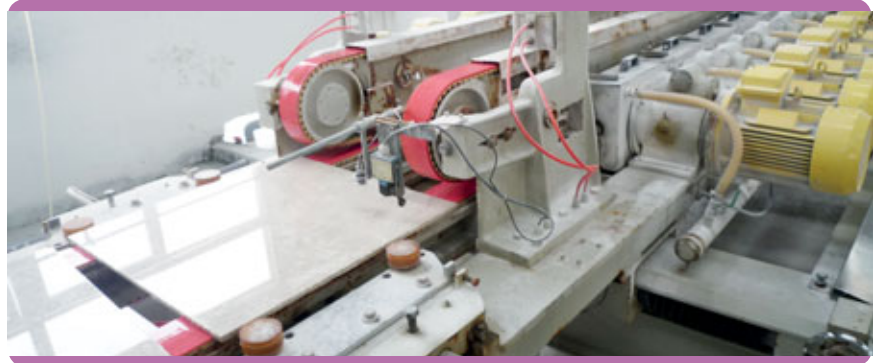


Fig. 3.5 – Tiles being cut by an automated mechanism after kiln firing to ensure dimensional consistency.

Another way to minimize inconsistent joints during laying is to use a gauge box on site to group the tiles according to their sizes. Typically measurements are marked on the box and the tiles are placed and grouped according to the sizes. For example, if the tile size is 300 x 300 mm and the manufacturing tolerance is + or - 1 mm, the gauge box will have markings of 299, 300 & 301 mm. Although this is a time consuming process, segregating and grouping the tiles according to the sizes first before laying will lead to better and consistent joints.



Fig. 3.6 – Gauge box used on site to group tiles according to size.



*Fig. 3.7 – Good dimensional tiles aid better consistency in joints.*

### ***b. Warpage***

Warpage is curvature in the face of a tile which can be concave or convex in shape. This is due to changes that occur during the firing and cooling process of production. Edge warpage is measured at the centre of a tile's edge and diagonal warpage is measured at the center of the tile. Both are expressed as a percentage of the tile's linear dimensions. Most tiles (both homogeneous and ceramic tiles) will exhibit some warpage after firing.



*Fig. 3.8 – Warpage on tiles may occur after the firing and cooling process.*

Tile warpage is often the cause (apart from poor workmanship) of lippage or unevenness between tiles. Lippage is a condition where one edge of a tile is higher than adjacent tile, giving the finished surface a ragged and uneven appearance. Lippage in floor tiling often causes discomfort to end users walking with bare feet and may result in injury especially on sharp edged tiles. It also affects the visual appearance of the floor and in wet areas, it can impede water flow and build up stagnant water.

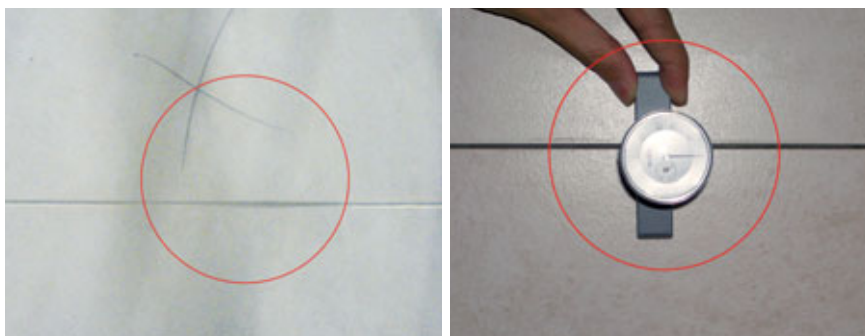


Fig. 3.9 – Depth gauge used to measure lippage or unevenness between tiles

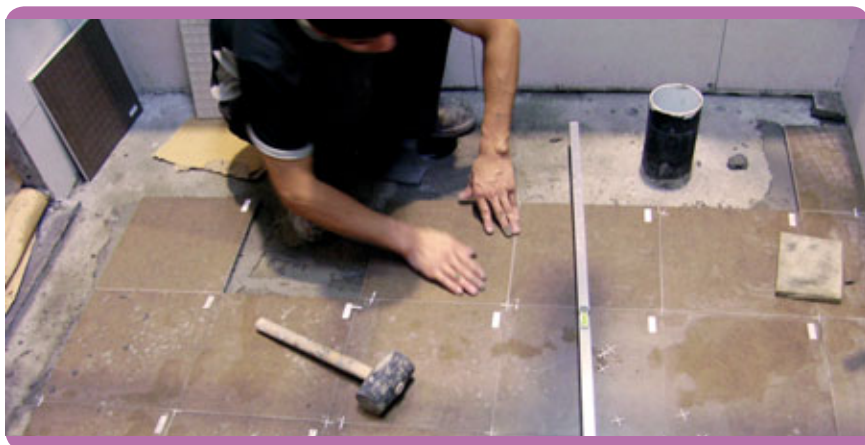


Fig. 3.10 – Lippage in wet areas can build up stagnant water.

### c. Water absorption, surface cracks and damage

The raw material used and the manufacturing process affect the density of the tile. This in turn controls the water absorption rate of the tile. There is a direct relationship between the water absorption rate and the suitability of the tile for interior or exterior use. The following are some general classifications used by some factories based on water absorption rates and the recommended use of the tiles:

**Non vitreous tiles:** Absorb 7% or more of its weight – Suitable for dry indoor area.

**Semi vitreous tiles:** Absorb 3% to 7% of its weight – Suitable for dry indoor area.

**Vitreous tiles:** Absorb 0.5% to 3% of its weight – Suitable for dry & wet area indoor use.

**Impervious tiles:** Absorb between 0 and 0.5% of its weight – Suitable for both indoor and exterior use.

**Crazing** is a defect or phenomenon in a glazed tile where thin cracks appear on the surface. This is usually caused by tensile stress between the bisque and glaze. When the bisque and glaze expand and contract at different rates, fine cracks may appear on the glazed surface. The other reason could be thermal shock where in the kiln, the tiles are either brought up to high temperature too soon or cooled too quickly.

**Degree of Hardness** of a tile is achieved by the choice of raw materials used and the manner in which the tile is manufactured. Ceramic tiles are made from clay and not all clays have the same properties and mineral content. During the manufacturing process the soft clay tiles are subjected to high temperatures in a kiln. The final hardness of the tile is directly related to the mineral content, the temperature reached in the kiln and the duration of time the tiles are fired. MOH (Measurement of Hardness) test is used to rate the tiling hardness from 1 (softest) to 10 (hardest). Ceramic tiles with a value of 5 or more are suitable for most residential floor tile applications. Tiles with a value of 7 or higher are normally acceptable for most commercial applications or heavy traffic areas.



Fig. 3.11 – Tiles with low MOH rating are not suitable for heavy traffic areas.

#### *d. Shade variations*

The variation in color, texture and tone between individual tiles is termed as shade variation. Shade variation is an inherent characteristic of majority of fired ceramic products. The color is bound to vary to some degree in each production run. So it is important to purchase sufficient quantity of tiles from the same batch of production to complete the job. If not, obtaining additional tiles from a different batch production even from the same factory may lead to shade variation. The following is a general guideline used by some factories for grading tiles according to their shade variation.

##### ***V1-Uniform Appearance***

##### ***V2-Slight Variation***

##### ***V3-Moderate Variation***

##### ***V4-Random or Dramatic Variation***



Fig. 3.12 – Shade variations may affect visual appearance.

It is also a common practice that tile size, color shade and other information are printed on each carton in order to group them on site to get better consistency.



Fig. 3.13 – Typical information on tiles packing.

### 3.4 SUMMARY

Ceramic and homogeneous tiles are available in a wide range of grades and classifications. Hence it is important to ensure that the tiles meet the required standards before starting installation. The various tests for tiles such as slip resistance, water absorption, breaking strength, impact resistance, abrasive hardness, chemical resistance, etc are valuable to builders when choosing tiles for specific application. It is also advisable to select samples from different production batches for laboratory tests to ensure their consistency. The selection of compatible adhesives and grouting, correct method of installation and maintenance are other important factors to ensure performance.